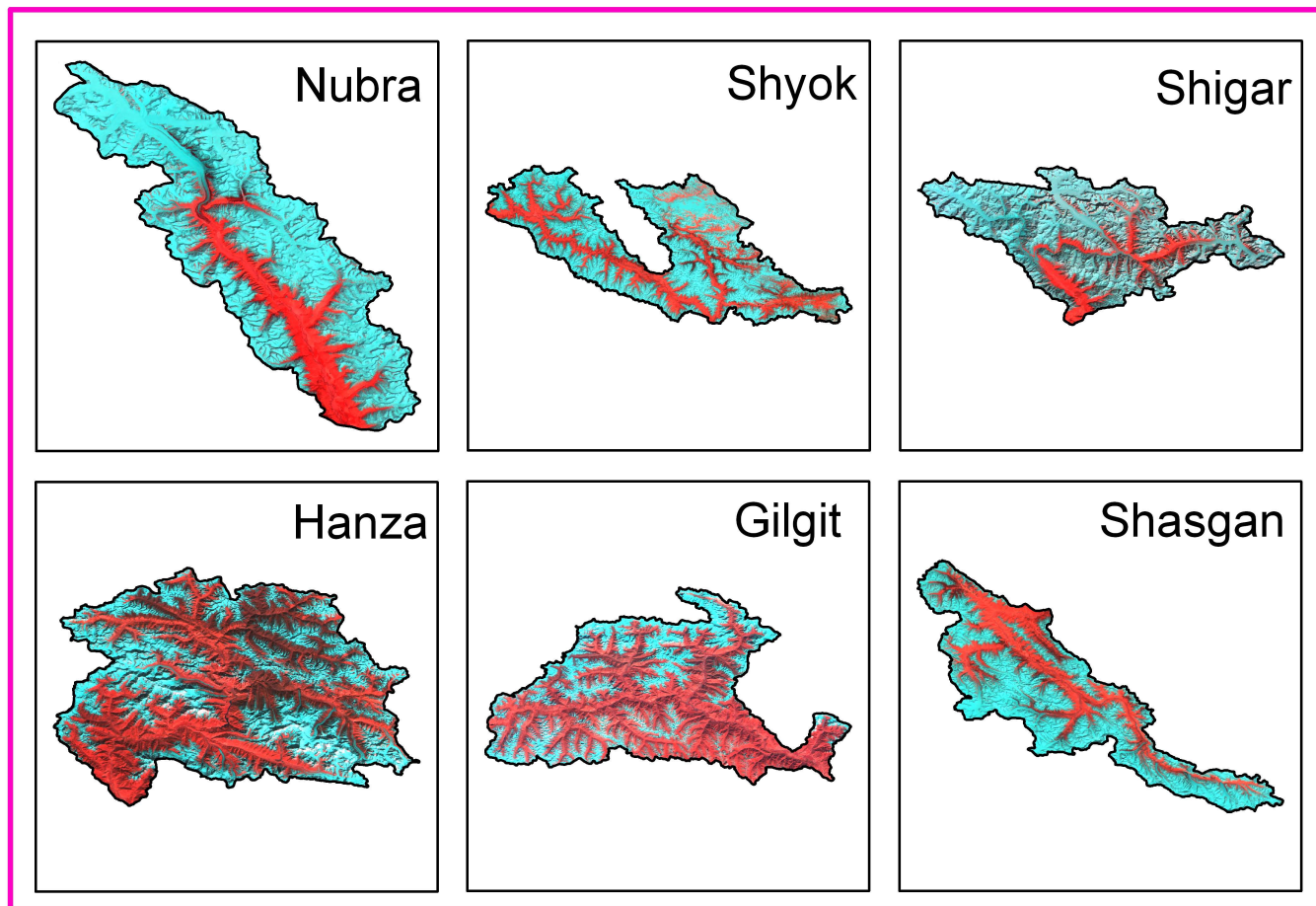


SNOW COVER ATLAS OF INDUS BASIN

Sub basins: Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan

(A Joint Project of Indian Space Research Organisation and
Ministry of Environment and Forests, Govt. of India)

Year : 2010-11



Volume II



**Remote Sensing Applications Centre U. P.
Lucknow - 226021**

and

**Space Applications Centre (ISRO)
Ahmedabad - 380015**

March, 2012

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SPACE APPLICATIONS CENTRE (ISRO), AHMEDABAD - 380015**DOCUMENT CONTROL AND DATA SHEET**

Report Number	SAC/EPsA/MPsG/SGP/SN/ 64 /2012
Month and year of publication	March 2012
Title	Snow cover Atlas of the Indus basin
Type of Report	Scientific Report
No. of pages	140
No. of figures, Charts & Tables	110, 18 & 12
Authors	Team members
No. of References	9
Originating Unit	Geo Sciences Division, Marine, Geo and Planetary Sciences Group, Earth, Ocean, Atmosphere, Planetary Sciences and Applications area, Space Applications Centre (ISRO), Ahmedabad-15
Abstract	<p>This atlas gives subbasin-wise distribution of snow cover in the Indus basin from October 2010 to June 2011. The subbasins included in this report are Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan. The areal extent of snow cover was estimated in fully automatic mode using Normalized Difference Snow Index (NDSI) based algorithm. For this purpose AWiFS sensor of Resourcesat satellite was used. This atlas gives snow cover products, statistics and seasonal snow depletion curve. It is expected that this data will be useful for hydrological and climatological applications.</p>
Key words	Snow cover, NDSI, AWiFS, depletion curve, Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan basins.
Security Classification	Unrestricted
Distribution	Among concerned

Authors (Team Members)

Space Applications centre (ISRO)

Ahmedabad – 380015

B. P. Rathore

S. K. Singh

I. Bahuguna

A. S. Rajawat

Ajai

Remote Sensing Applications centre, U. P.

Lucknow - 226021

Diwakar Pandey

Rupendra Singh

S. K. S. Yadav

Ram Chandra

Anjani K. Tangri

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1. Introduction

Snow covers almost 40 per cent of the Earth's land surface during Northern Hemisphere winter. This makes albedo and areal extent of snow as important component of the Earth's radiation balance (Foster and Chang, 1993). In addition, large areas in the Himalayas are also covered by snow during winter. Area of snow can change significantly during winter and spring. This can affect stream flow for rivers originating in the higher Himalayas. All the rivers originating from higher Himalayas receive almost 30-50 % of annual flow from snow and glacier melt run off (Agarwal et al., 1983). In addition, snow pack ablation is highly sensitive to climatic variation. Increase in atmospheric temperature can influence snowmelt and stream runoff pattern (Kulkarni et al., 2002). Therefore, mapping of the areal extent and reflectance of snow are important parameter for various climatological and hydrological applications. In addition, extent of snow cover can also be used as input for numerous other applications.

Mapping and monitoring of seasonal snow cover using field methods are normally very difficult in a mountainous terrain, like the Himalayas. Therefore, remote sensing techniques have been extensively used for snow cover monitoring. Snow cover monitoring using satellite images were started by using the TIROS-1 satellite from April 1960 (Singer and Popham 1963). Since then, the potential for operational satellite-based mapping has been enhanced by the development of higher temporal frequency and satellite sensors with higher spatial resolution. In addition, satellites with better radiometric resolutions, such as NOAA have been used successfully for snow mapping (Hall et al., 1995). This is possibly due to the distinct spectral reflectance characteristics of snow in visible and near infrared regions. India has launched series of Indian Remote Sensing satellite (IRS) to study the different earth resources. Previously launched satellites have flown with many sensors having different spatial, temporal and spectral resolutions. Recently launched RESOURCESAT-1 satellite has three different sensors namely LISS III, LISS IV & AWiFS with different spatial, temporal and spectral resolutions as desired for different applications. AWiFS (Advanced Wide Field Sensor) is an advanced version of earlier Indian satellite sensor WiFS (Wide Field Sensor) with improved spectral and spatial resolutions maintaining the same repetivity. There are a series of other polar orbiting satellites, like Landsat, NOAA and MODIS etc., which have provided information on different aspects of

snow. Geo-stationary satellites also proved their utility in mapping/monitoring the snow-covered regions. Information generated from satellite observations has been extensively used for snowmelt runoff modeling (Kulkarni et al., 1997).

2. Study Area:

This Atlas gives distribution of snow cover in six subbasins of the Indus basin. These are Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan sub basins. Locations of these basins are shown in Figure 1.

3. Data used:

AWiFS data from October 2010 to June 2011 were used in this study.

4. Normalised Difference Snow Index (NDSI):

In general, the reflectance of snow is high at the red end of the visible spectrum. It tends to decline in the near-infrared region until 1090 nm, where slight gain in reflectance occurs and gives a minor peak at approximately 1090 to 1100 nm. One of the important difficulties in snow cover monitoring is the presence of cloud cover. Cloud has strong reflectivity in visible, NIR and SWIR regions while snow absorbs in SWIR, and this difference can be utilized for snow/cloud discrimination. Normalized Difference Snow Index (NDSI) utilize the normalized ratio of green and SWIR and is used as an automated approach for snow mapping addressing the shadow and cloud problems in snow bound areas.

Normalized Difference Snow Index was calculated using the ratio of green wavelength (band 2) and SWIR (band 5) of AWiFS sensor:

$$\text{Normalized Difference Snow Index (NDSI)} = (\text{band2} - \text{band5}) / (\text{band2} + \text{band5}) \quad \text{..(1)}$$

To estimate NDSI, DN numbers were converted into reflectance. This involves conversion of digital numbers into the radiance values, known as sensor calibration, and then estimation of reflectance from these radiance values. Various parameters needed for estimating spectral reflectance are maximum and minimum radiances and mean solar exo-atmospheric spectral irradiances in the satellite sensor bands, satellite data acquisition time, solar declination, solar zenith and solar azimuth angles, mean Earth-Sun distance etc. (Markham and Barker, 1987; Srinivasulu and Kulkarni, 2004).

5. Snow cover monitoring algorithm

An algorithm is developed to provide changes in the areal extent of snow (Kulkarni et. al., 2006). Snow extent is estimated at an interval of 5-days and 10-days, depending upon availabilities of AWiFS data. In 5-daily product, snow extent is generated scene-wise. In this product, snow and cloud extents are given. Estimate of cloud is important because, at times, snow is covered by cloud and this may be classified as non-snow area, leading to erroneous conclusions. In 10-daily product, three scenes are analyzed, if available. For example, 10 March product data of 5, 10 and 15 March was used. If any pixel is identified as snow on any one date then this pixel will be classified as snow on final product. This provides snow cover at an interval of 10 days, an important requirement in hydrological applications. Therefore, this product is generated basin-wise. Since this product is using three scenes, probability becomes high that at least in one scene, pixel may be cloud-free and this helps in overcoming problem associated with snow under cloud cover. If three consecutive scenes are not available, then all available scenes in 10 days window was used in the analysis. Differentiation between water and snow is difficult using NDSI image. In addition, separation of snow and water pixels is also difficult based on reflectance due to mountain shadow. Therefore, in the present algorithm, water bodies are marked in pre-winter

season and are masked in the final products during winter. Flow diagram of the algorithm is given in Figure 2.

6. Results and discussions

In this atlas, basin-wise snow cover statistics, maps, and seasonal depletion curves have been provided from October 2010 to June 2011. Snow ablation pattern varies from basin to basin, depending on area altitude distribution in the basins. Many of these sub-basins like Nubra, Shyok, Shasgan, Shigar and Hanza are highly glacierized, therefore large area under snow and glacier cover was observed even at the beginning and end of accumulation season. In case of Gilgit sub-basin, it is at lower altitude and is less Glacierized so lot of variation in areal extent of snow was observed.

Acknowledgements

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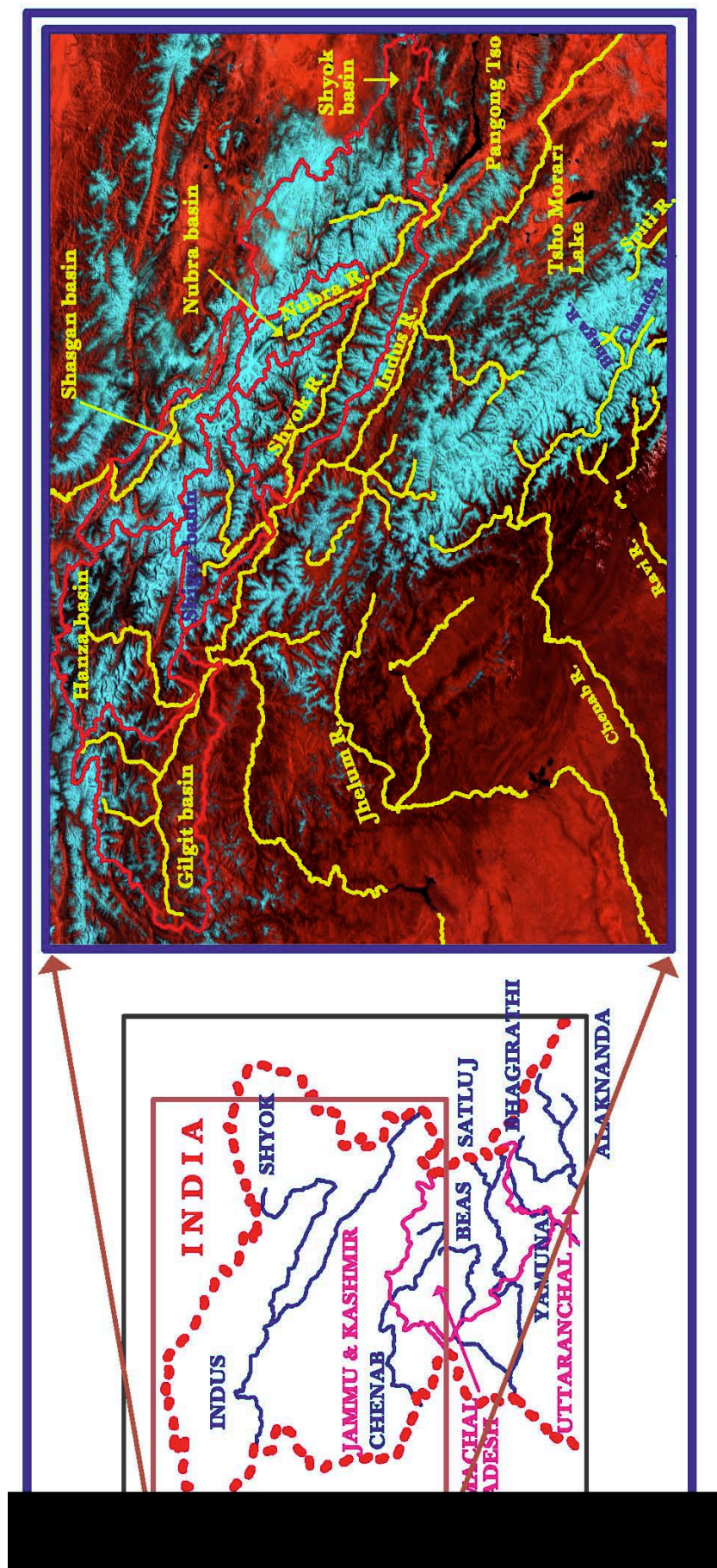


Figure 1: Location map of Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan sub-basins (Part of Indus basin)

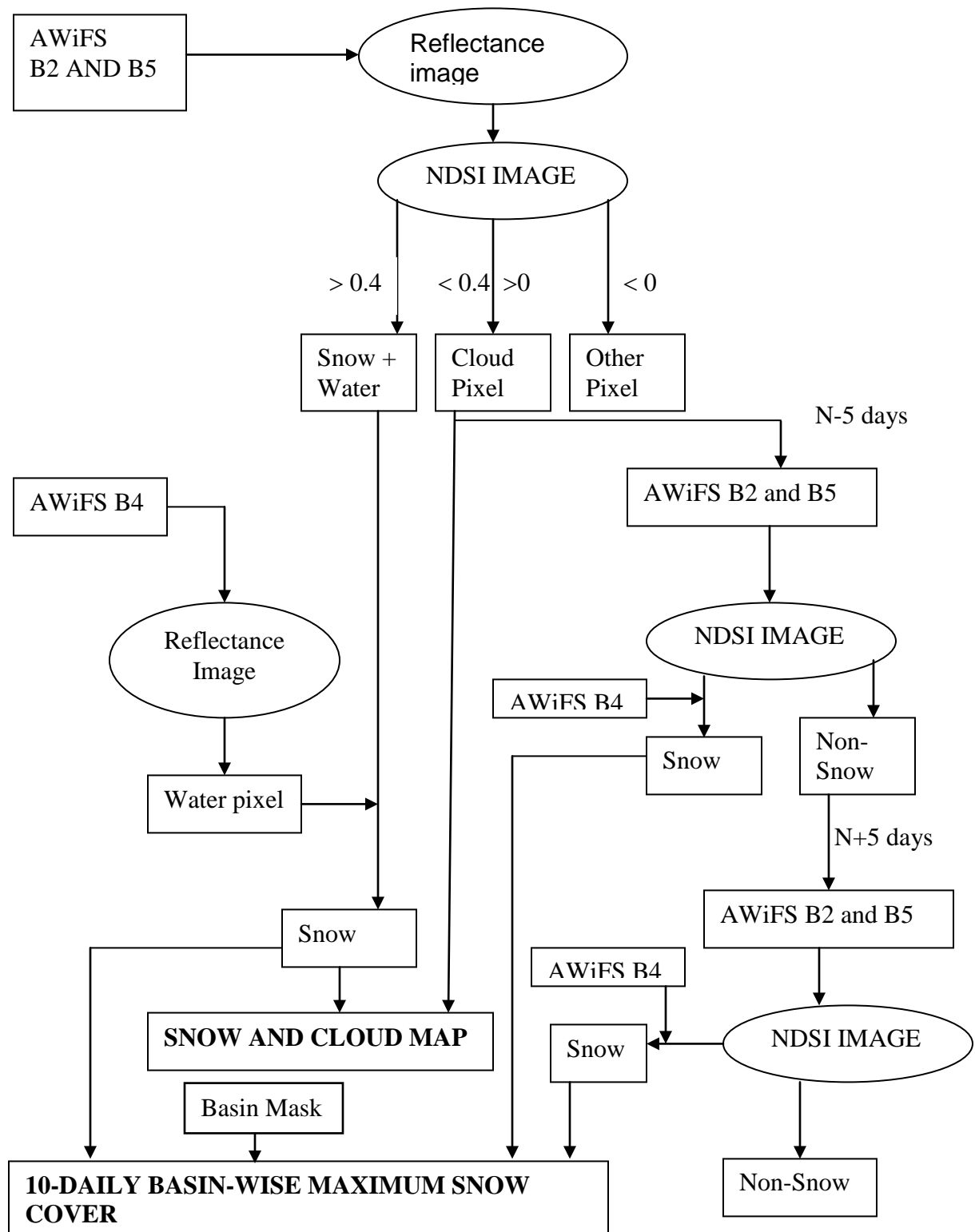


Figure 2: Algorithm for snow cover mapping using AWiFS data

NUBRA BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: NUBRA

BASIN AREA: 4258 sq km

S No	Date	Snow cover (sq. km)	Snow cover (%)	S No	Date	Snow cover (sq. km)	Snow cover (%)
October 2010							
1	3-Oct-10	2257.96	53	2	8-Oct-10	2123.87	50
3	17-Oct-10	2197.48	52	4	18-Oct-10	2134.13	50
November 2010							
5	6-Nov-10	2582.97	61	6	10-Nov-10	2475.00	58
7	15-Nov-10	2368.62	56	8	29-Nov-10	2759.99	65
9	30-Nov-10	2664.36	63				
December 2010							
10	4-Dec-10	1545.33	36	11	5-Dec-10	2008.96	47
12	14-Dec-10	2438.22	57	14	19-Dec-10	2594.29	61
15	24-Dec-10	2729.83	64	16	29-Dec-10	2665.35	63
January 2011							
17	2-Jan-11	3992.90	94	18	12-Jan-11	3936.12	92
19	21-Jan-11	3502.85	82	20	22-Jan-11	3833.18	90
February 2011							
21	9-Feb-11	3303.21	78	22	10-Feb-11	3740.46	88
March 2011							
23	10-Mar-11	3583.75	84	24	15-Mar-11	3434.99	81
25	25-Mar-11	3576.90	84	26	30-Mar-11	3832.12	90
April 2011							
27	13-Apr-11	3503.26	82	28	18-Apr-11	3986.95	94
29	23-Apr-11	3464.67	81				
May 2011							
30	12-May-11	2520.86	59	31	17-May-11	2813.52	66
32	20-May-11	3150.81	74				
June 2011							
33	9-Jun-11	2844.86	67	34	14-Jun-11	2095.26	49
35	19-Jun-11	1975.41	46				

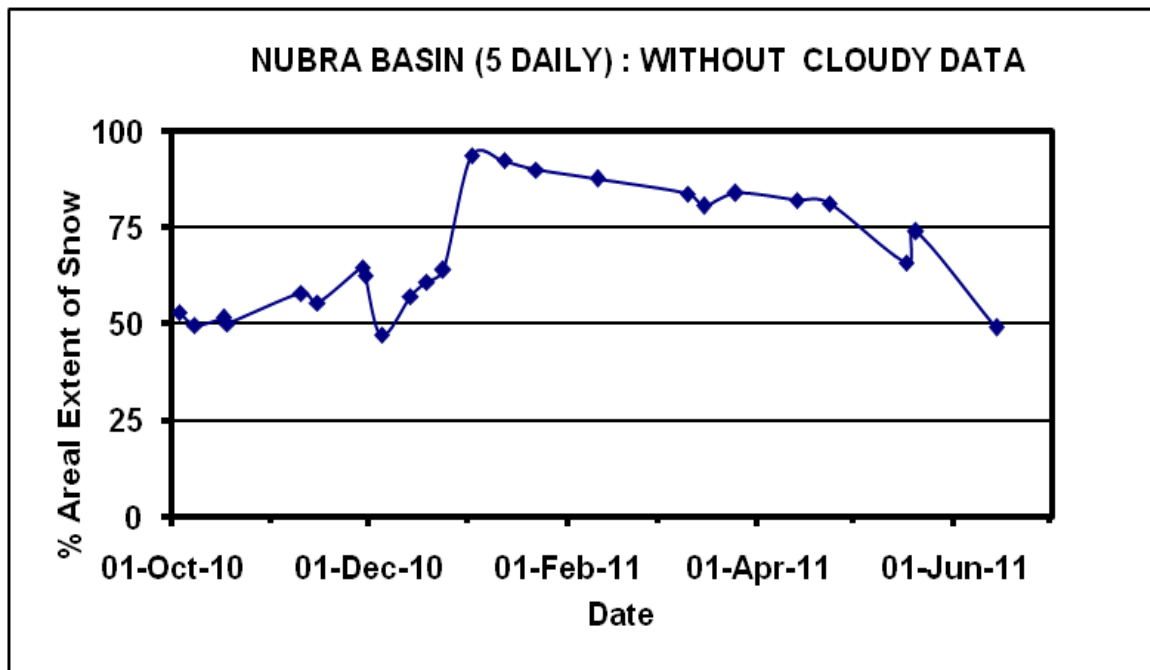
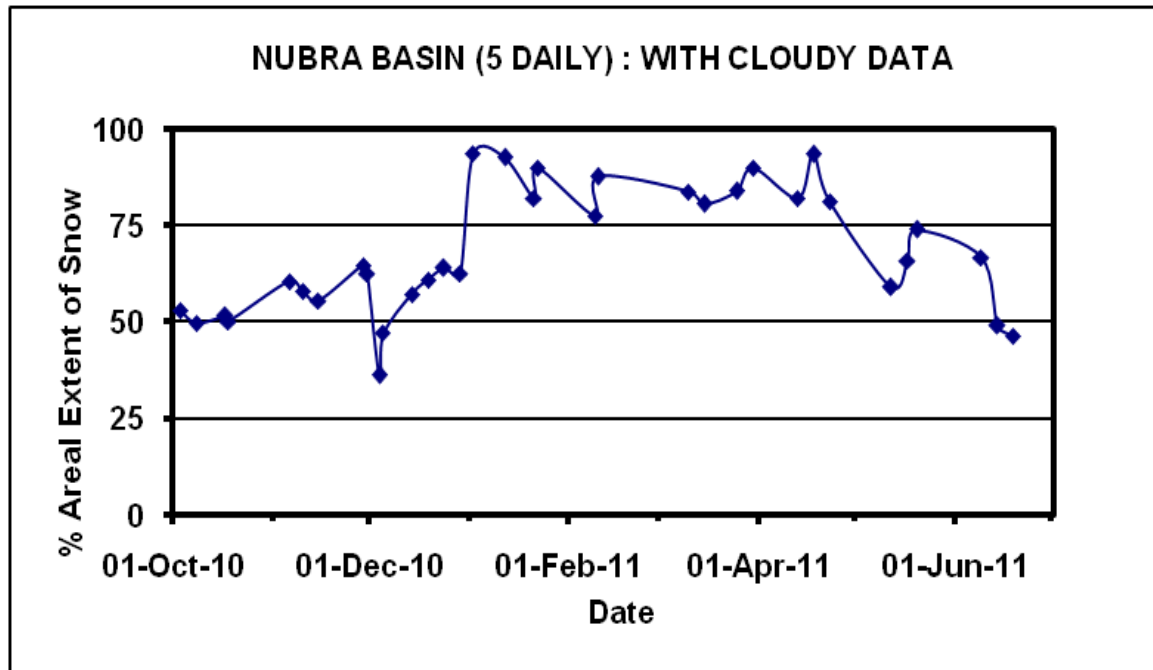
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: NUBRA

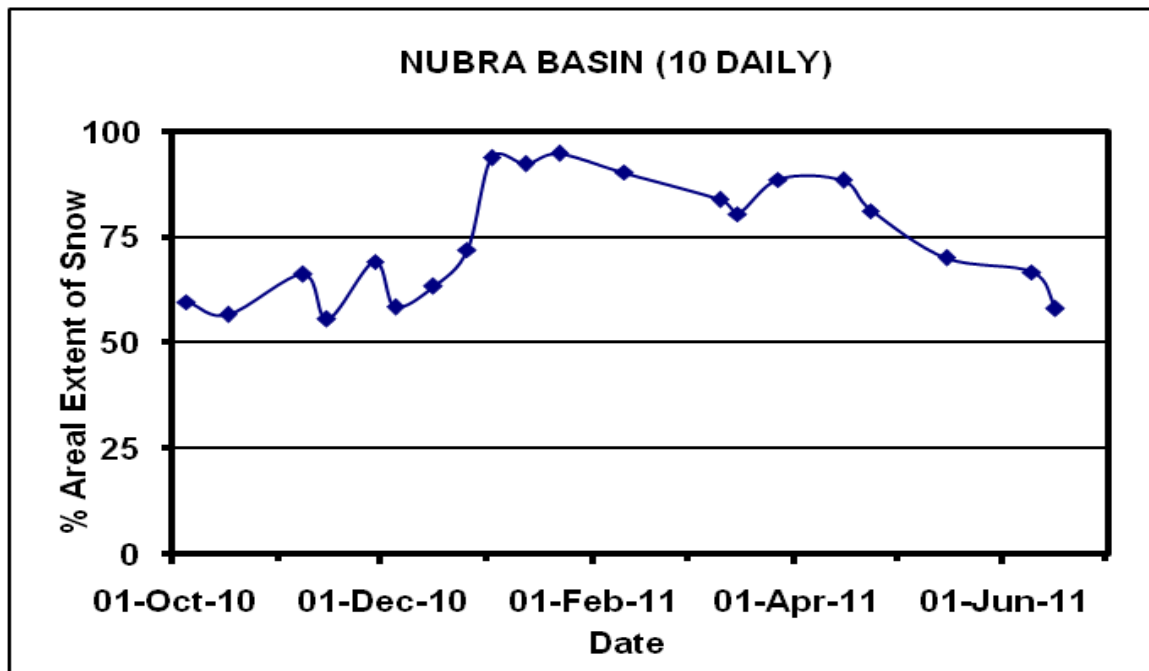
BASIN AREA: 4258 sq km

S No	Date	Snow cover (sq. km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	2541.73	60	3	8-Nov-10	2820.48	66
2	17-Oct-10	2416.08	57	4	15-Nov-10	2368.62	56
				5	29-Nov-10	2951.58	69
December 2010				January 2011			
6	5-Dec-10	2506.54	59	9	2-Jan-11	3992.90	94
7	16-Dec-10	2702.65	63	10	12-Jan-11	3936.12	92
8	26-Dec-10	3071.19	72	11	22-Jan-11	4041.51	95
February 2011				March 2011			
12	10-Feb-11	3848.04	90	13	10-Mar-11	3583.75	84
				14	15-Mar-11	3434.99	81
				15	27-Mar-11	3780.86	89
April 2011				May 2011			
16	15-Apr-11	3767.82	88	18	15-May-11	2989.85	70
17	23-Apr-11	3464.67	81				
June 2011							
19	9-Jun-11	2844.86	67				
20	16-Jun-11	2477.21	58				

Snow cover depletion curve

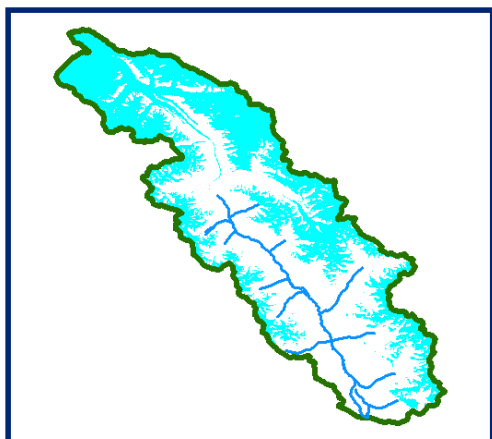


Snow cover depletion curve

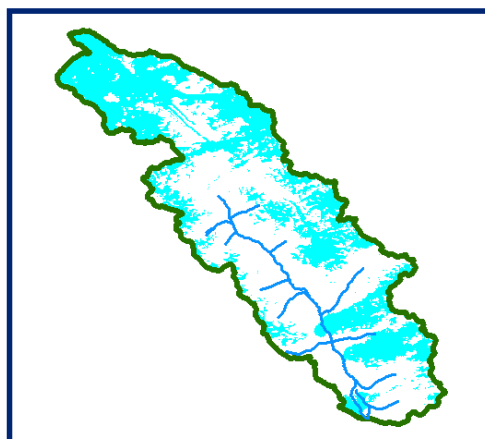


SNOW COVER MAP

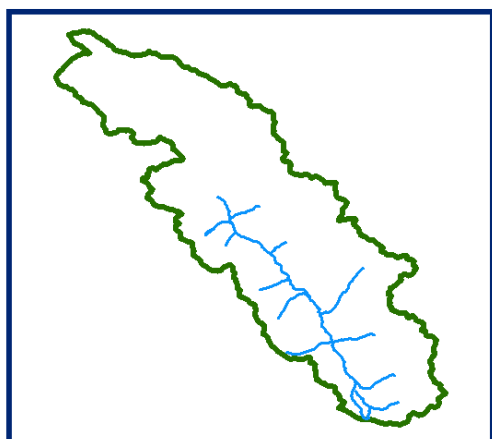
SNOW COVER MAP : NUBRA BASIN



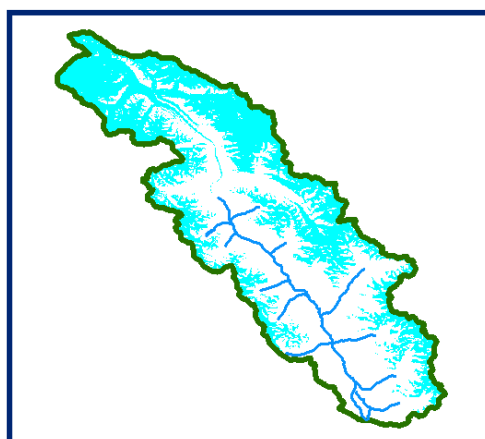
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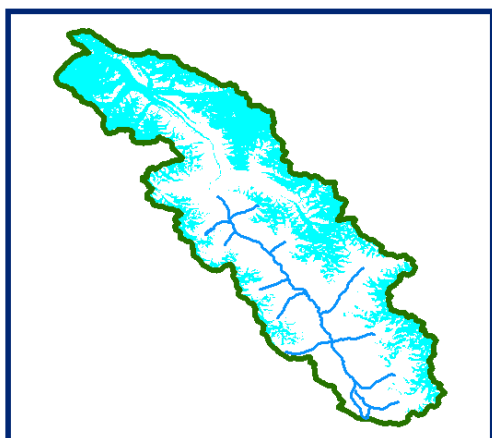
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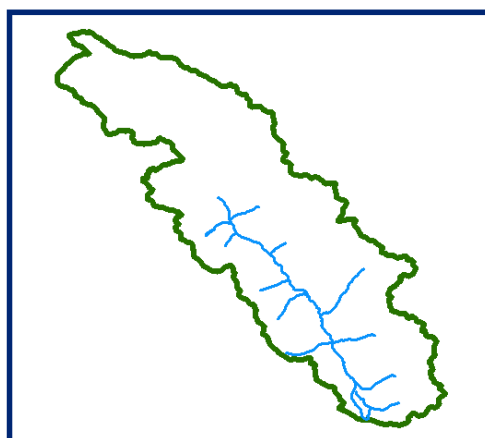
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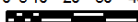
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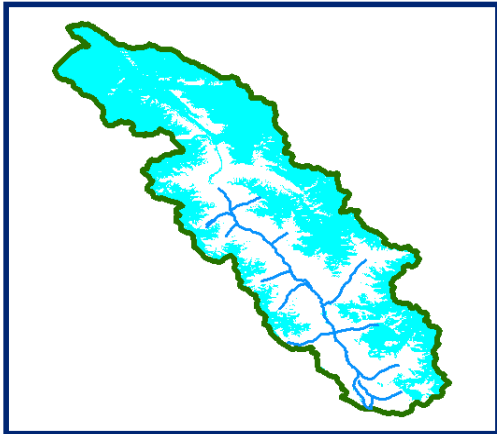
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 SNOW

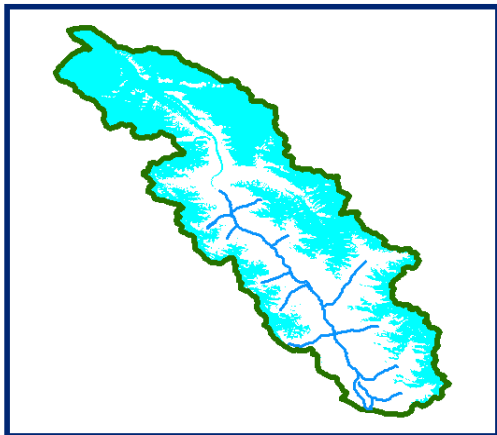
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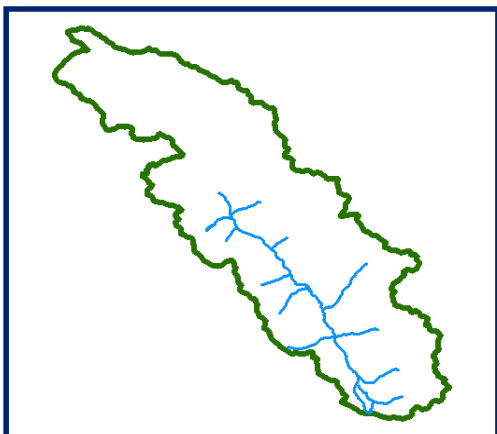
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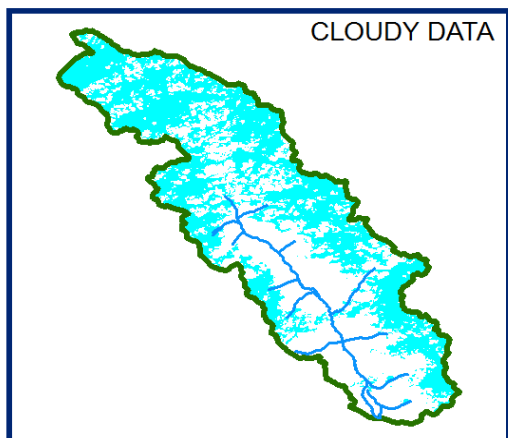
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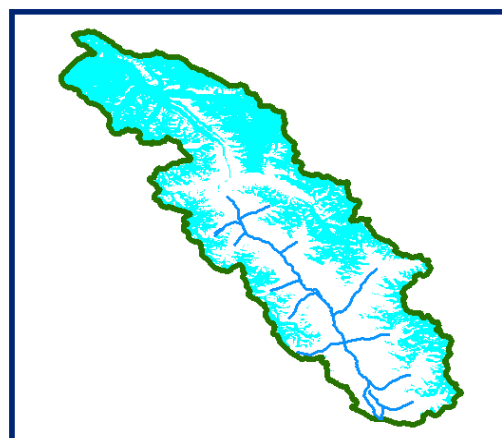
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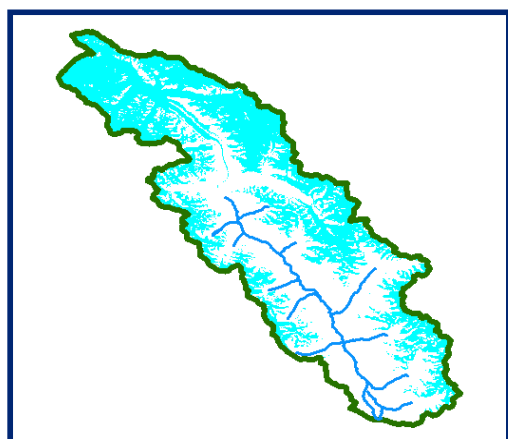
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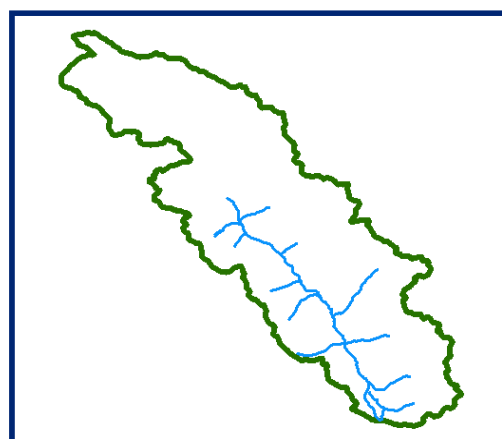
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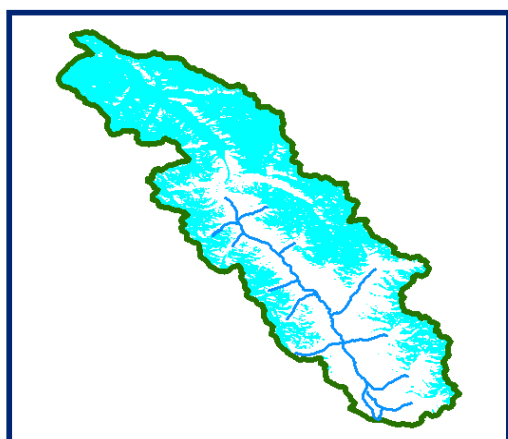
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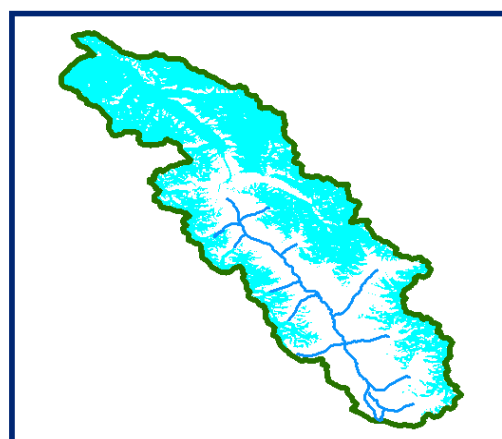
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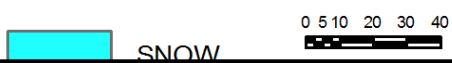
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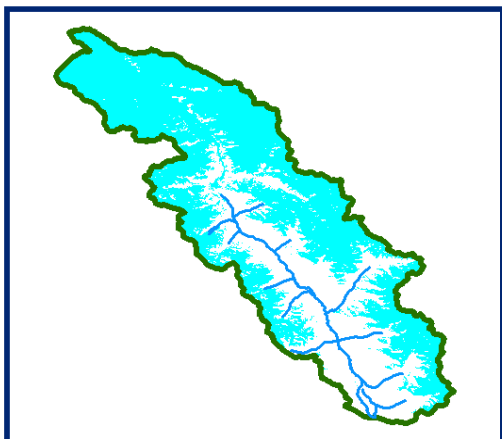
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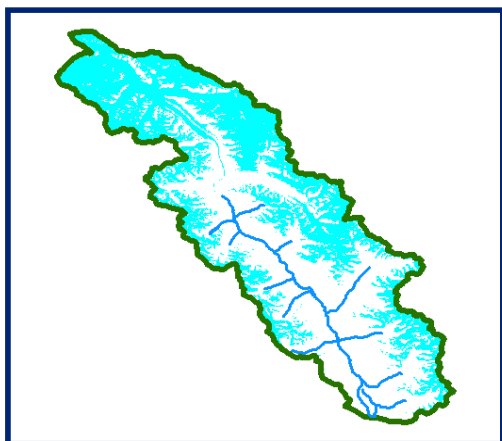
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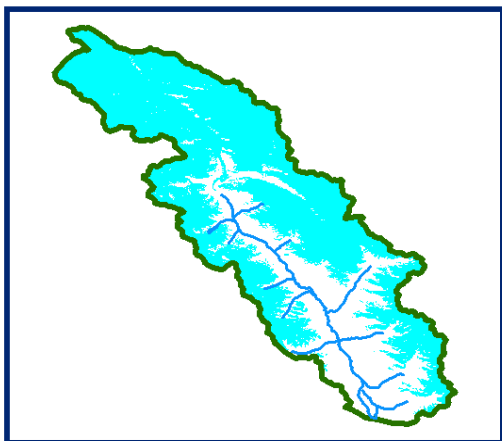
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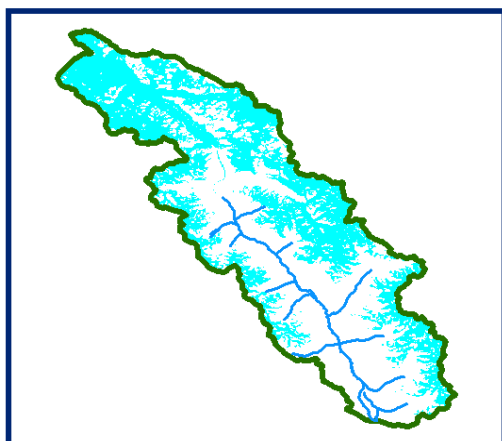
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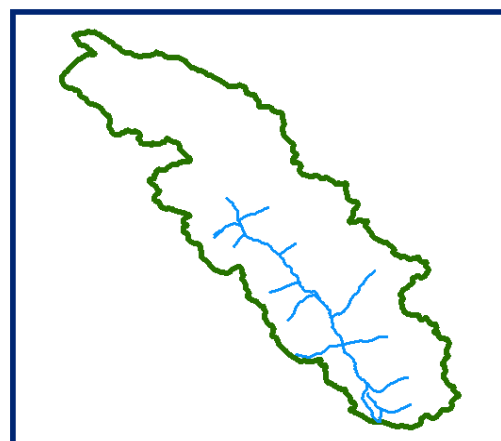
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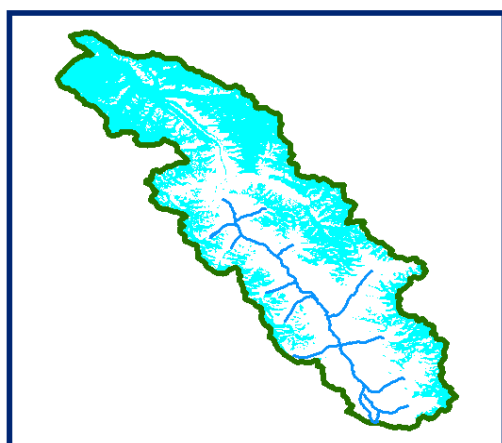
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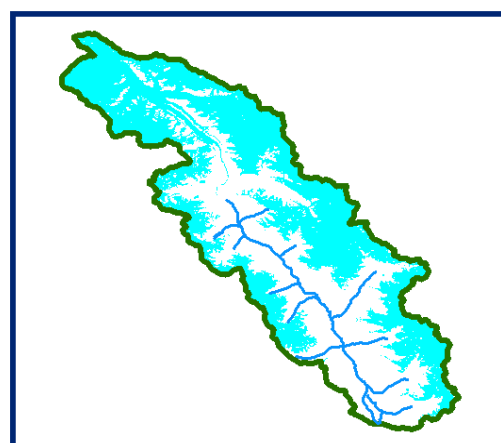
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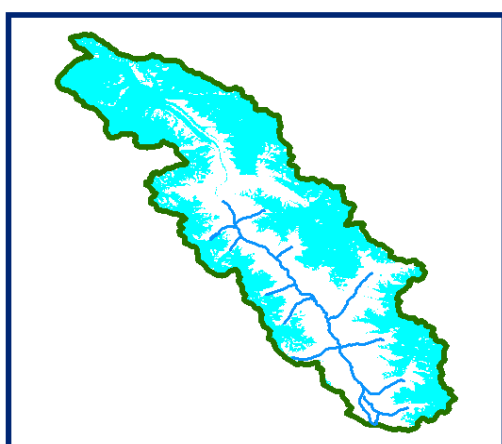
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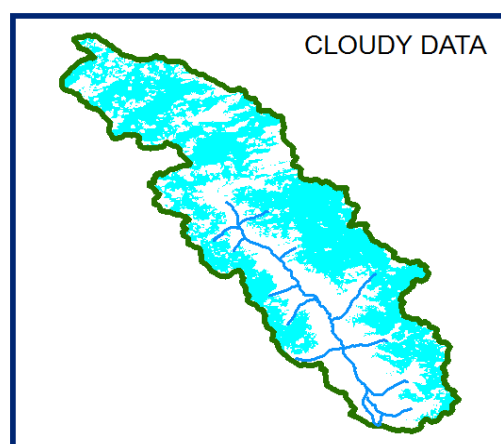
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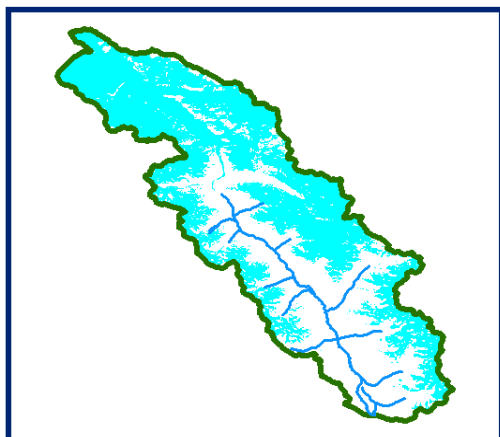


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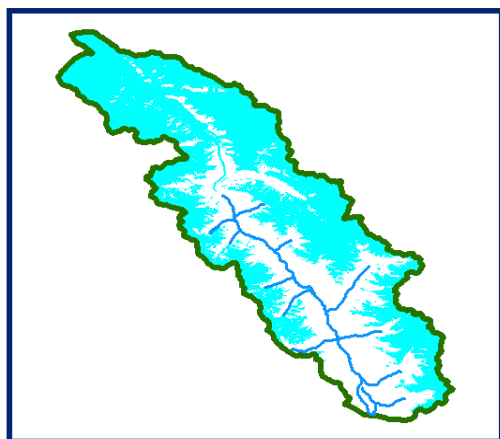
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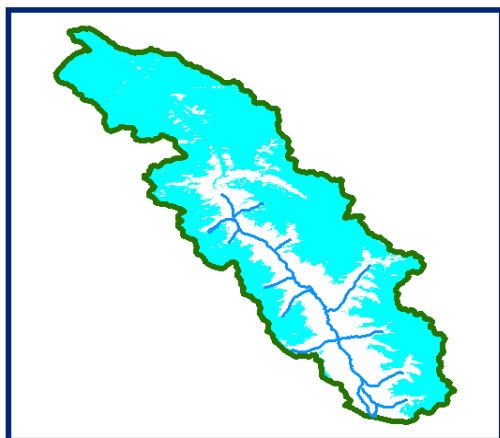
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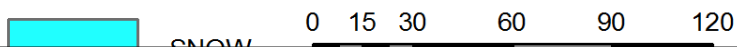
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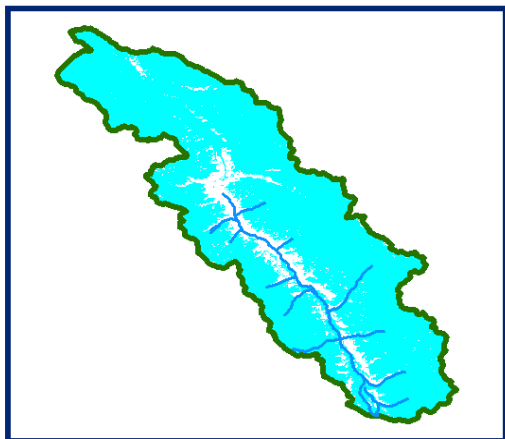
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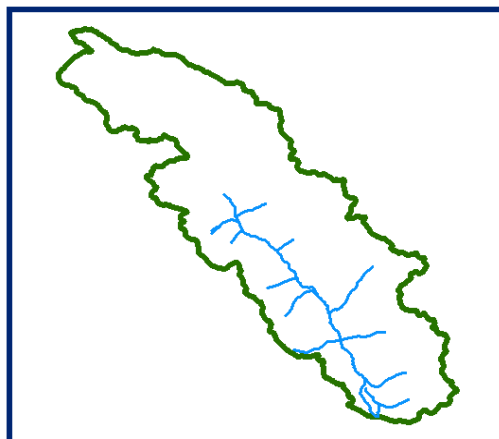
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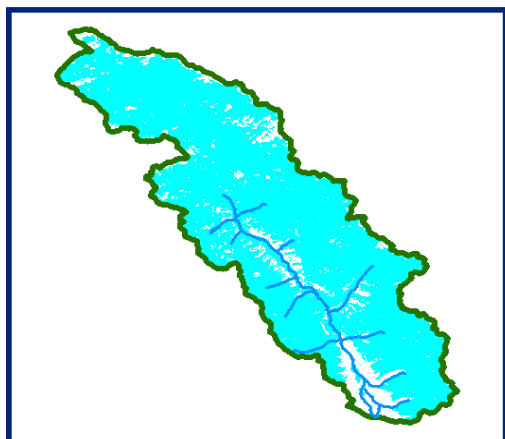
NUBRA BASIN



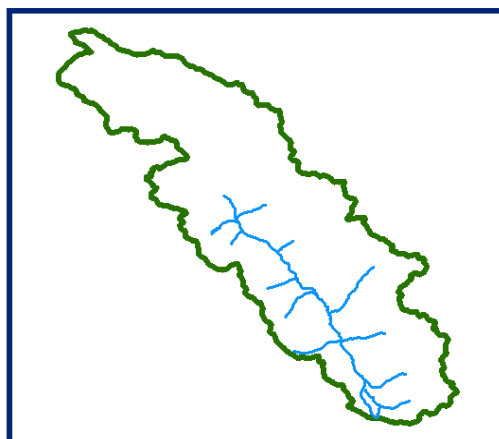
2 JANUARY 2011



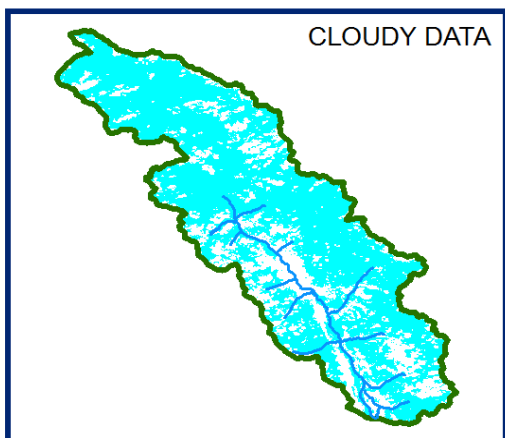
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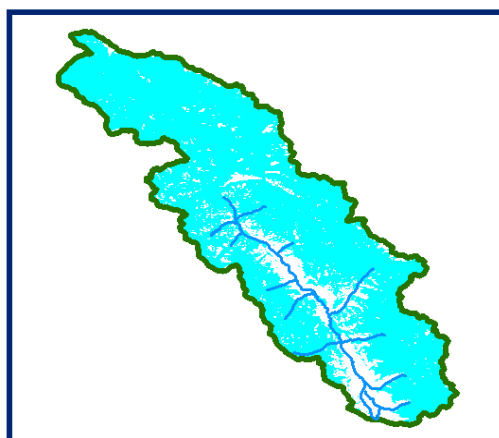
12 JANUARY 2011



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21 JANUARY 2011



22 JANUARY 2011

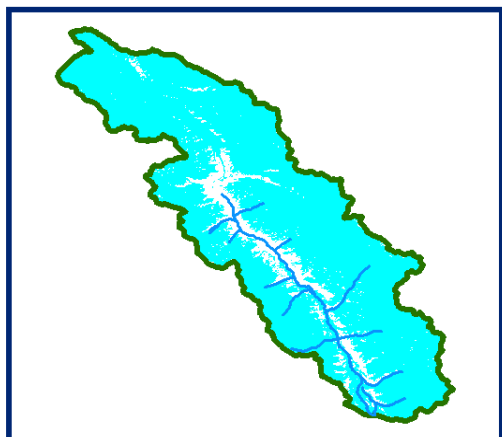


SNOW

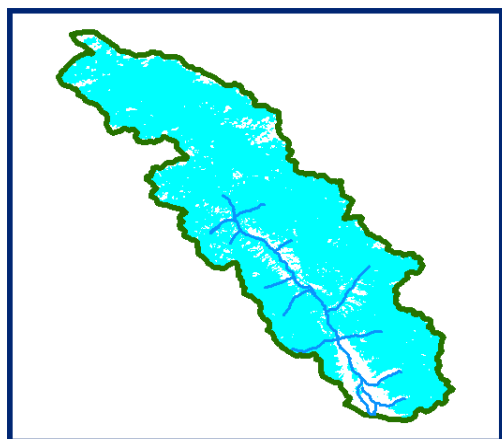
0 5 10 20 30 40



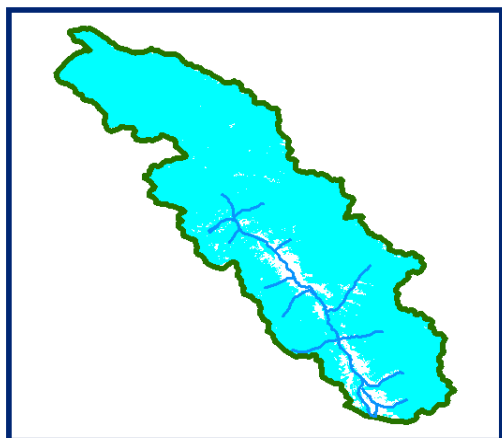
10 DAILY SNOW COVER MAP: NUBRA BASIN



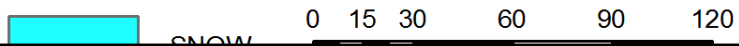
DATA USED
2 JANUARY 2011



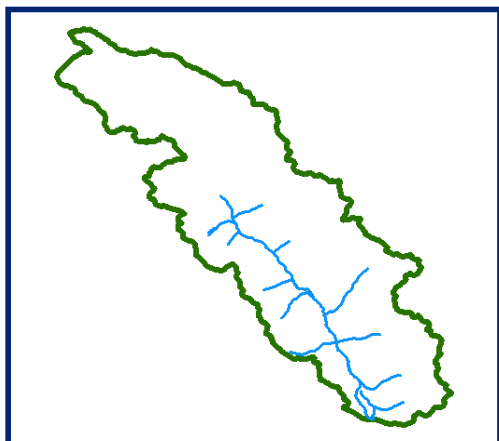
DATA USED
12 JANUARY 2011



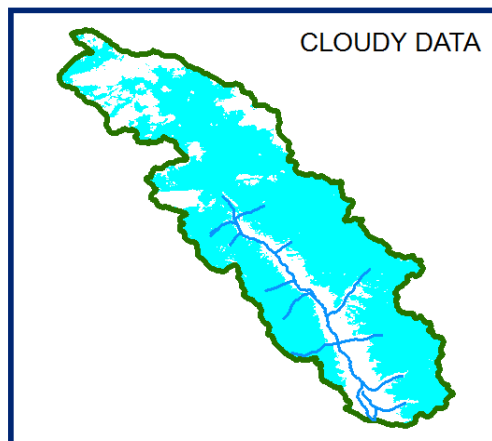
DATA USED
21 JANUARY 2011
22 JANUARY 2011



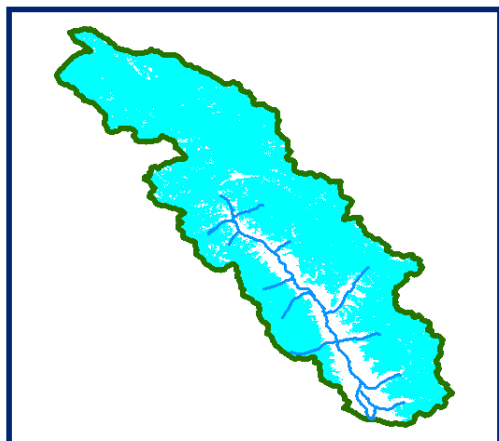
SNOW COVER MAP : NUBRA BASIN



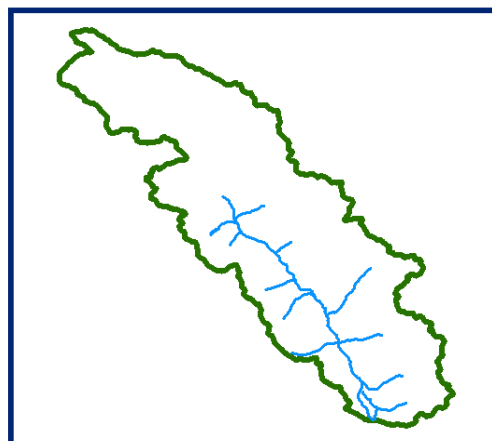
DATA NOT AVAILABLE



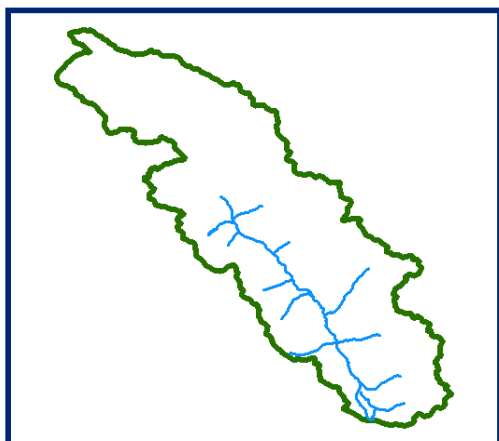
9 FEBRUARY 2011



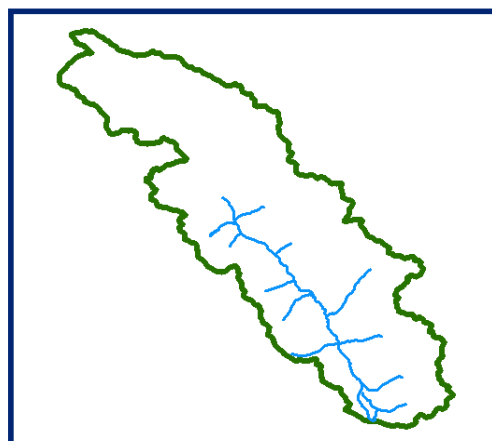
10 FEBRUARY 2011



DATA NOT AVAILABLE



DATA NOT AVAILABLE

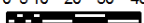


DATA NOT AVAILABLE

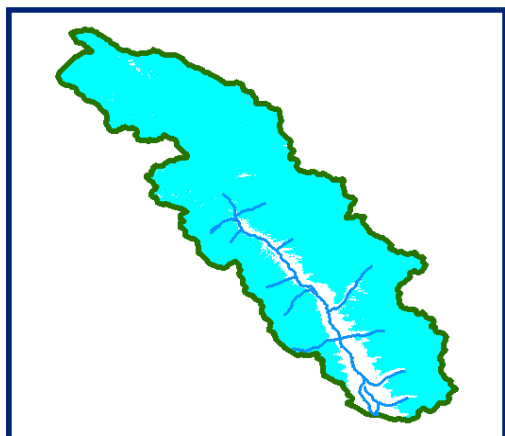


SNOW

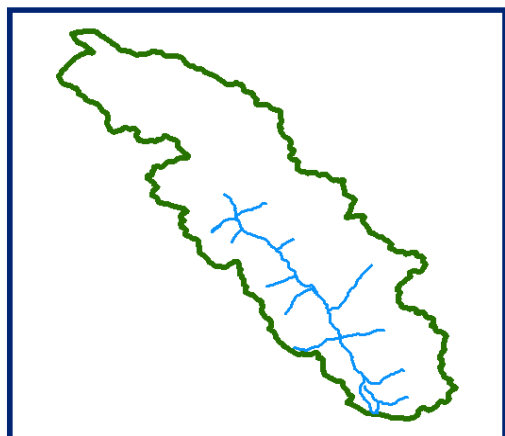
0 5 10 20 30 40



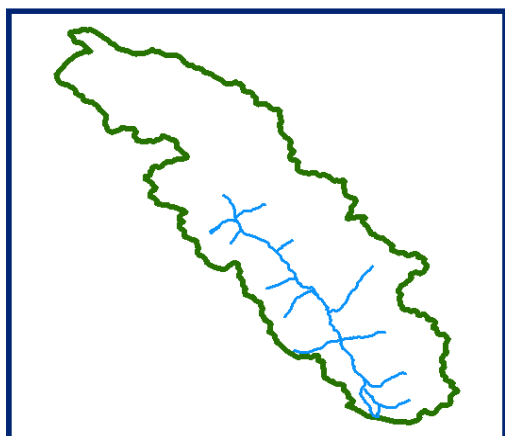
10 DAILY SNOW COVER MAP: NUBRA BASIN



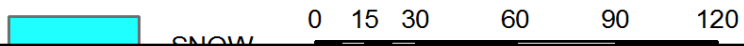
DATA USED
9 FEBRUARY 2011



DATA USED
DATA NOT AVAILABLE



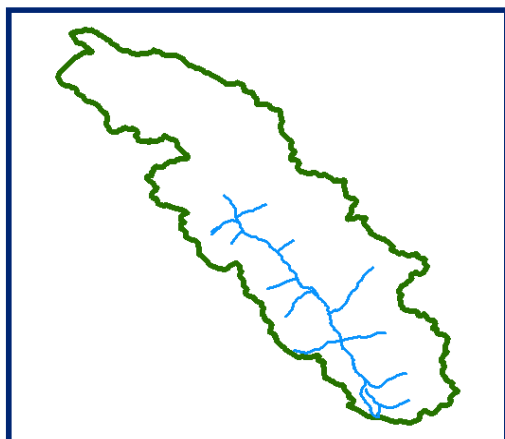
DATA USED
DATA NOT AVAILABLE



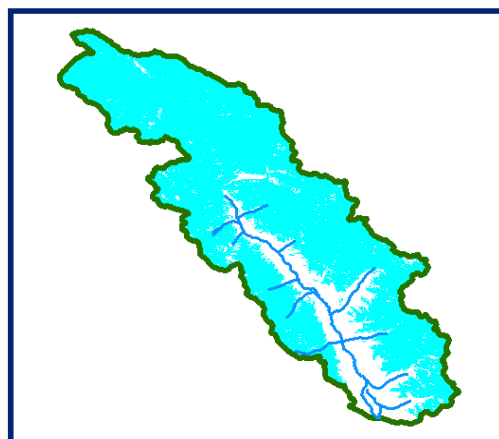
SNOW COVER MAP

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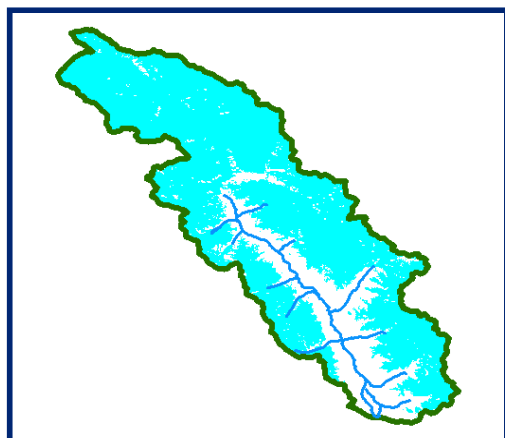
NUBRA BASIN



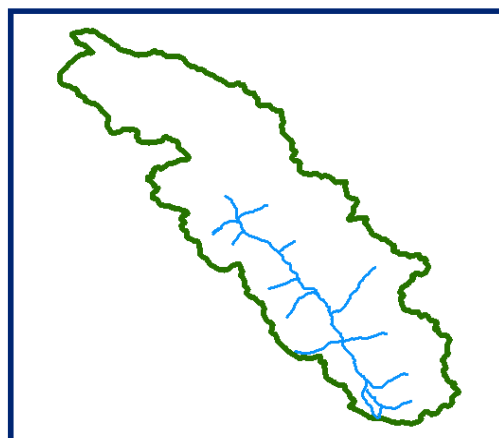
DATA NOT AVAILABLE



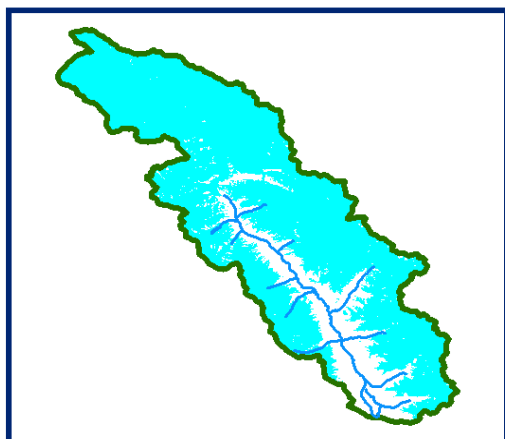
10 MARCH 2011



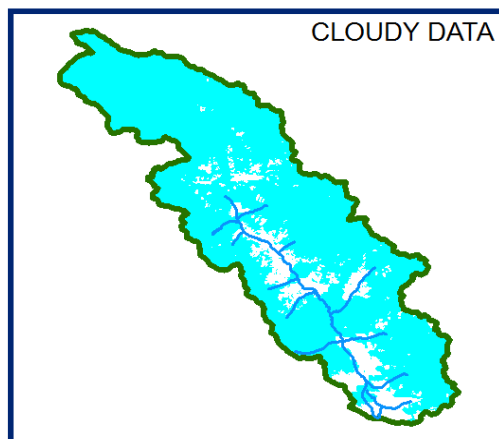
15 MARCH 2011



DATA NOT AVAILABLE



25 MARCH 2011

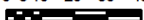


30 MARCH 2011

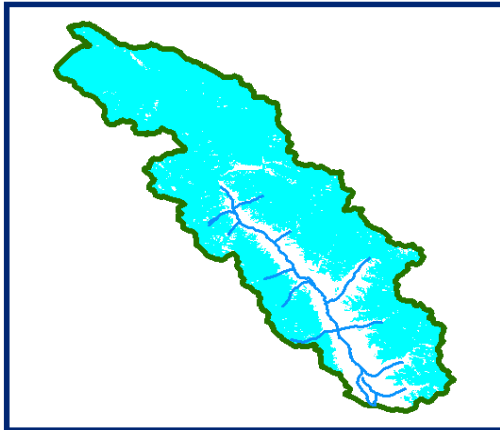


SNOW

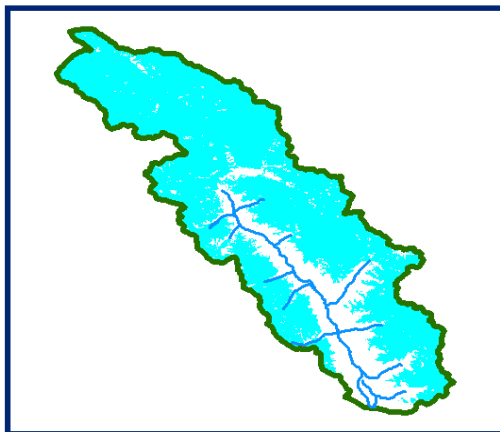
0 5 10 20 30 40



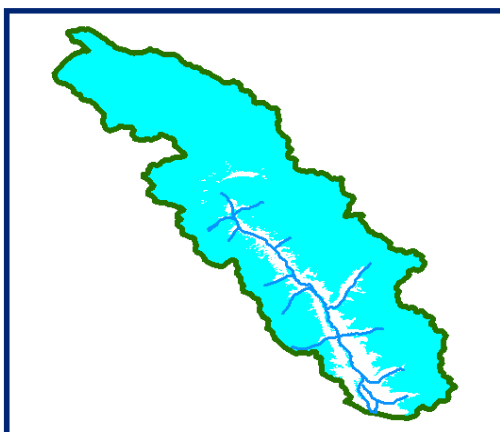
10 DAILY SNOW COVER MAP: NUBRA BASIN




DATA USED
10 MARCH 2011



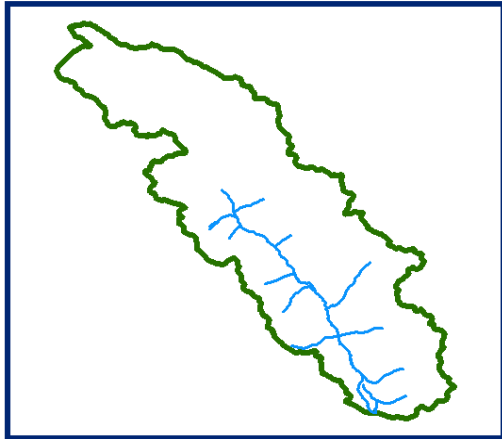
DATA USED
15 MARCH 2011



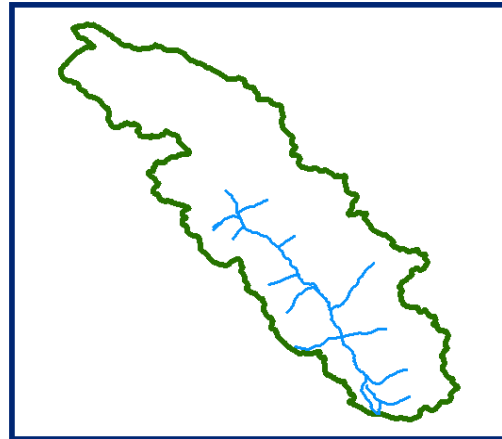
DATA USED
25 MARCH 2011
30 MARCH 2011

 SNOW 0 15 30 60 90 120

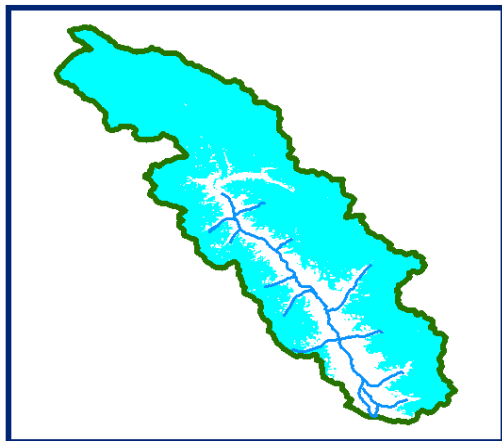
SNOW COVER MAP : NUBRA BASIN



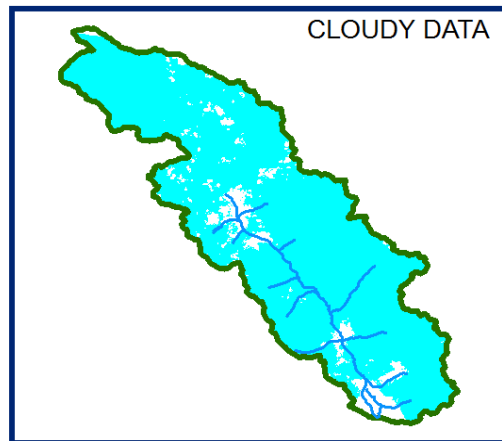
DATA NOT AVAILABLE



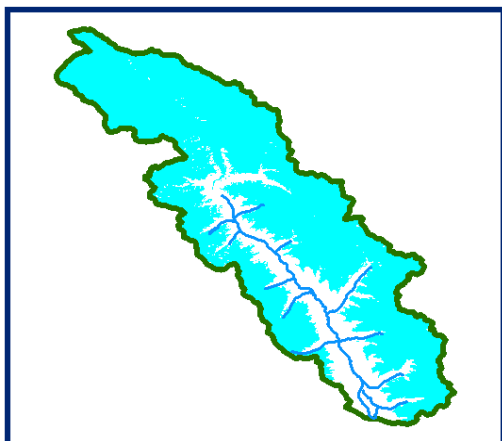
DATA NOT AVAILABLE



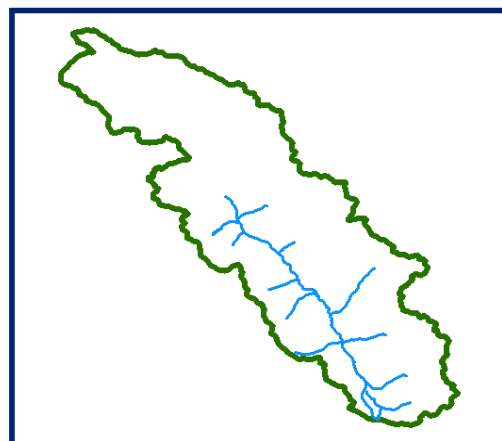
13 APRIL 2011



18 APRIL 2011



23 APRIL 2011



DATA NOT AVAILABLE

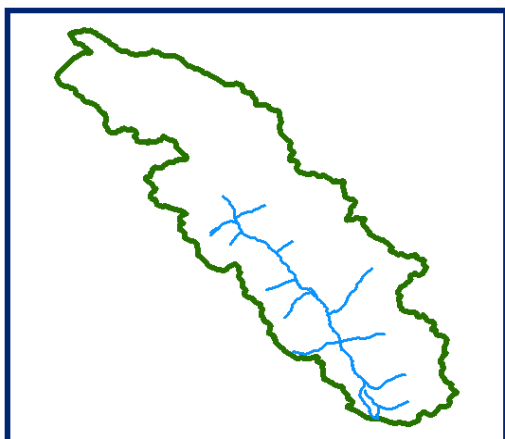


SNOW

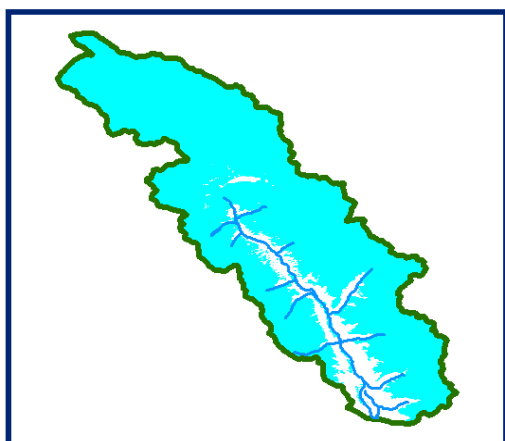
0 5 10 20 30 40



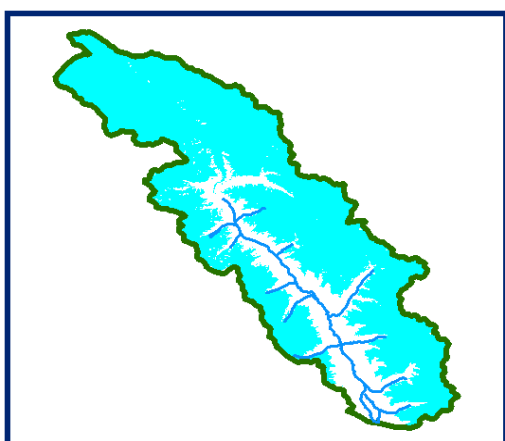
10 DAILY SNOW COVER MAP: NUBRA BASIN



DATA USED
DATA NOT AVAILABLE



DATA USED
13 APRIL 2011
18 APRIL 2011



DATA USED
23 APRIL 2011



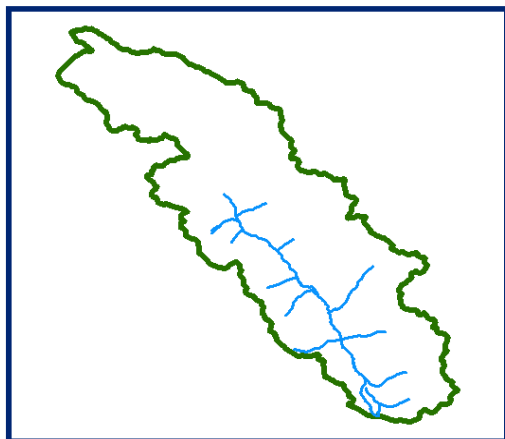
SNOW

0 15 30 60 90 120

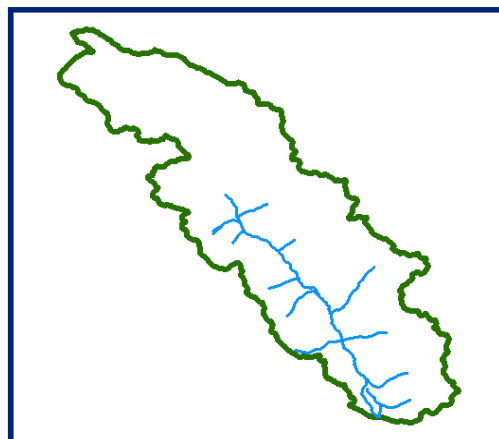
SNOW COVER MAP

:

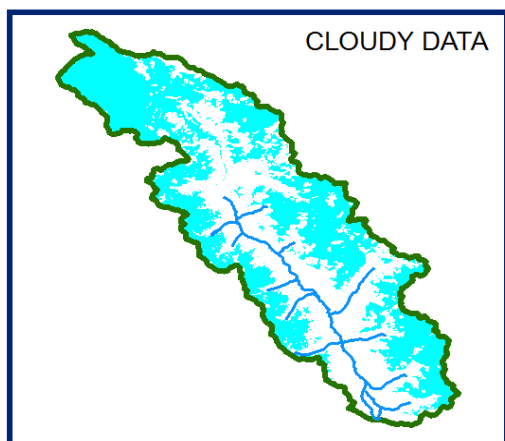
NUBRA BASIN



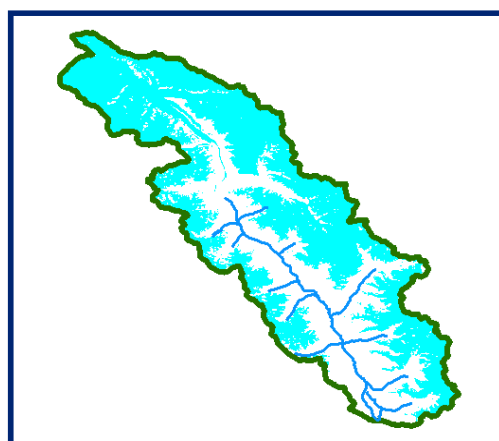
DATA NOT AVAILABLE



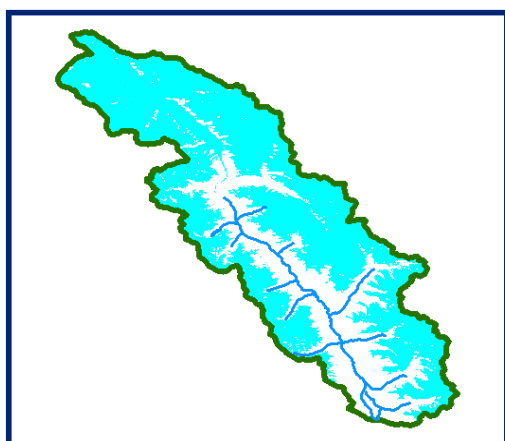
DATA NOT AVAILABLE



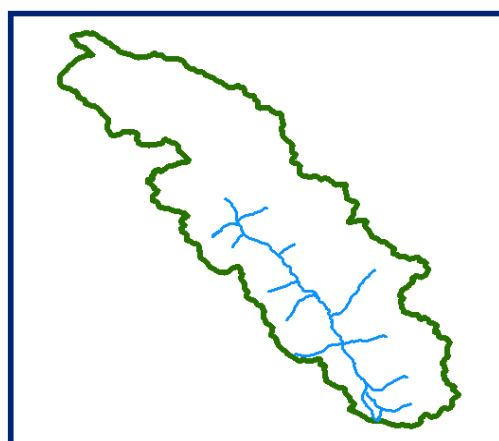
12 MAY 2011



17 MAY 2011



20 MAY 2011



DATA NOT AVAILABLE

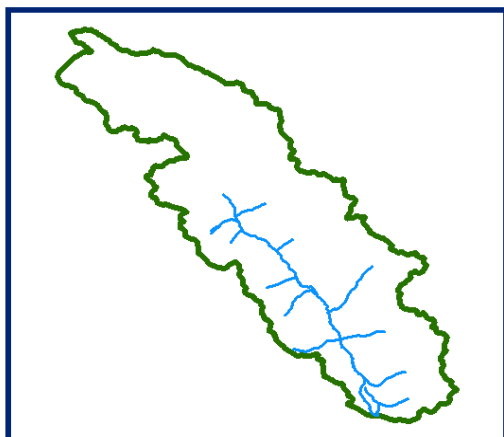


SNOW

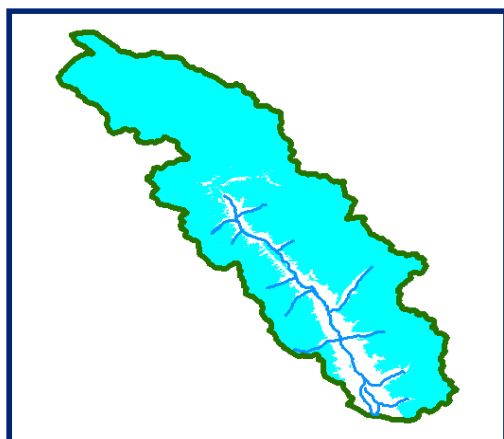
0 5 10 20 30 40



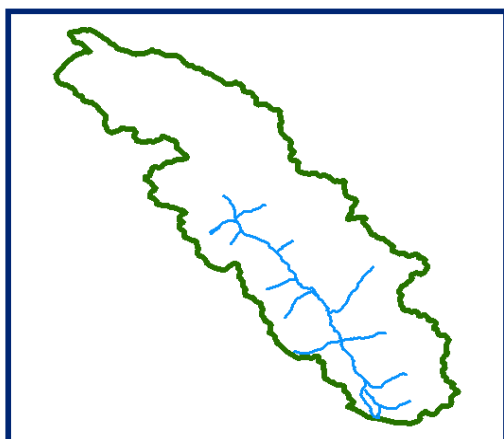
10 DAILY SNOW COVER MAP: NUBRA BASIN



DATA USED
DATA NOT AVAILABLE



DATA USED
12 MAY 2011
17 MAY 2011
20 MAY 2011



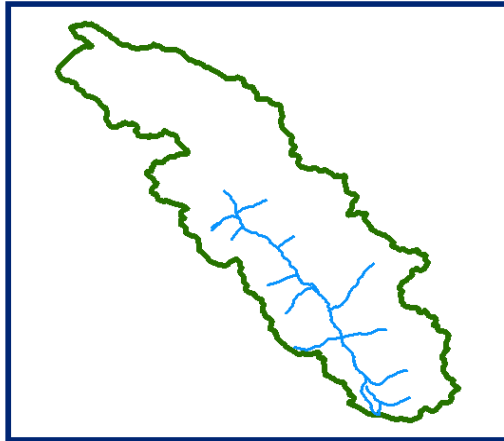
DATA USED
DATA NOT AVAILABLE



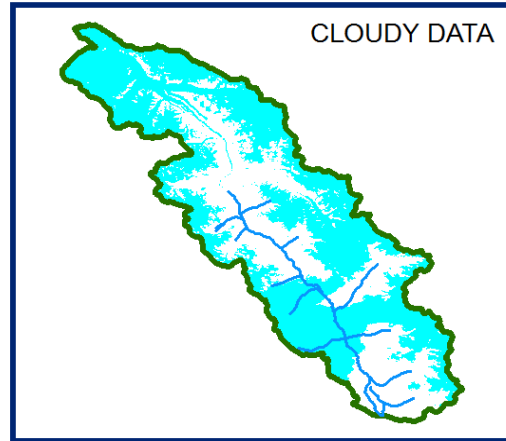
SNOW

0 15 30 60 90 120

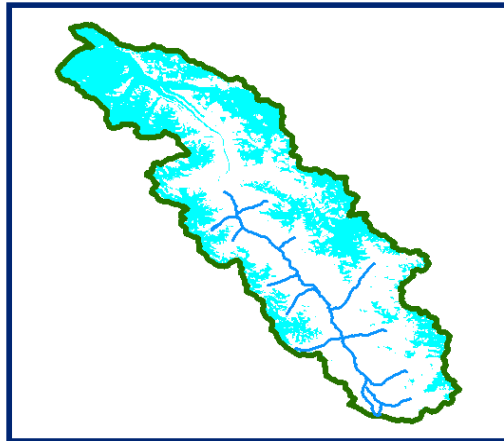
SNOW COVER MAP : NUBRA BASIN



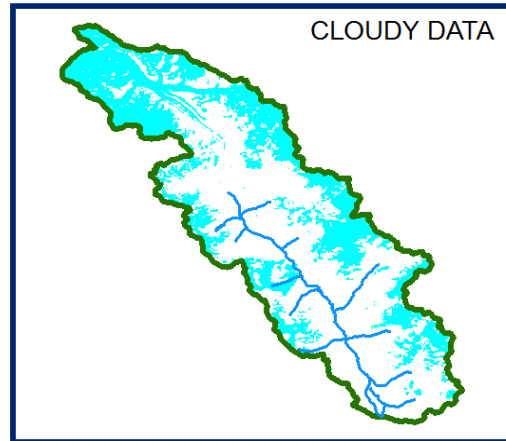
DATA NOT AVAILABLE



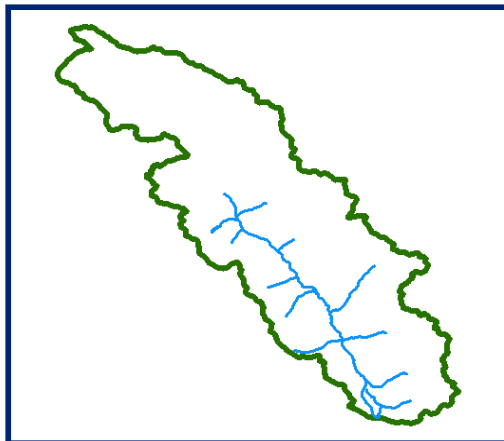
9 JUNE 2011



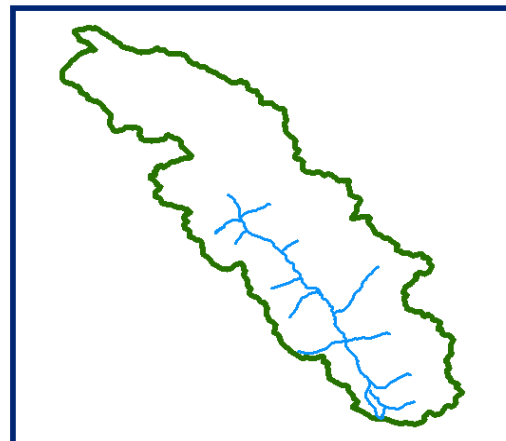
14 JUNE 2011



19 JUNE 2011




DATA NOT AVAILABLE

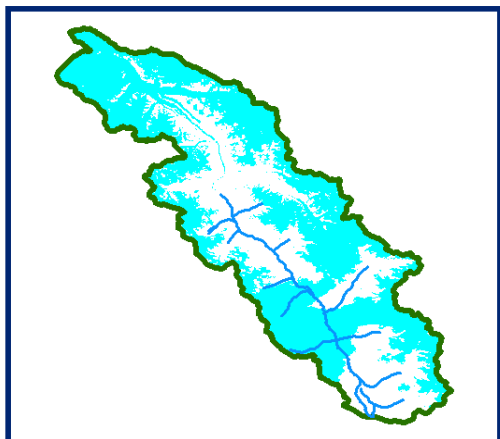


DATA NOT AVAILABLE

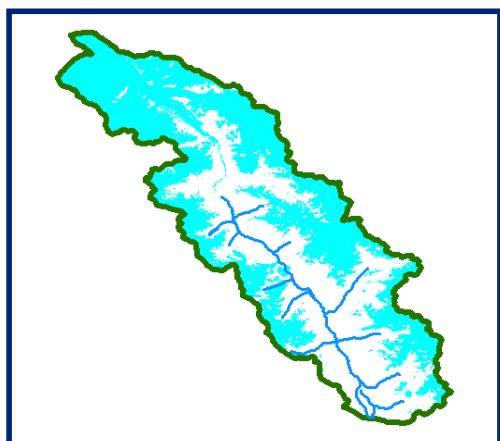
 SNOW

0 5 10 20 30 40


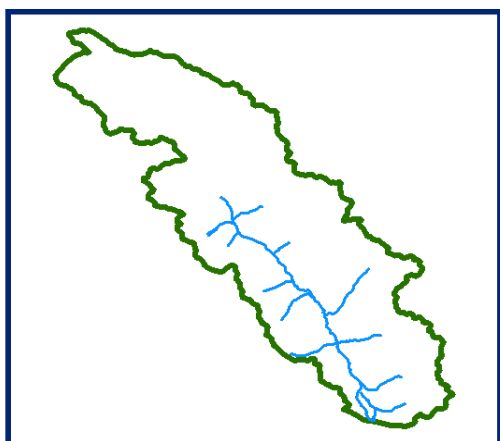
10 DAILY SNOW COVER MAP: NUBRA BASIN



DATA USED
9 JUNE 2011



DATA USED
14 JUNE 2011
19 JUNE 2011



DATA USED
DATA NOT AVAILABLE



SNOW

0 15 30 60 90 120

SHYOK BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: SHYOK

BASIN AREA: 27120 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010							
1	3-Oct-10	6589.61	24	2	8-Oct-10	7209.16	27
3	18-Oct-10	6213.95	23				
November 2010							
4	6-Nov-10	7307.02	27	5	15-Nov-10	7605.50	28
6	30-Nov-10	9360.46	35				
December 2010							
7	04-Dec-10	5724.86	21	8	14-Dec-10	8723.12	32
9	19-Dec-10	12387.10	46	10	24-Dec-10	12629.10	47
11	29-Dec-10	10769.40	40				
January 2011							
12	2-Jan-11	23492.90	87	13	12-Jan-11	21258.80	78
February 2011							
14	10-Feb-11	22641.40	83				
March 2011							
15	15-Mar-11	16848.10	62	16	25-Mar-11	20329.90	75
17	30-Mar-11	20960.50	77				
April 2011							
18	13-Apr-11	19672.60	73	19	23-Apr-11	19239.10	71
May 2011							
20	12-May-11	11176.00	41	21	17-May-11	11078.30	41
22	20-May-11	15267.90	56				
June 2011							
23	19-Jun-11	7016.08	26				

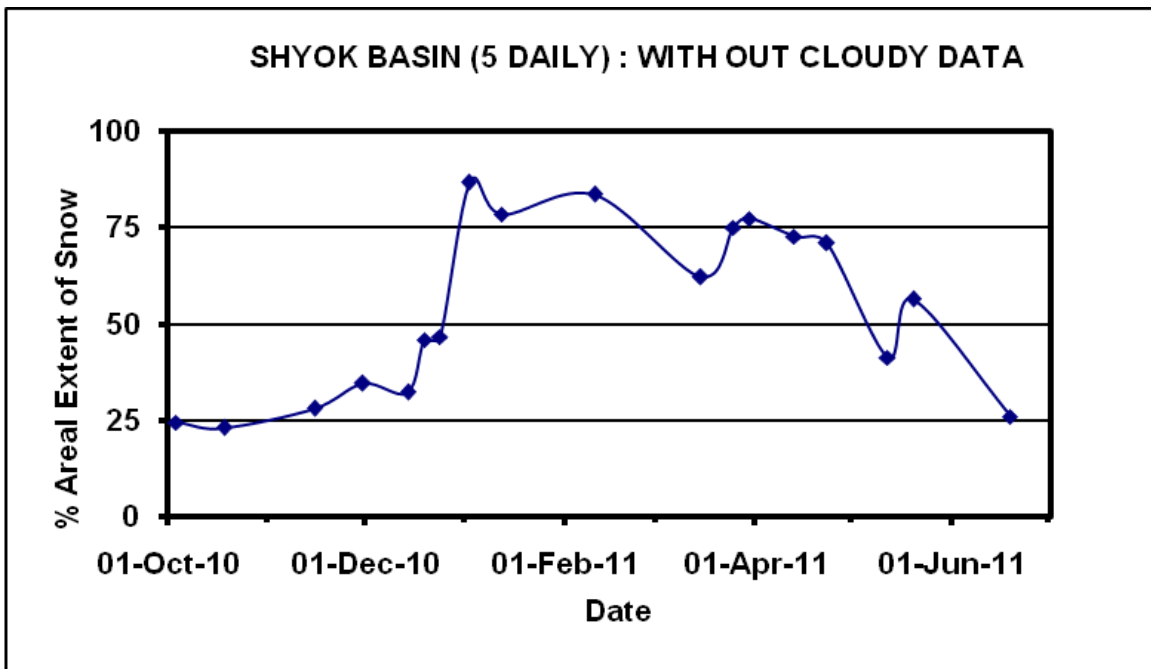
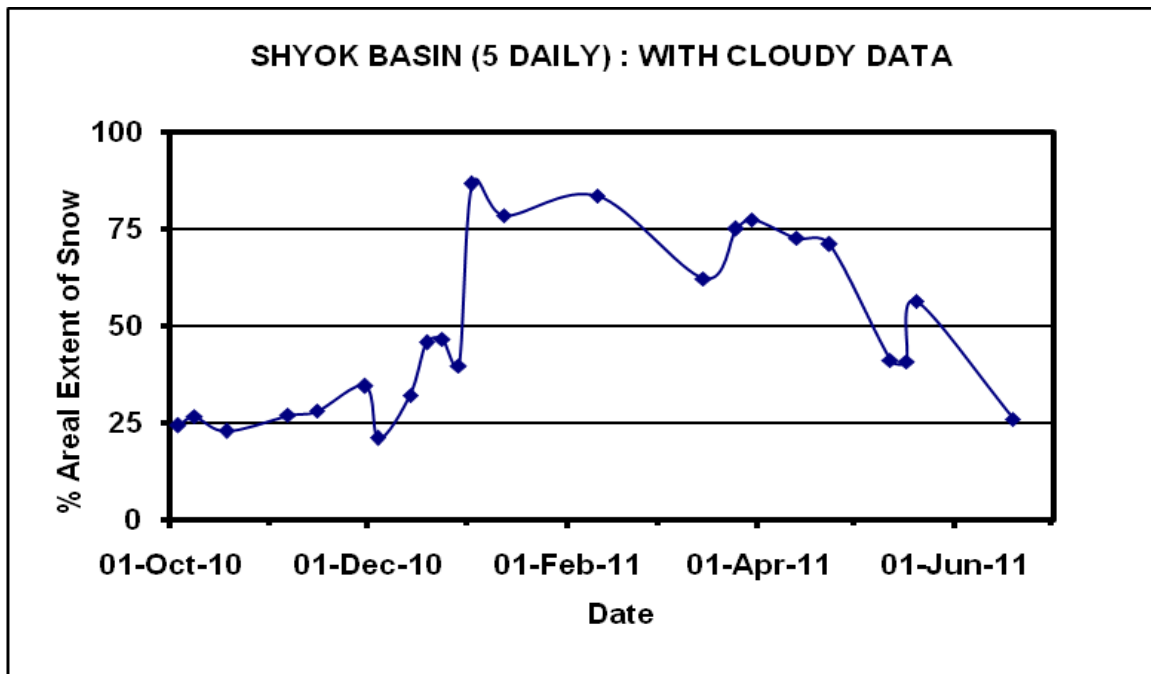
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHYOK

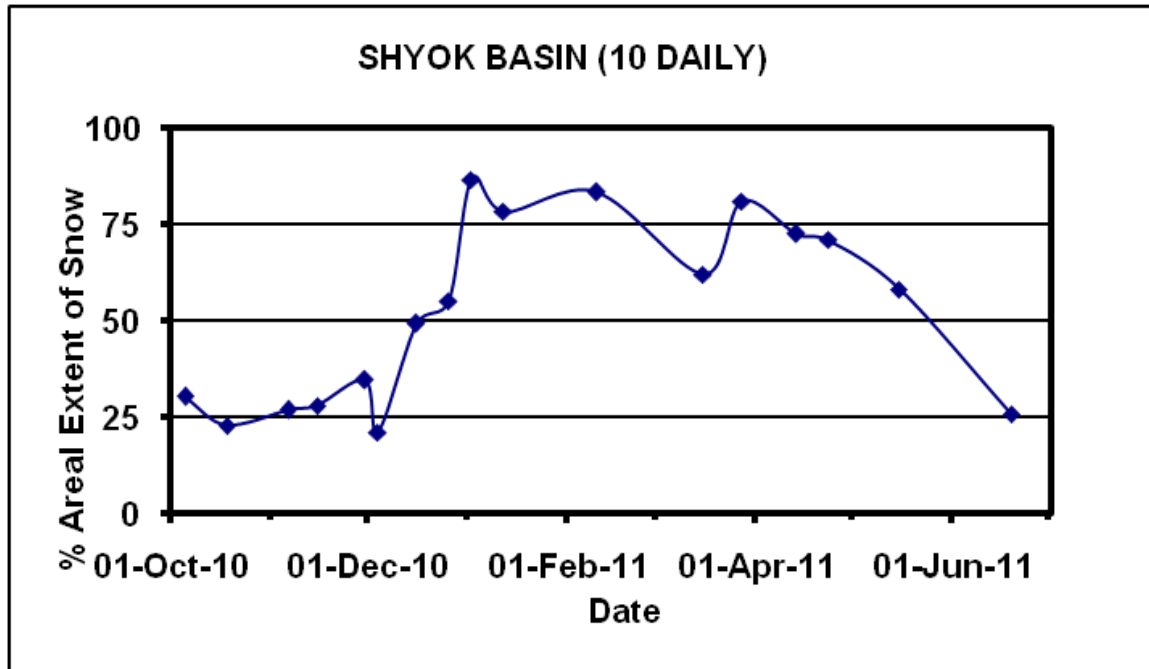
BASIN AREA: 27120 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq. km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	8211.46	30	3	6-Nov-10	7307.02	27
2	18-Oct-10	6213.95	23	4	15-Nov-10	7605.50	28
				5	30-Nov-10	9360.46	35
December 2010				January 2011			
6	04-Dec-10	5724.86	21	9	2-Jan-11	23492.90	87
7	16-Dec-10	13352.30	49	10	12-Jan-11	21258.80	78
8	26-Dec-10	14976.00	55				
February 2011				March 2011			
11	10-Feb-11	22641.40	83	12	15-Mar-11	16848.10	62
				13	27-Mar-11	21969.80	81
April 2011				May 2011			
14	13-Apr-11	19672.60	73	16	15-May-11	15776.60	58
15	23-Apr-11	19239.10	71				
June 2011							
17	19-Jun-11	7016.08	26				

Snow cover depletion curve

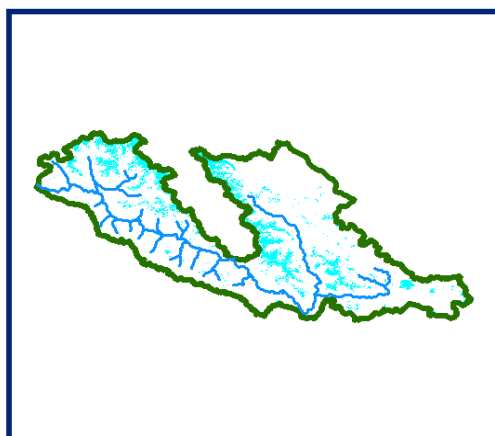


Snow cover depletion curve

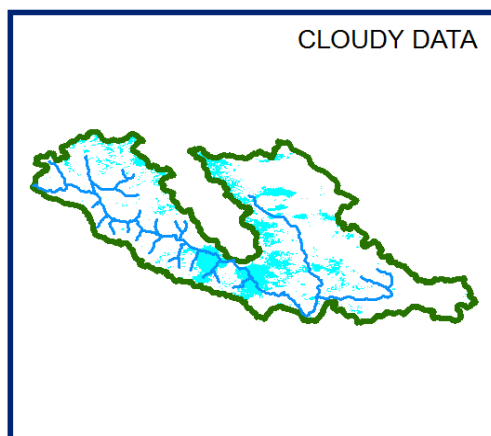


SNOW COVER MAP

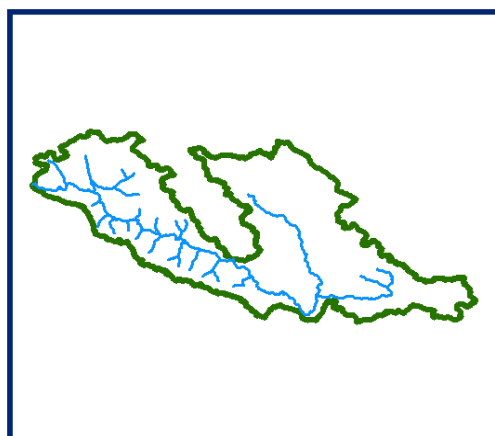
SNOW COVER MAP : SHYOK BASIN



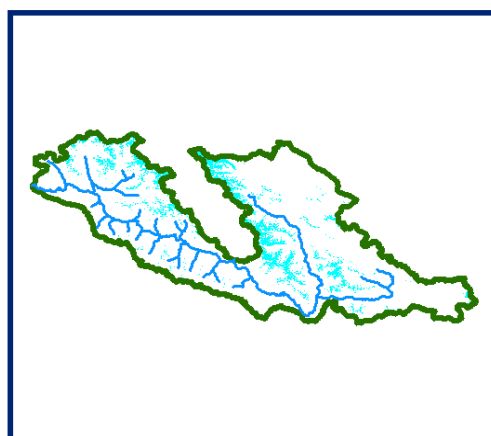
03 OCTOBER 2010



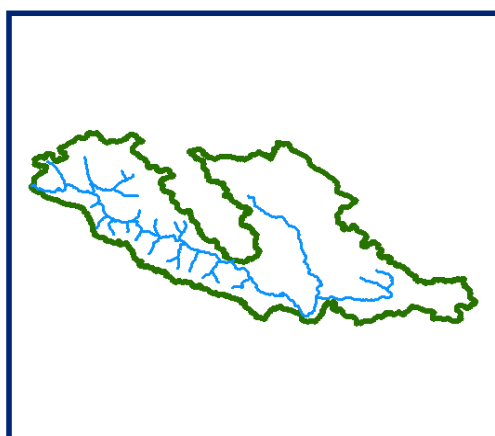
08 OCTOBER 2010



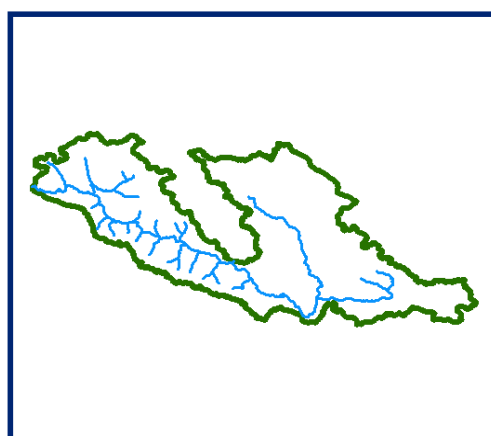
DATA NOT AVAILABLE



**18 OCTOBER 2010
17 OCTOBER 2010**



DATA NOT AVAILABLE



DATA NOT AVAILABLE

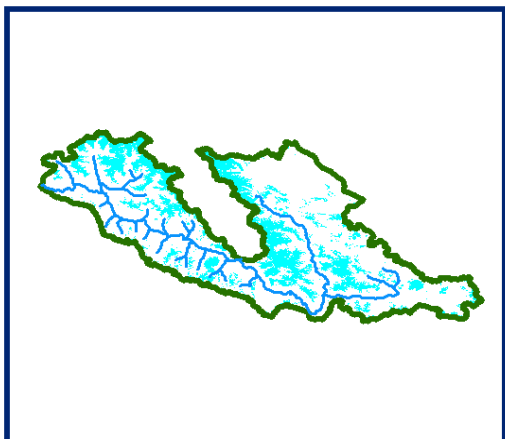


SNOW

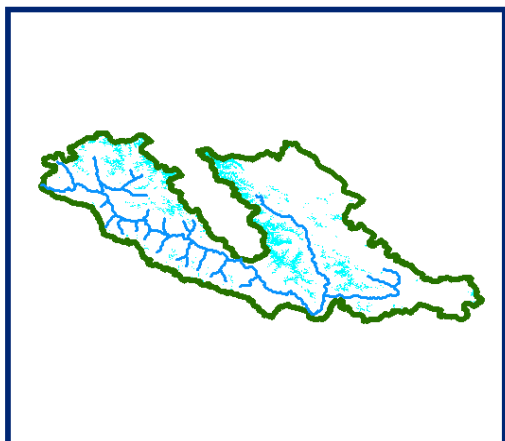
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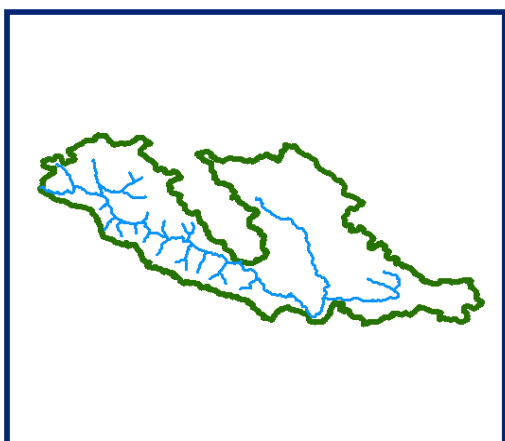
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
3 OCTOBER 2010
8 OCTOBER 2010



DATA USED
18 OCTOBER 2010



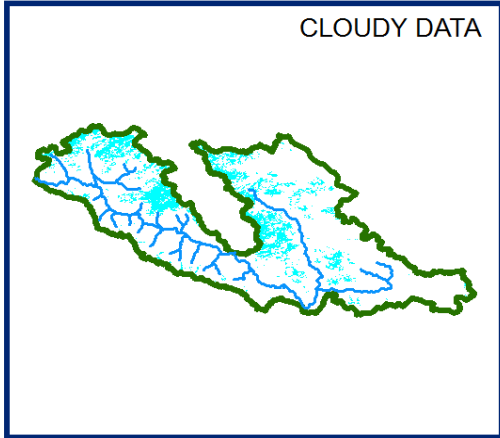
DATA USED
DATA NOT AVAILABLE



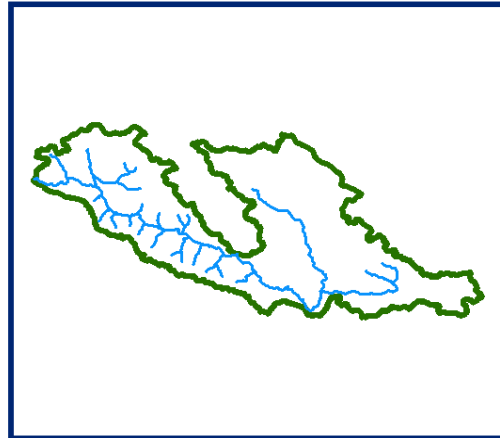
SNOW

0 50 100 200 300 400

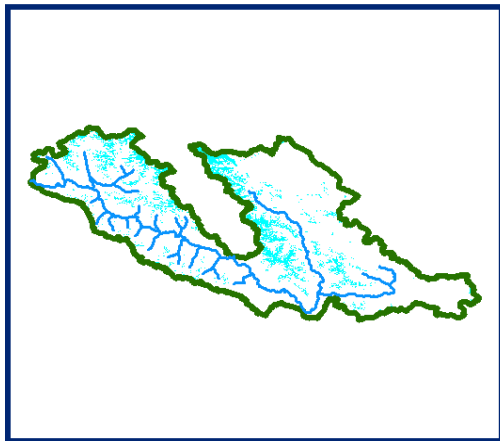
SNOW COVER MAP : SHYOK BASIN



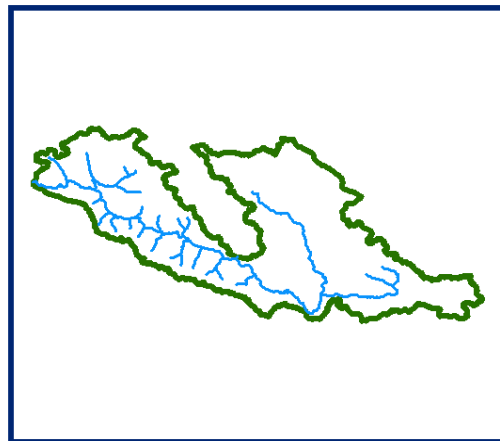
6 NOVEMBER 2010



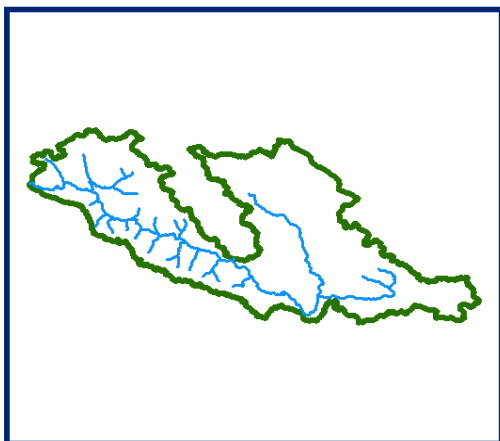
DATA NOT AVAILABLE



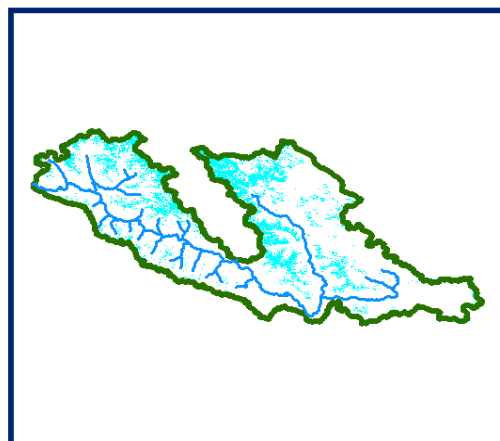
15 NOVEMBER 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE



30 NOVEMBER 2010

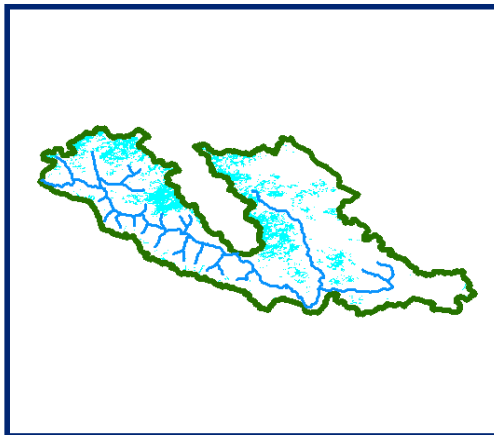


SNOW

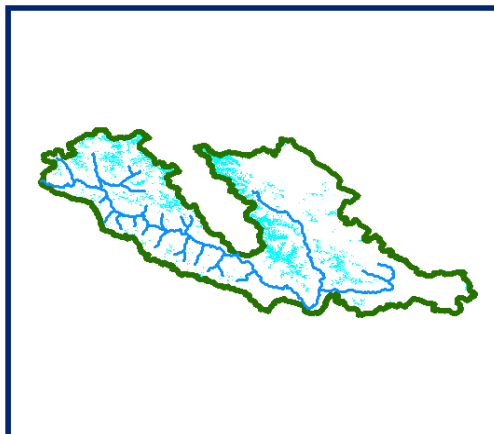
0 45 90 180 270 360



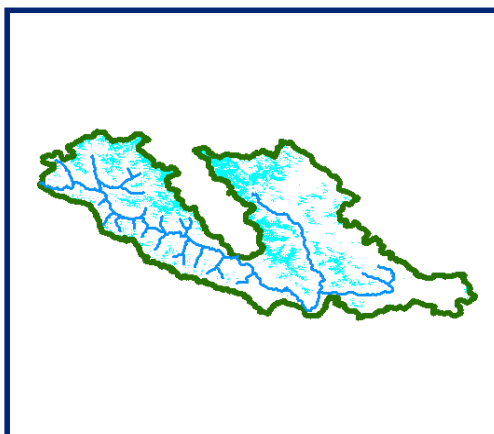
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
6 NOVEMBER 2010



DATA USED
15 NOVEMBER 2010



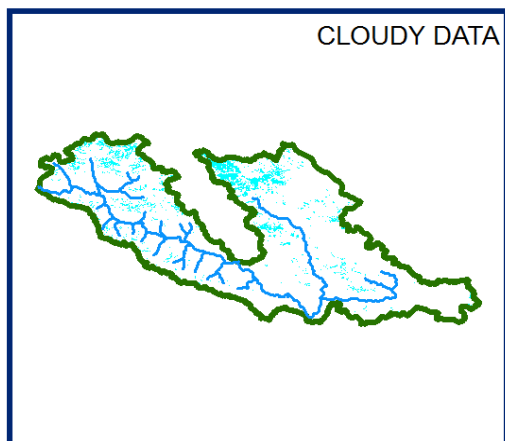
DATA USED
30 NOVEMBER 2010



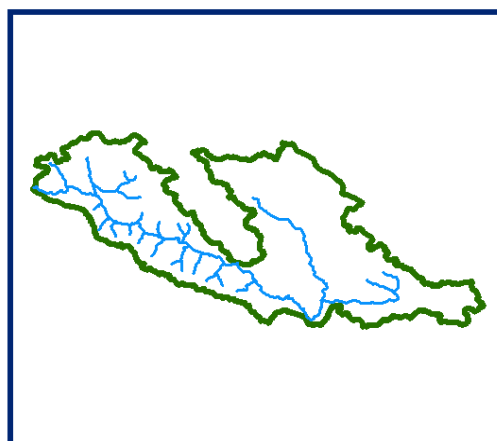
SNOW

0 50 100 200 300 400

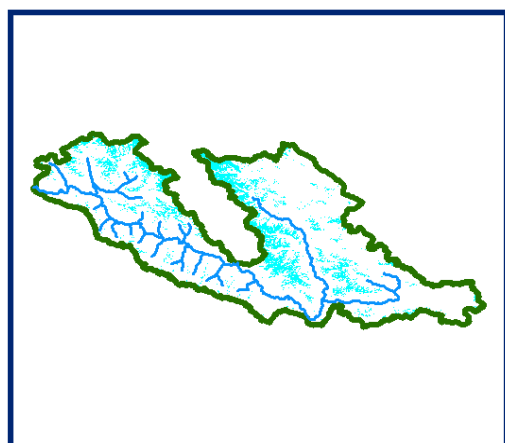
SNOW COVER MAP : SHYOK BASIN



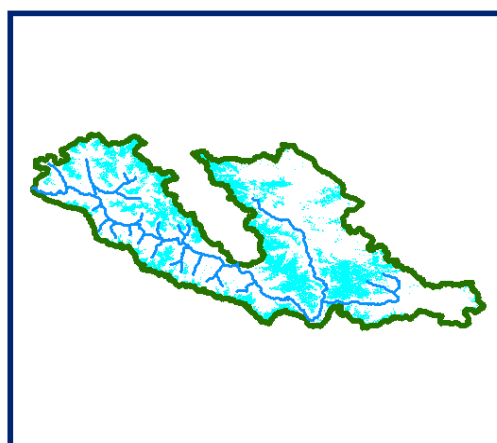
04 DECEMBER 2010



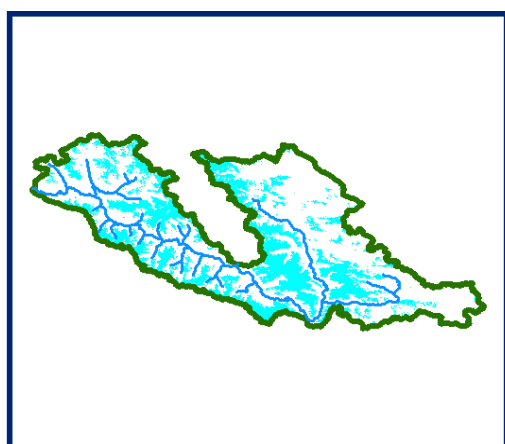
DATA NOT AVAILABLE



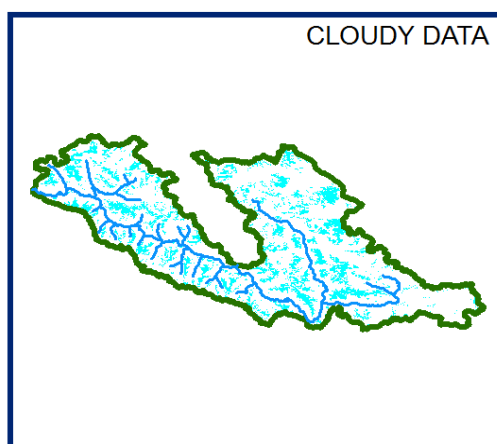
14 DECEMBER 2010



19 DECEMBER 2010



24 DECEMBER 2010

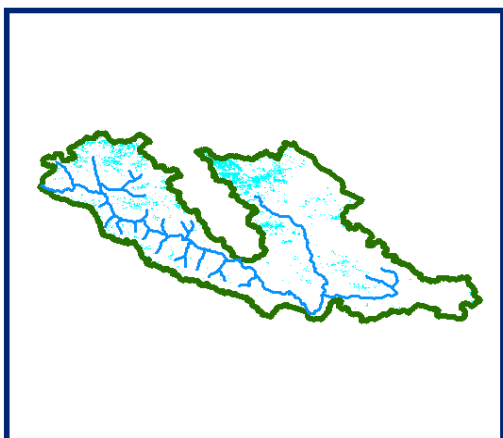


**29 DECEMBER 2010
24 DECEMBER 2010**

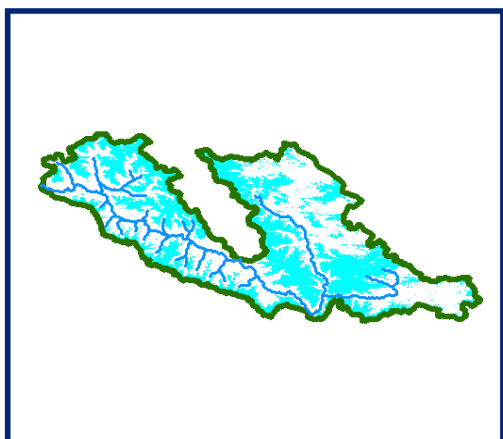
 SNOW

0 45 90 180 270 360

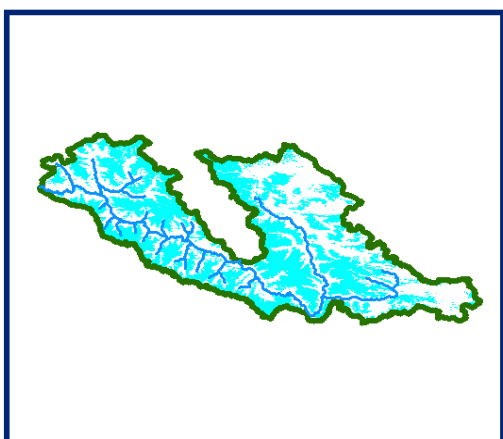
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
4 DECEMBER 2010



DATA USED
14 DECEMBER 2010
19 DECEMBER 2010



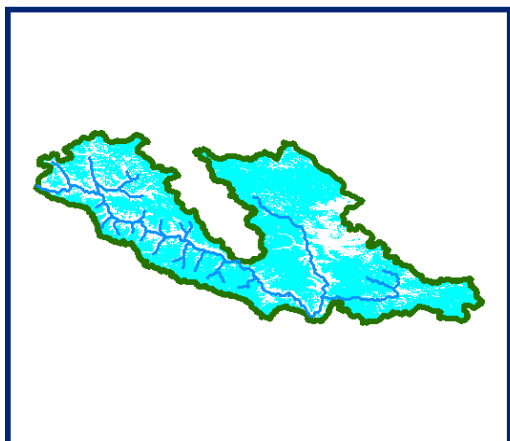
DATA USED
24 DECEMBER 2010
29 DECEMBER 2010



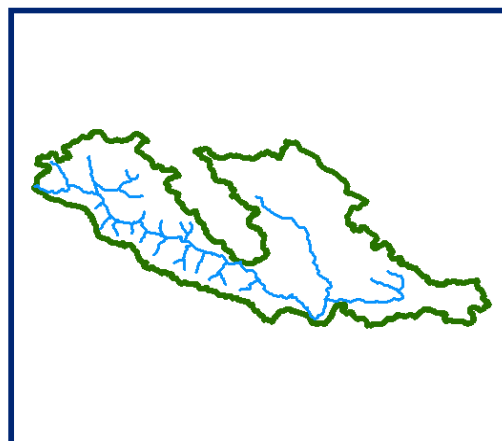
SNOW

0 50 100 200 300 400

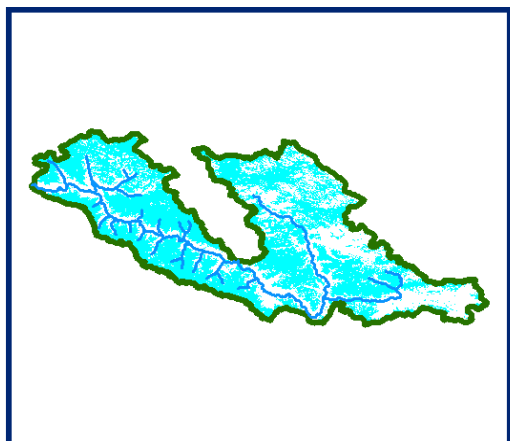
SNOW COVER MAP : SHYOK BASIN



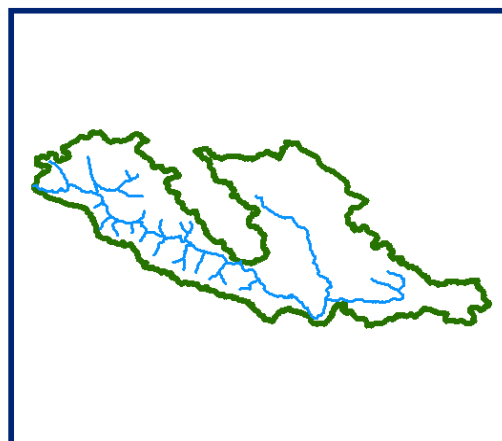
02 JANUARY 2011



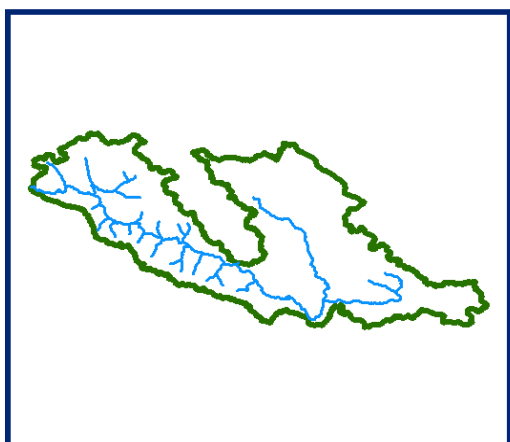
DATA NOT AVAILABLE



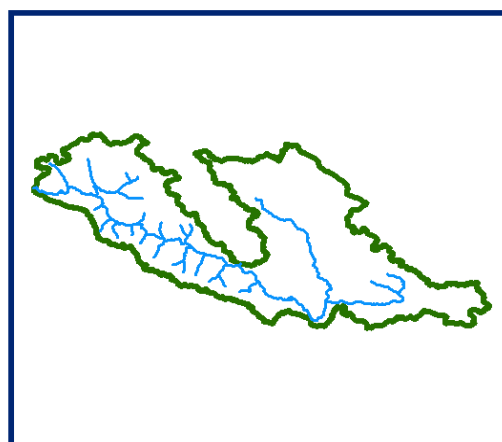
**12 JANUARY 2011
03 JANUARY 2011**



DATA NOT AVAILABLE



DATA NOT AVAILABLE



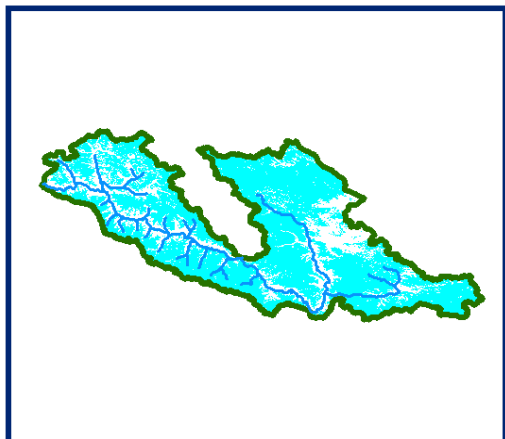
DATA NOT AVAILABLE

 SNOW

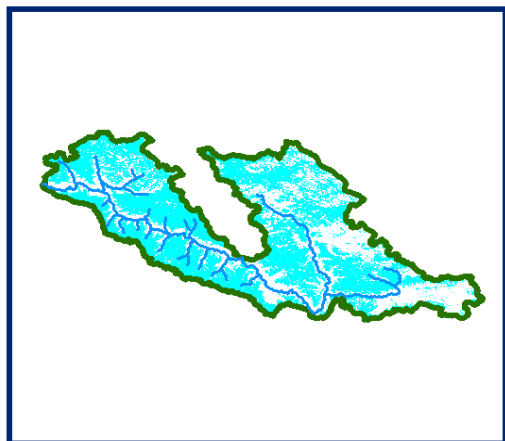
0 45 90 180 270 360



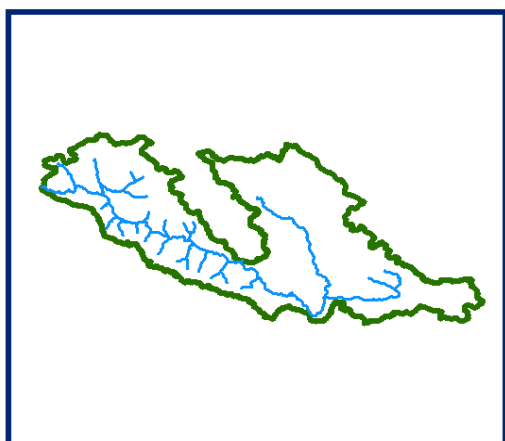
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
2 JANUARY 2011



DATA USED
12 JANUARY 2011



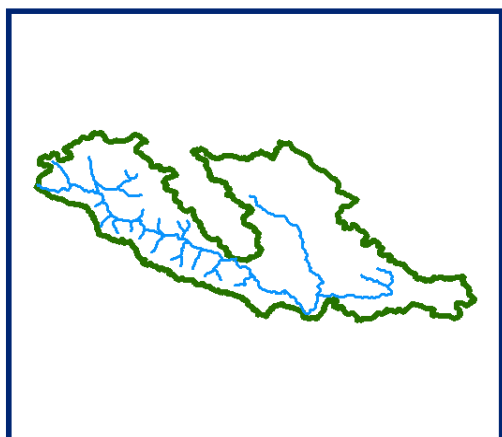
DATA USED
DATA NOT AVAILABLE



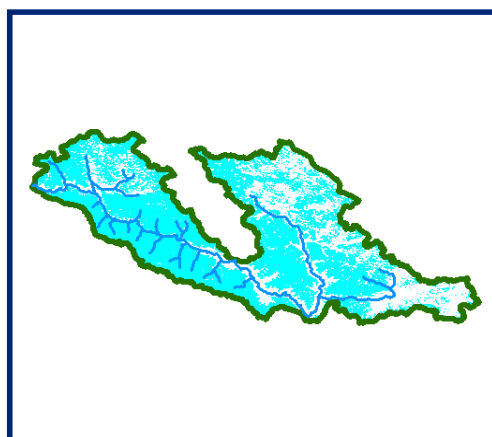
SNOW

0 50 100 200 300 400

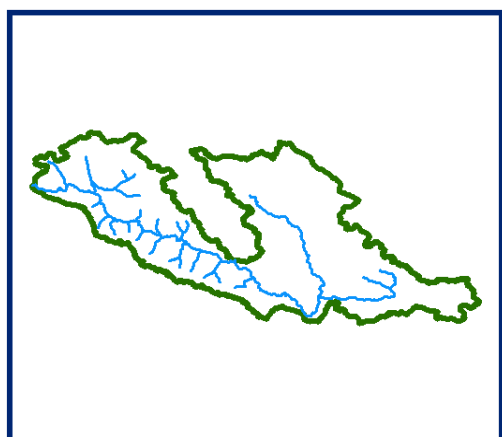
SNOW COVER MAP : SHYOK BASIN



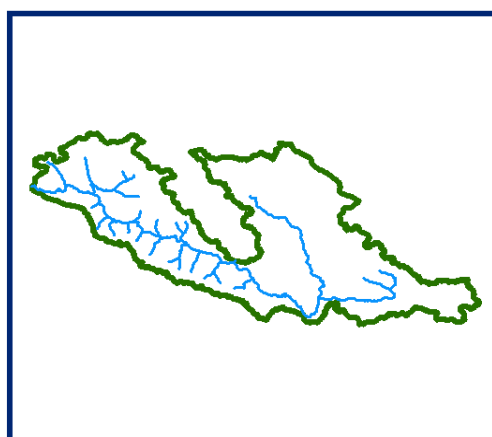
DATA NOT AVAILABLE



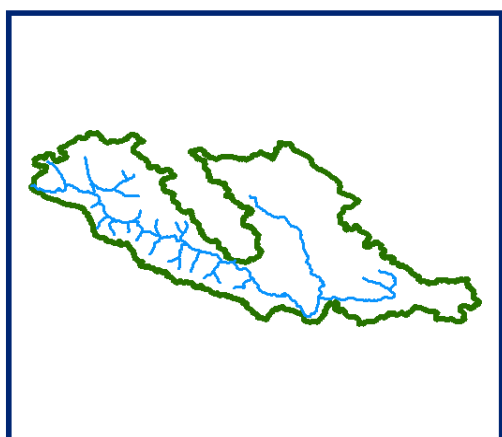
10 FEBRUARY 2011



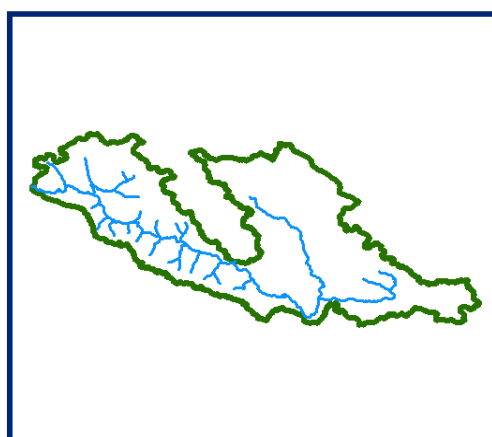
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE

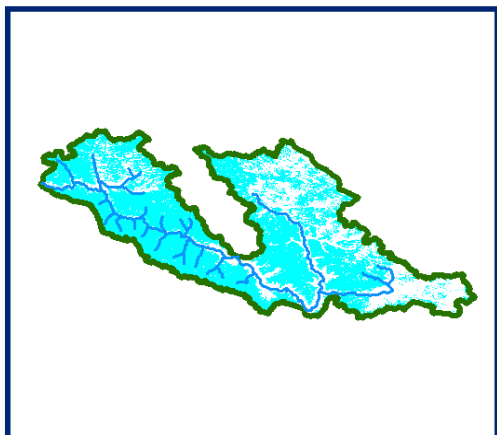


SNOW

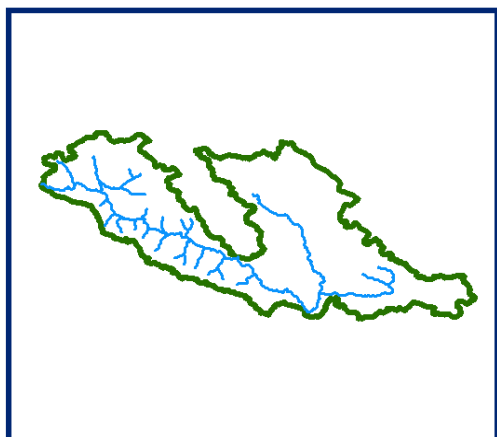
0 45 90 180 270 360



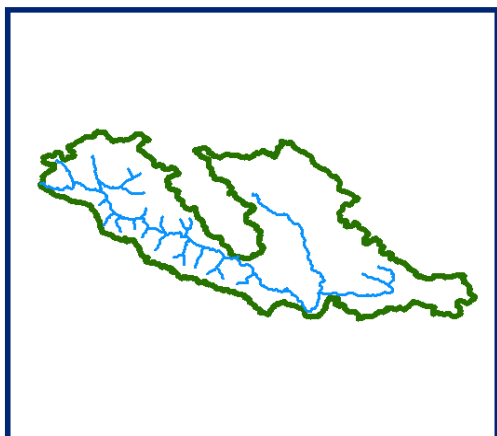
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
10 FEBRUARY 2011



DATA USED
DATA NOT AVAILABLE



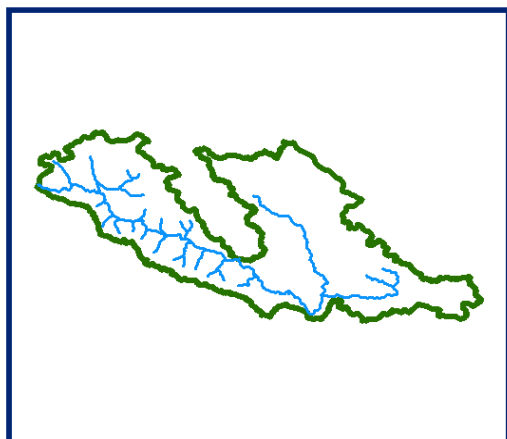
DATA USED
DATA NOT AVAILABLE



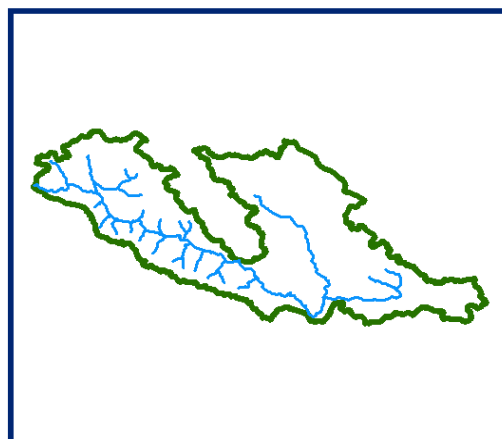
SNOW

0 50 100 200 300 400

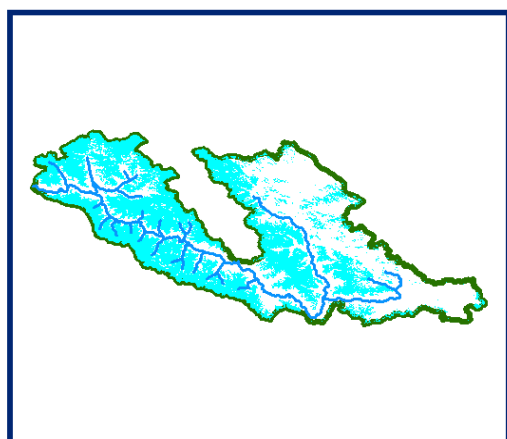
SNOW COVER MAP : SHYOK BASIN



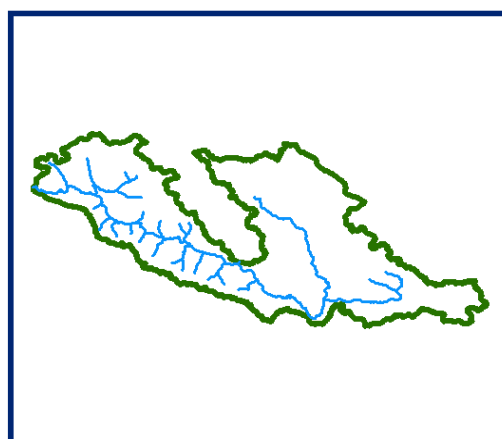
DATA NOT AVAILABLE



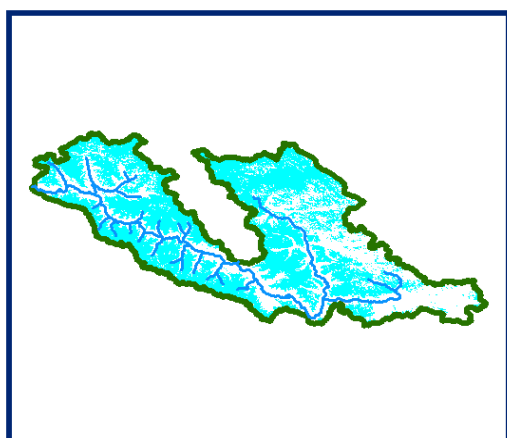
DATA NOT AVAILABLE



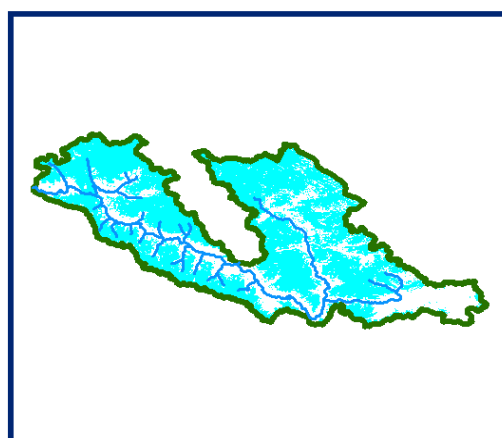
15 MARCH 2011



DATA NOT AVAILABLE



25 MARCH 2011



30 MARCH 2011

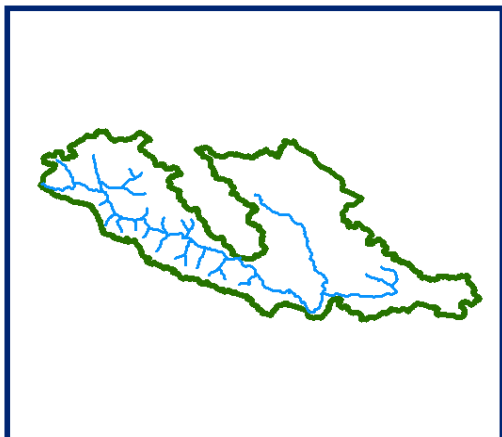


SNOW

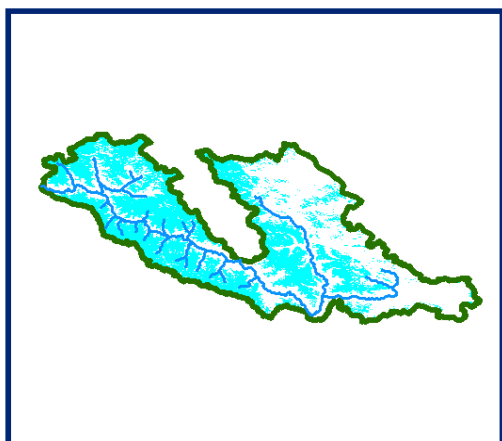
0 45 90 180 270 360



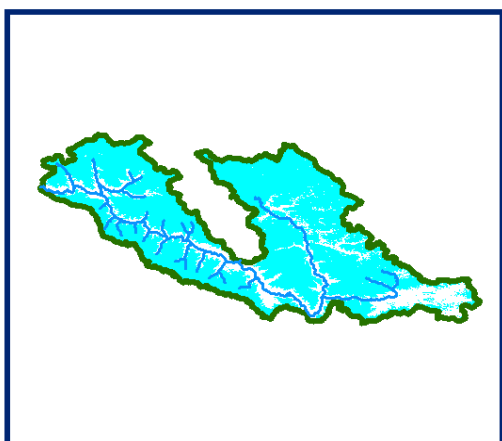
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
DATA NOT AVAILABLE



DATA USED
15 MARCH 2011



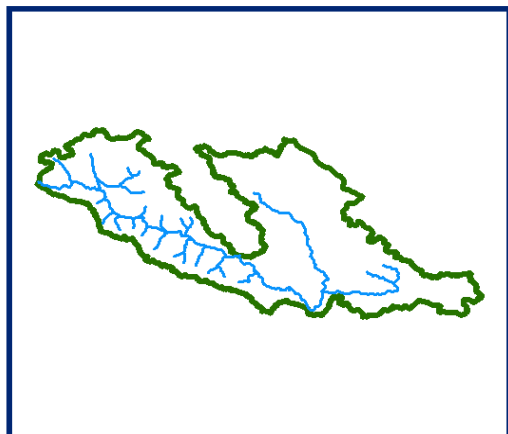
DATA USED
25 MARCH 2011
30 MARCH 2011



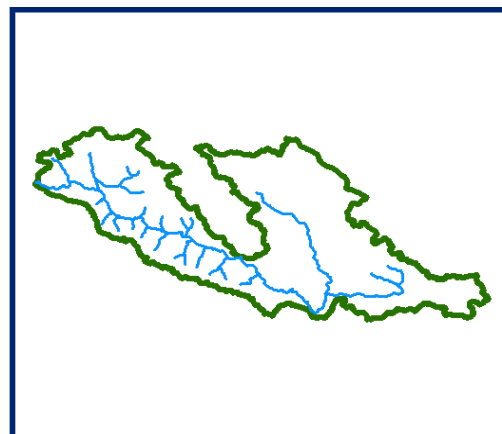
SNOW

0 50 100 200 300 400

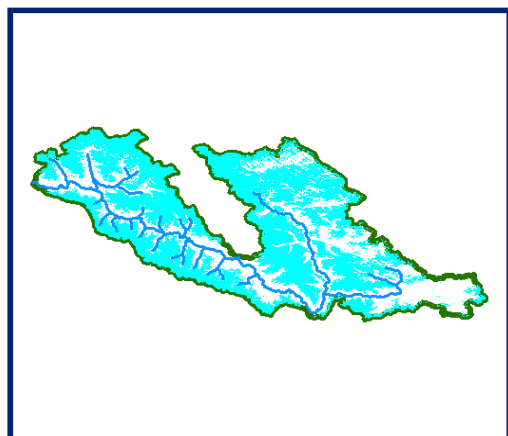
SNOW COVER MAP : SHYOK BASIN



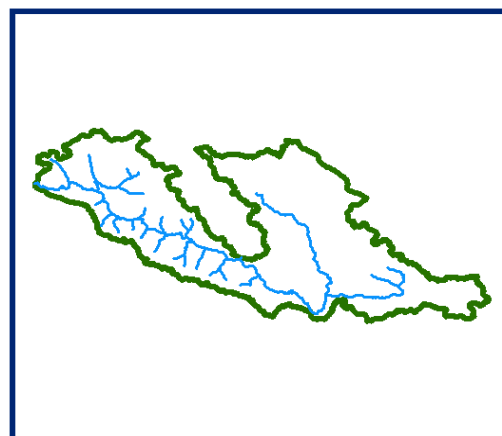
DATA NOT AVAILABLE



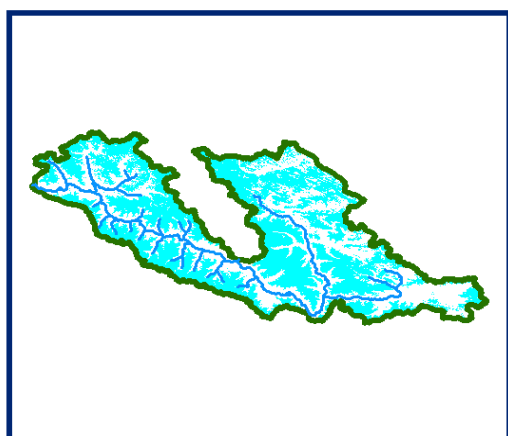
DATA NOT AVAILABLE



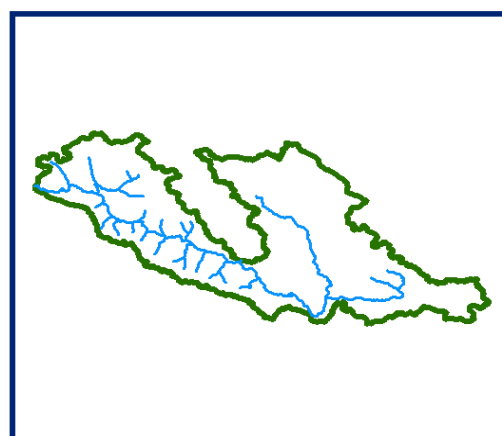
13 APRIL 2011



DATA NOT AVAILABLE



23 APRIL 2011



DATA NOT AVAILABLE

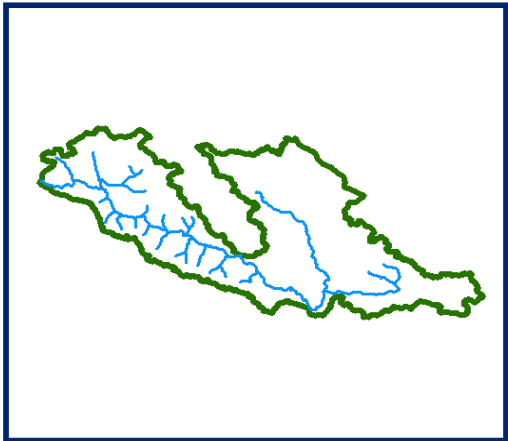


SNOW

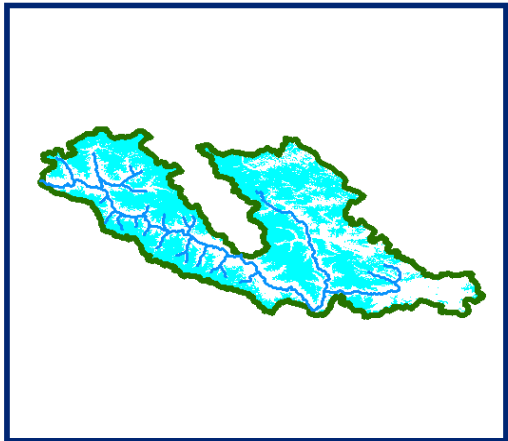
0 45 90 180 270 360



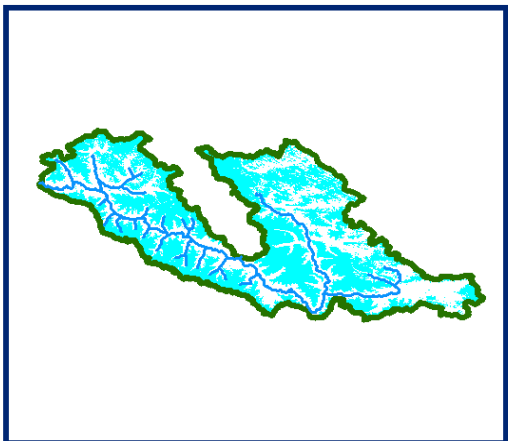
10 DAILY SNOW COVER MAP: SHYOK BASIN



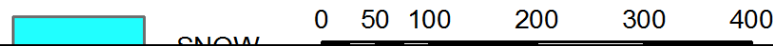
DATA USED
DATA NOT AVAILABLE



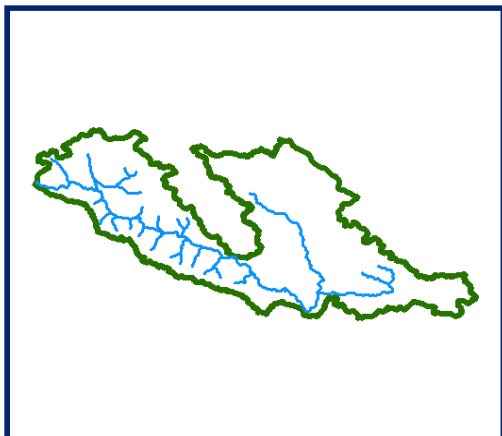
DATA USED
13 APRIL 2011



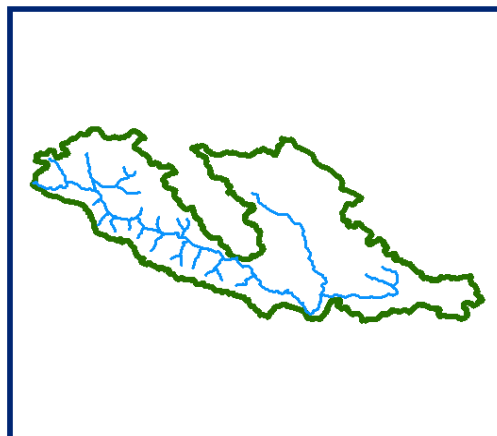
DATA USED
23 APRIL 2011



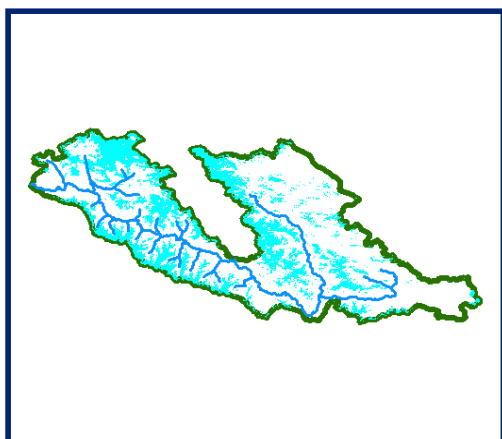
SNOW COVER MAP : SHYOK BASIN



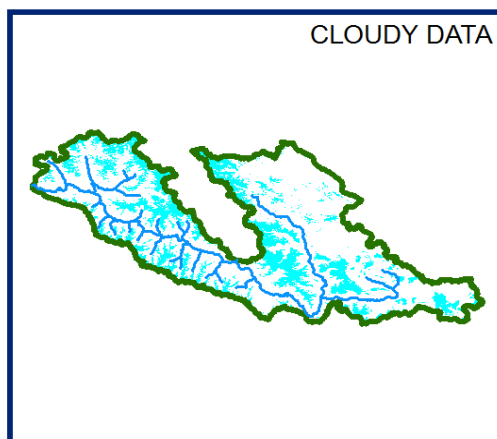
DATA NOT AVAILABLE



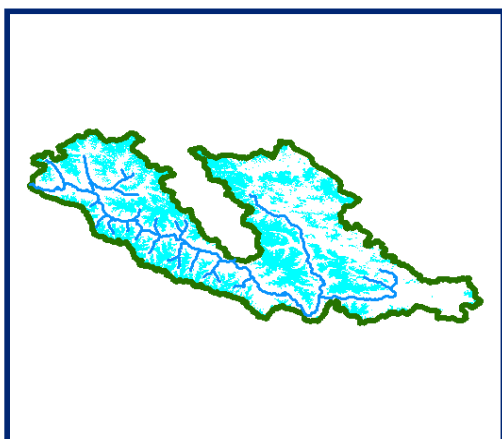
DATA NOT AVAILABLE



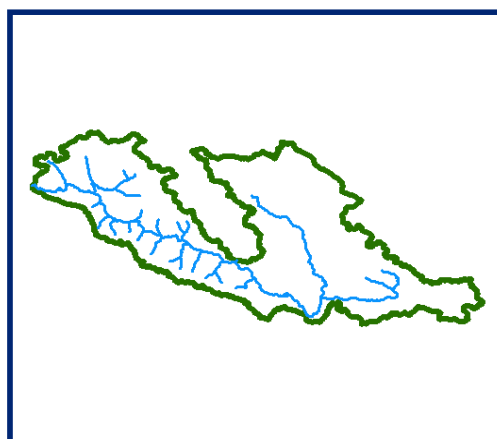
12 MAY 2011



17 MAY 2011



20 MAY 2011



DATA NOT AVAILABLE

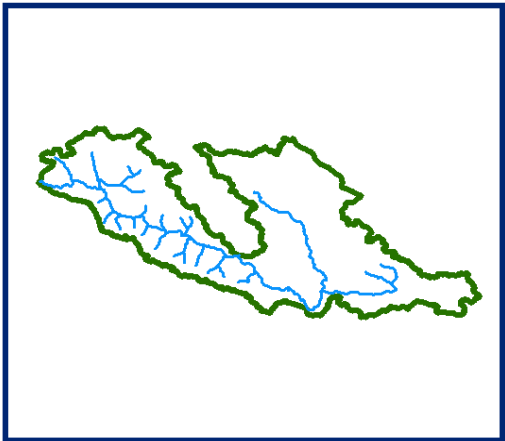


SNOW

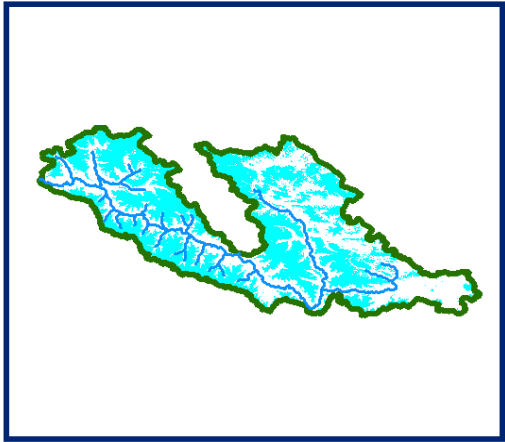
0 45 90 180 270 360



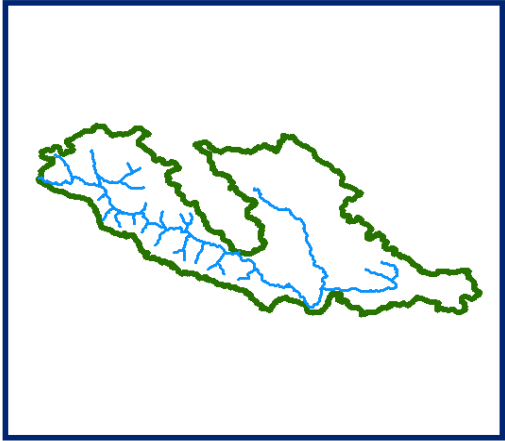
10 DAILY SNOW COVER MAP: SHYOK BASIN



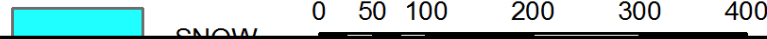
DATA USED
DATA NOT AVAILABLE



DATA USED
12 MAY 2011
17 MAY 2011
20 MAY 2011



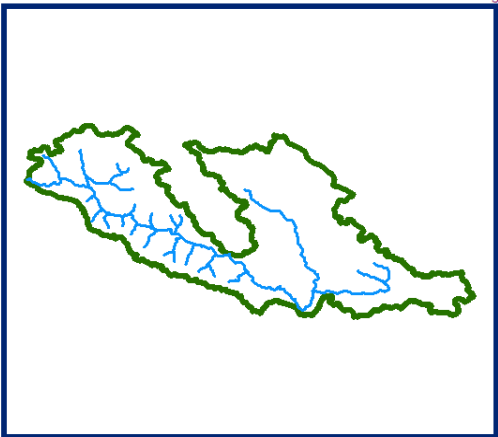
DATA USED
DATA NOT AVAILABLE



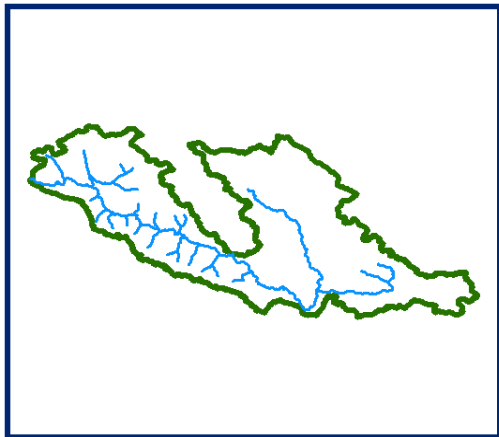
SNOW COVER MAP : SHYOK BASIN



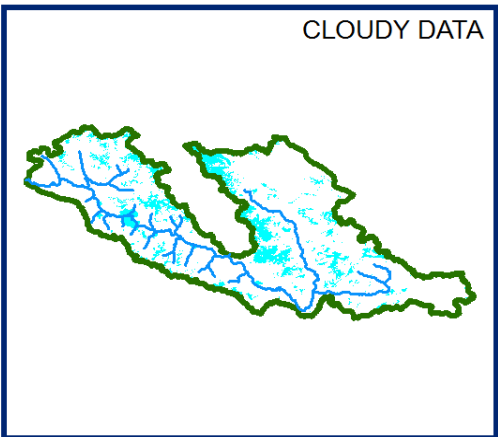
DATA NOT AVAILABLE



DATA NOT AVAILABLE

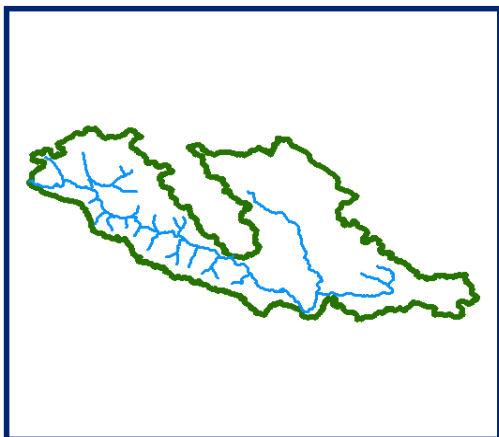


DATA NOT AVAILABLE

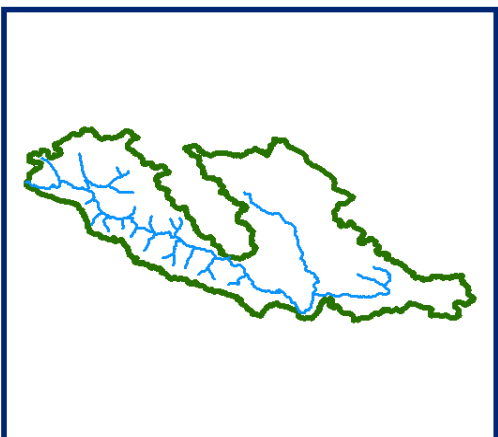


CLOUDY DATA

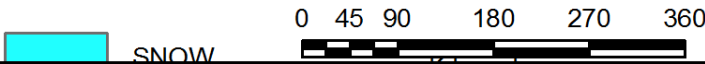
19 JUNE 2011



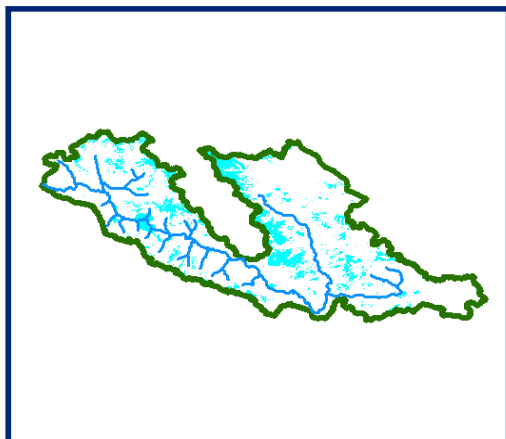
DATA NOT AVAILABLE



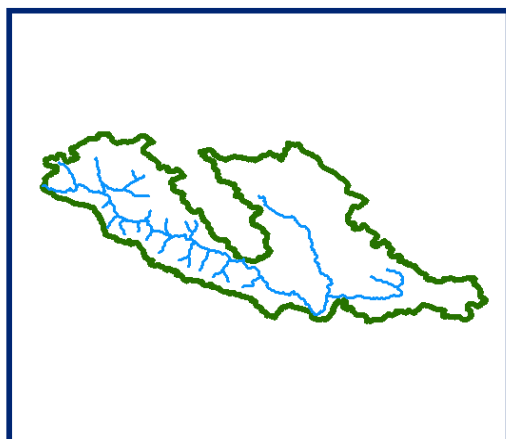
DATA NOT AVAILABLE



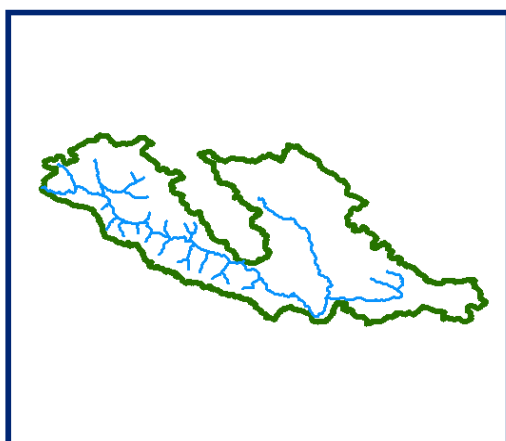
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA USED
19 JUNE 2011



DATA USED
DATA NOT AVAILABLE



DATA USED
DATA NOT AVAILABLE



SNOW

0 50 100 200 300 400

SHIGAR BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: SHIGAR

BASIN AREA: 7050 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010							
1	02-Oct-10	3784.92	54	2	3-Oct-10	3791.52	54
3	7-Oct-10	2931.35	42	4	8-Oct-10	2896.88	41
5	17-Oct-10	3363.90	48				
November 2010							
6	06-Nov-10	2743.55	39	7	10-Nov-10	4004.16	57
8	15-Nov-10	3758.01	53	9	24-Nov-10	2608.04	37
10	29-Nov-10	3994.33	57				
December 2010							
11	4-Dec-10	3098.15	44	12	14-Dec-10	3483.58	49
13	19-Dec-10	3940.21	56	14	24-Dec-10	3942.65	56
January 2011							
15	2-Jan-11	5738.00	81	16	12-Jan-11	5634.09	80
17	21-Jan-11	5537.13	79	18	30-Jan-11	6961.82	99
19	31-Jan-11	6958.83	99				
February 2011							
20	09-Feb-11	2450.40	35	21	10-Feb-11	6637.85	94
March 2011							
22	10-Mar-11	6186.00	88	23	15-Mar-11	5840.96	83
24	25-Mar-11	6045.68	86				
April 2011							
25	13-Apr-11	5593.74	79	26	23-Apr-11	5597.70	79
May 2011							
27	12-May-11	2968.83	42	28	17-May-11	4906.66	70
29	20-May-11	4936.08	63				
June 2011							
30	9-Jun-11	3690.36	52	31	10-Jun-11	3692.49	52
32	14-Jun-11	3082.15	44	33	19-Jun-11	2896.65	41

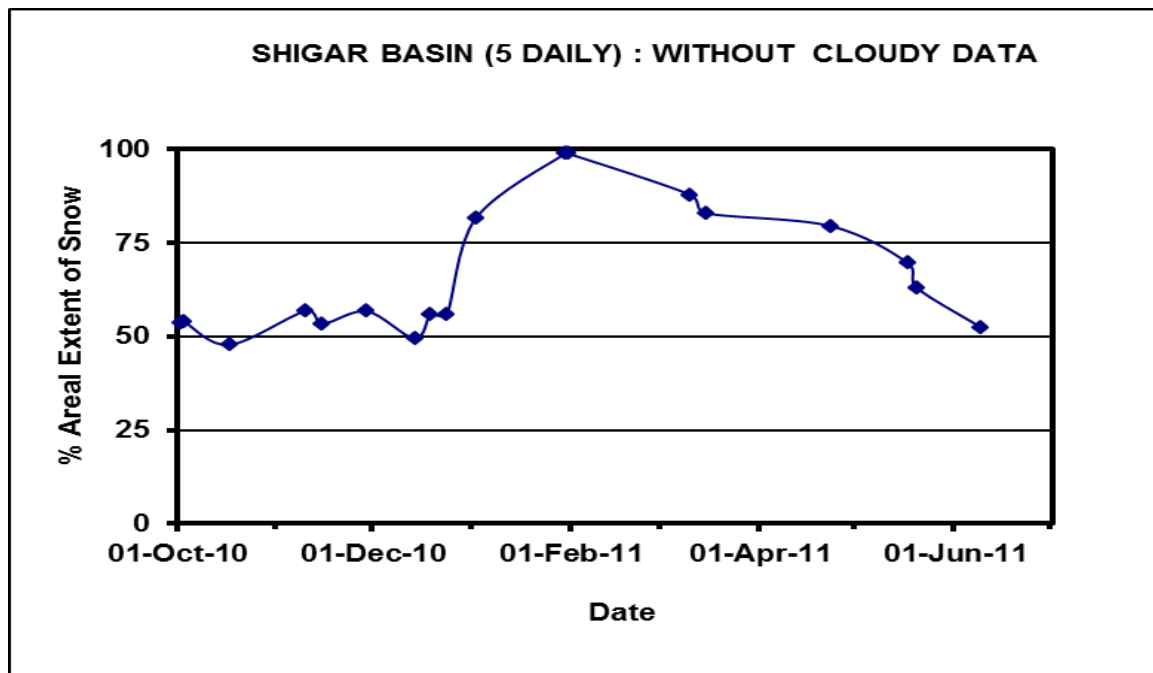
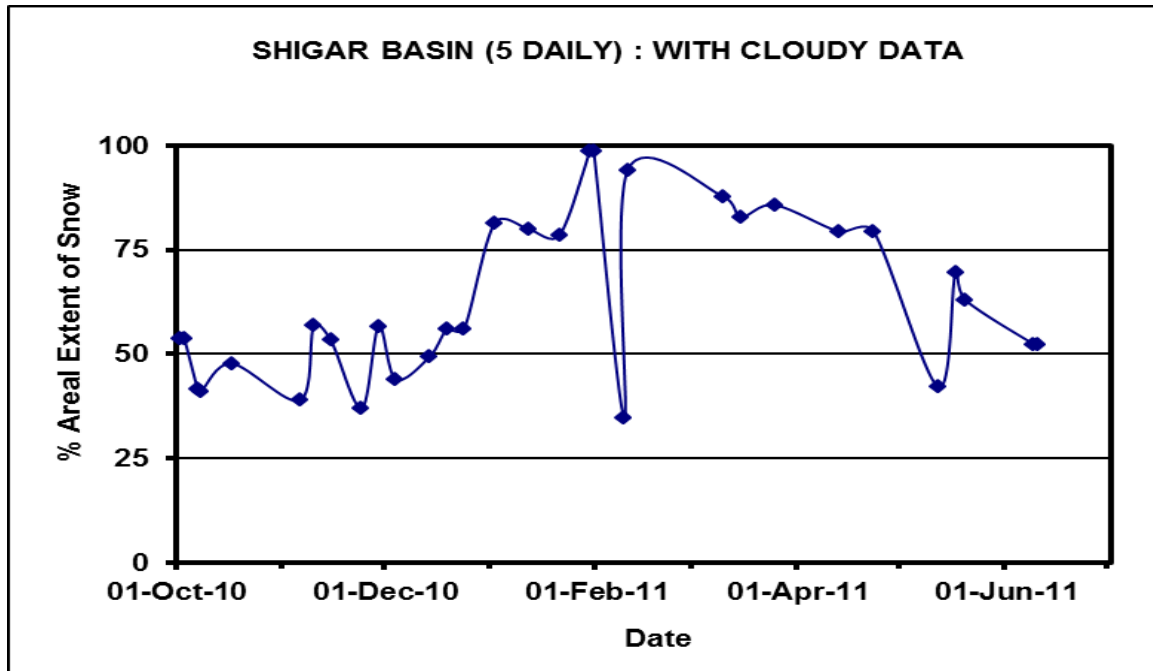
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHIGAR

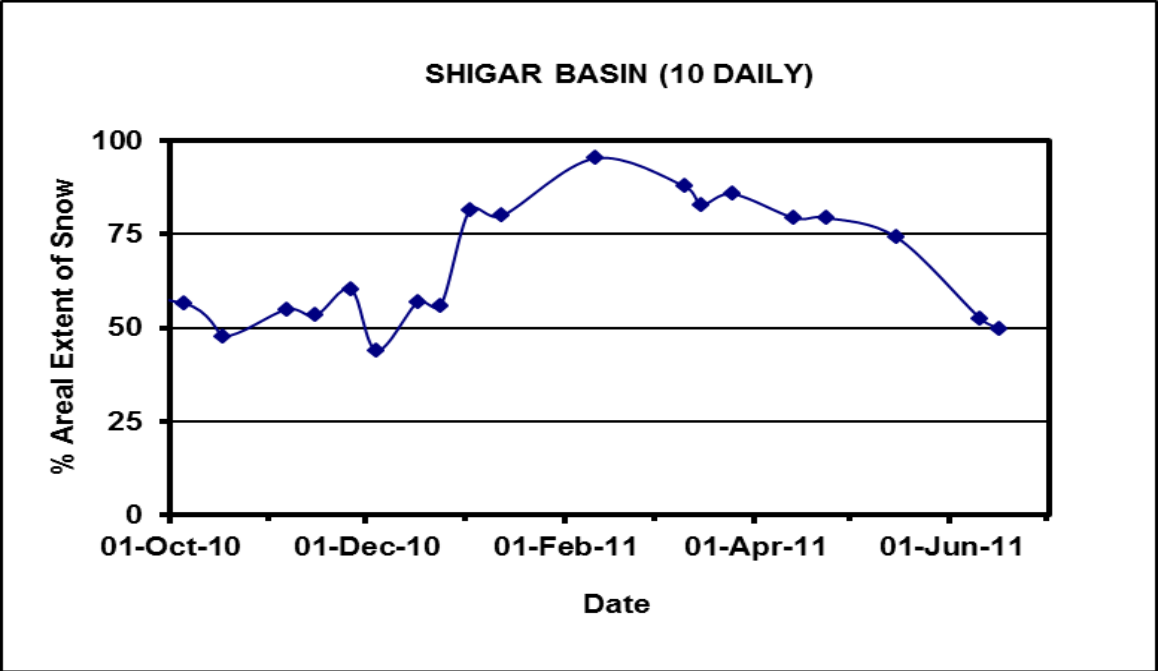
BASIN AREA: 7050 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	3986.97	57	3	06-Nov-10	3872.09	55
2	17-Oct-10	3363.90	48	4	15-Nov-10	3758.01	53
				5	26-Nov-10	4254.61	60
December 2010				January 2011			
6	4-Dec-10	3098.15	44	9	2-Jan-11	5738.00	81
7	17-Dec-10	4025.55	57	10	12-Jan-11	5634.09	80
8	24-Dec-10	3942.65	56	11	25-Jan-10	6913.83	98
February 2011				March 2011			
12	10-Feb-11	6716.53	95	13	10-Mar-11	6186.00	88
				14	15-Mar-11	5840.96	83
				15	25-Mar-11	6045.68	86
April 2011				May 2011			
16	13-Apr-11	5593.74	79	17	15-May-11	5225.63	74
18	23-Apr-11	5597.70	79				
June 2011							
19	10-Jun-11	3699.55	52				
20	16-Jun-11	3511.93	49.81				

Snow cover depletion curve

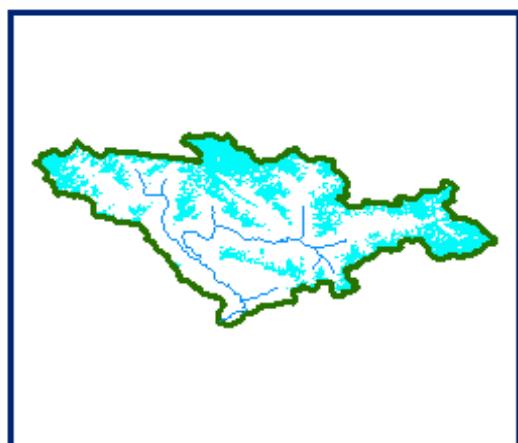


Snow cover depletion curve

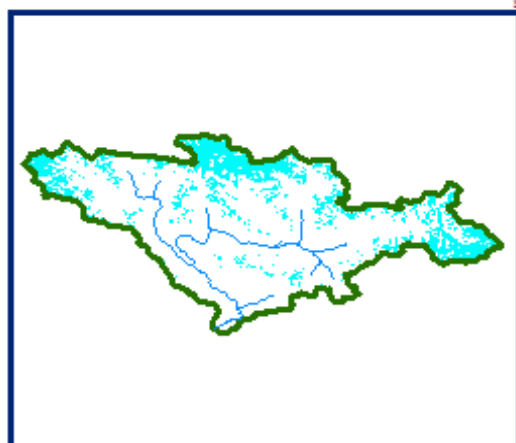


SNOW COVER MAP

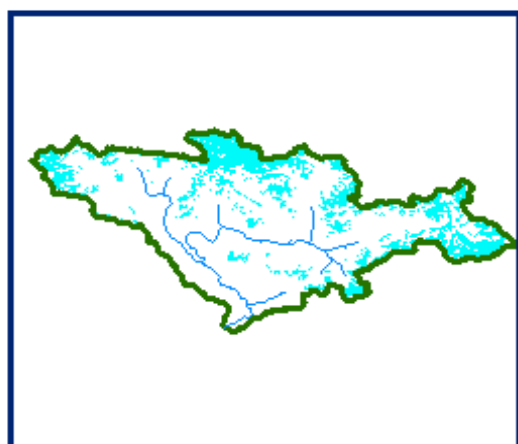
SNOW COVER MAP : SHIGAR BASIN



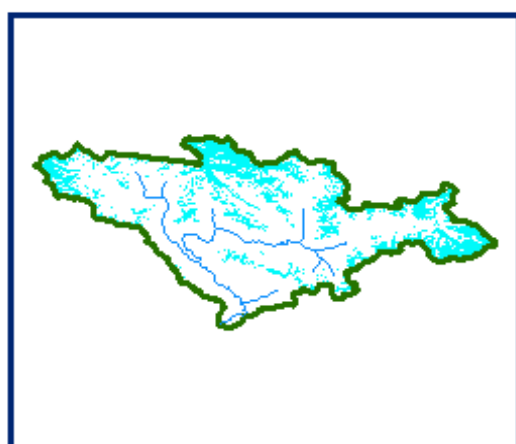
02 OCTOBER 2010
03 OCTOBER 2010



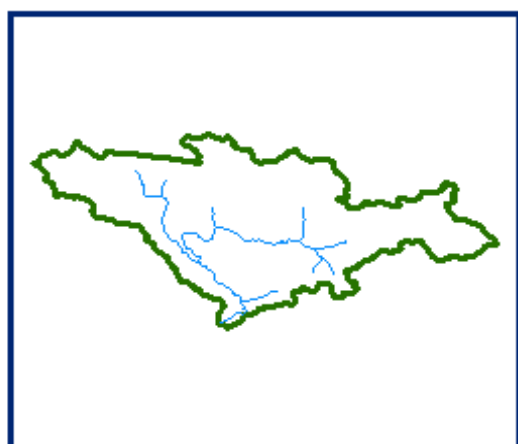
07 OCTOBER 2010



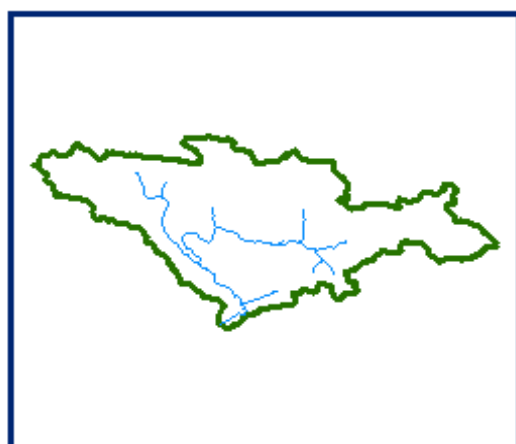
08 OCTOBER 2010



17 OCTOBER 2010




DATA NOT AVAILABLE

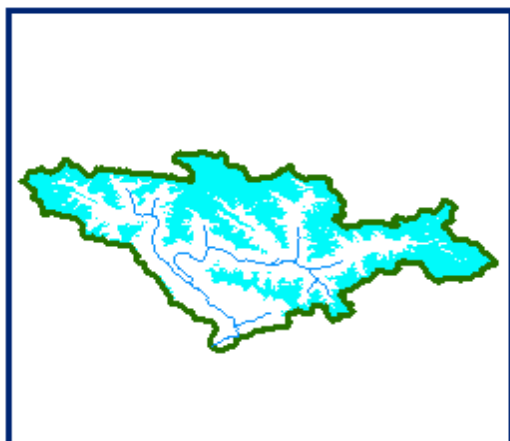


DATA NOT AVAILABLE

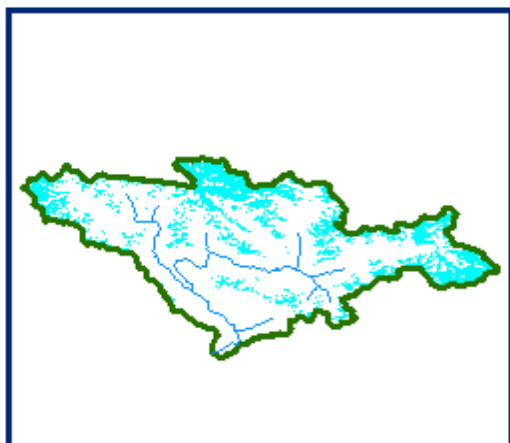
 SNOW

0 25 50 100 150 200

Kilometers

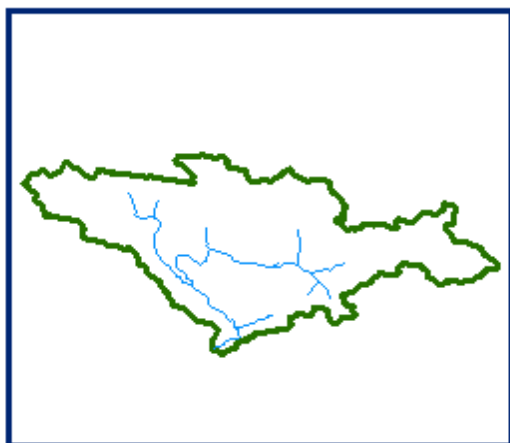
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
03 OCTOBER 2010
07 OCTOBER 2010
08 OCTOBER 2010



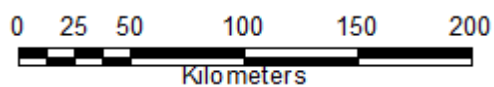
DATA USED
17 OCTOBER 2010



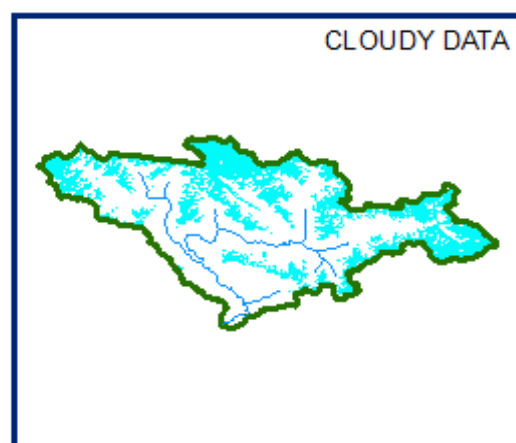
DATA USED
DATA NOT AVAILABLE



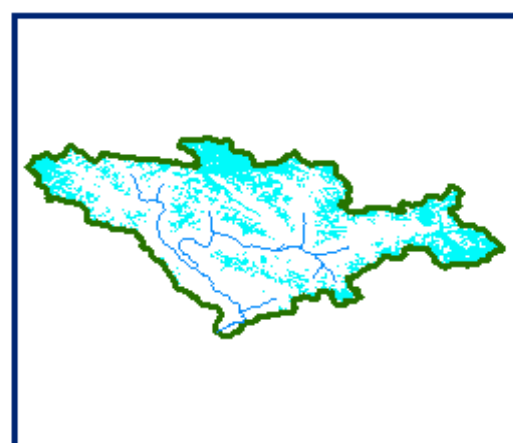
SNOW



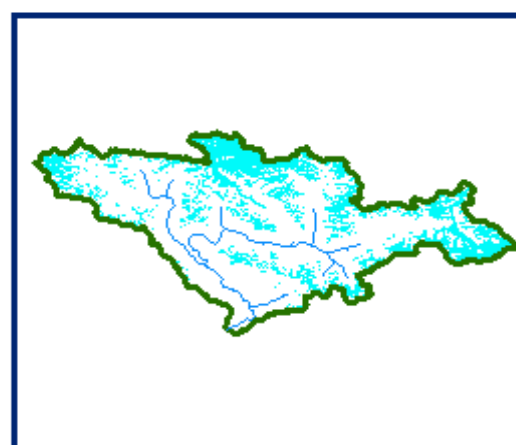
SNOW COVER MAP : SHIGAR BASIN



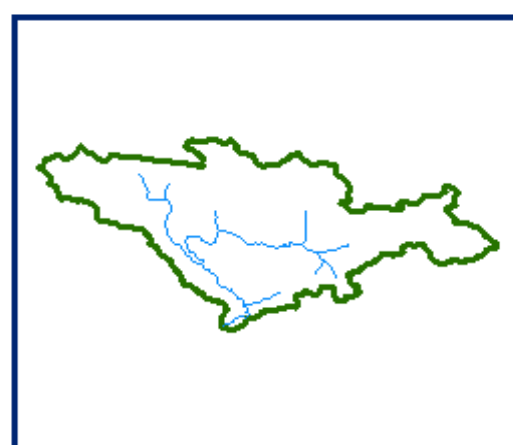
06 NOVEMBER 2010
24 NOVEMBER 2010



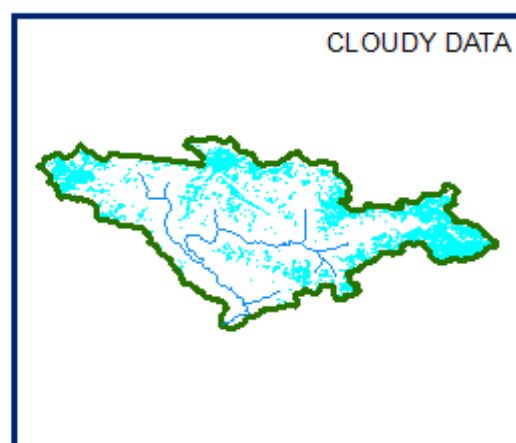
10 NOVEMBER 2010



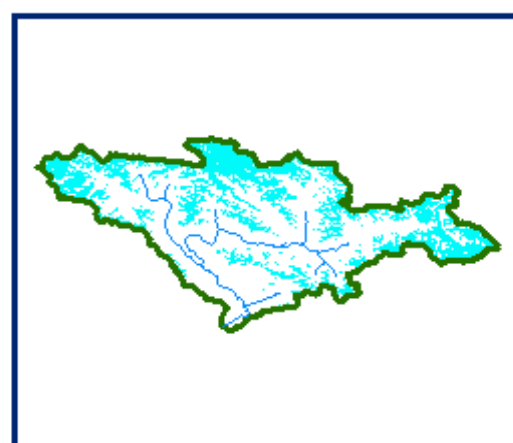
15 NOVEMBER 2010



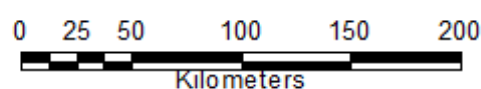
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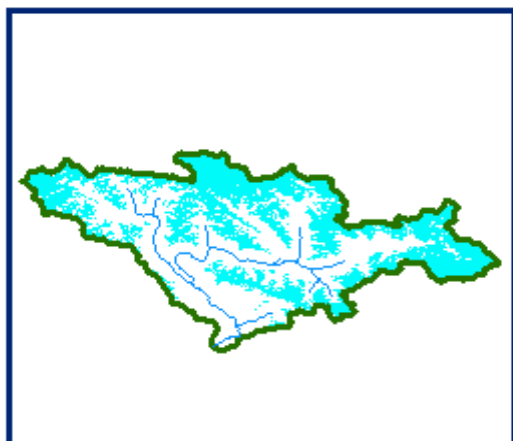
24 NOVEMBER 2010



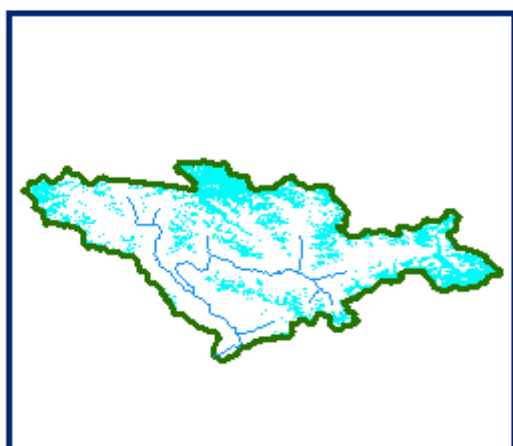
29 NOVEMBER 2010



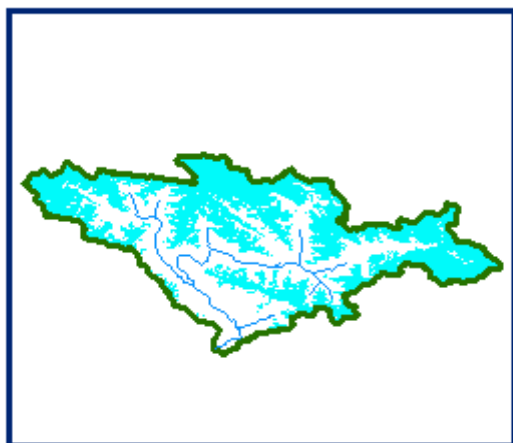
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
06 NOVEMBER 2010
10 NOVEMBER 2010



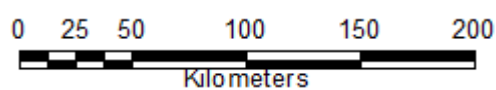
DATA USED
15 NOVEMBER 2010



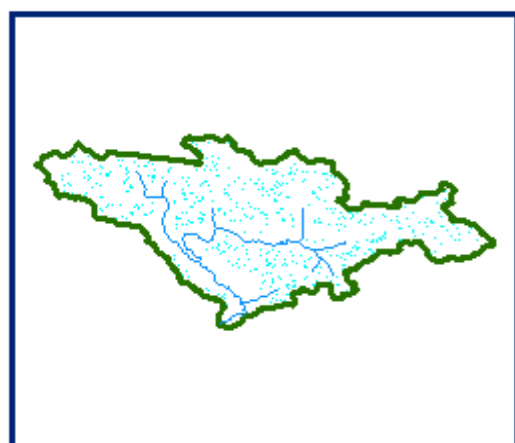
DATA USED
24 NOVEMBER 2010
29 NOVEMBER 2010



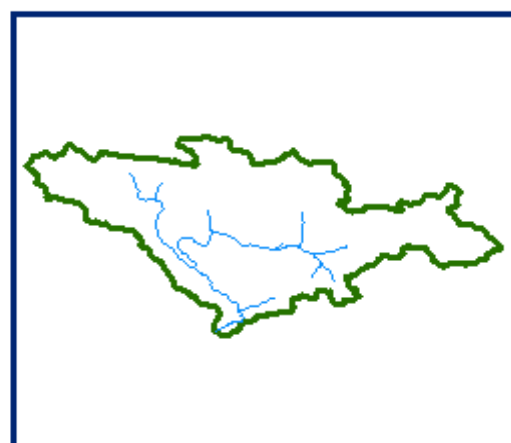
SNOW



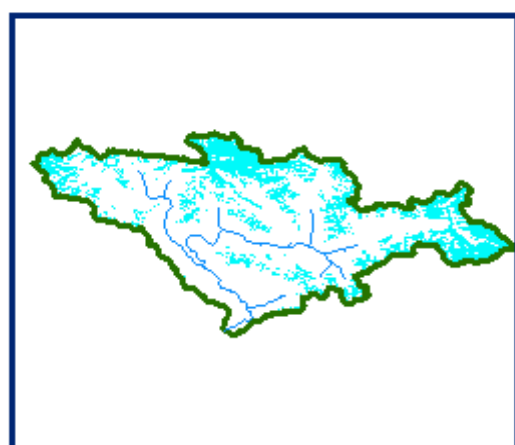
SNOW COVER MAP : SHIGAR BASIN



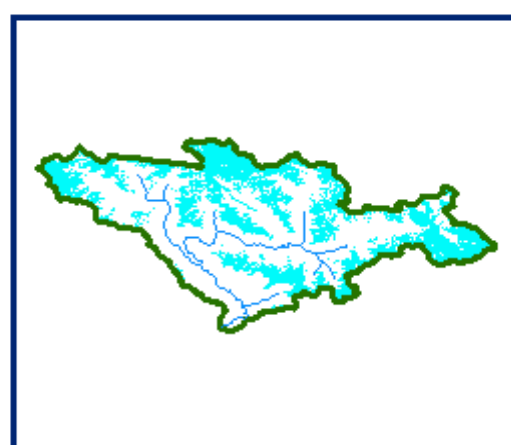
04 DECEMBER 2010



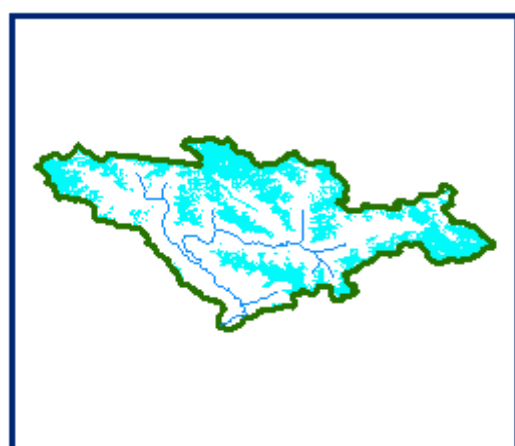
DATA NOT AVAILABLE



14 DECEMBER 2010

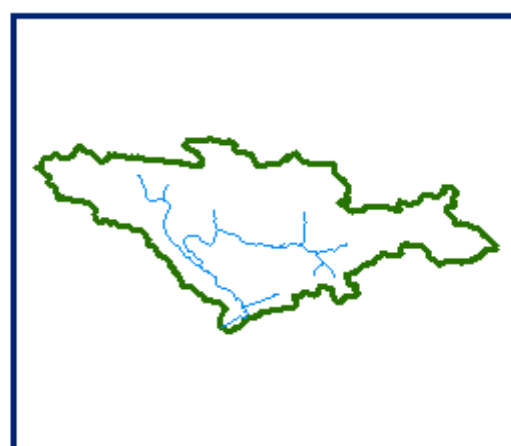


19 DECEMBER 2010



24 DECEMBER 2010

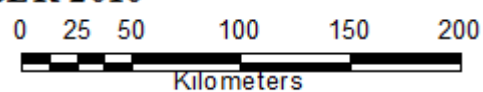
19 DECEMBER 2010



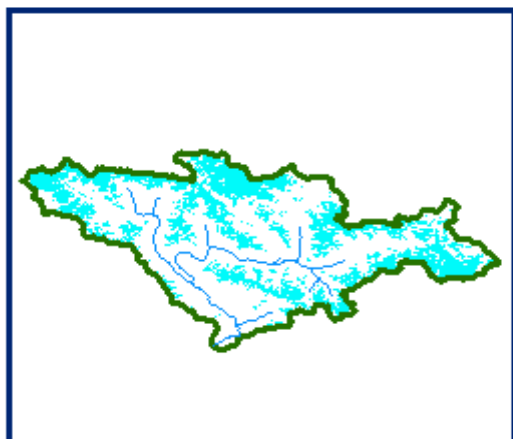
DATA NOT AVAILABLE



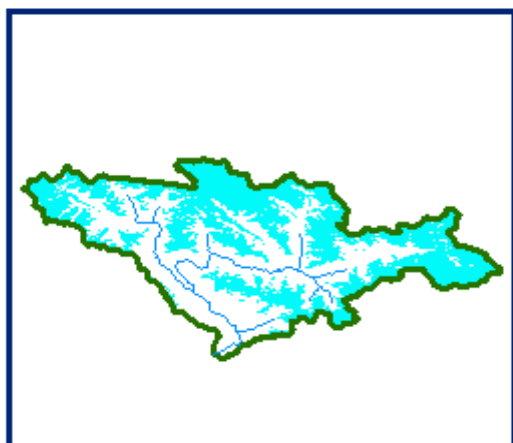
SNOW



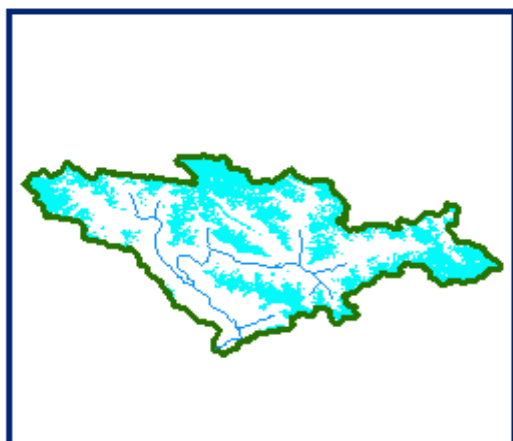
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
04 DECEMBER 2010



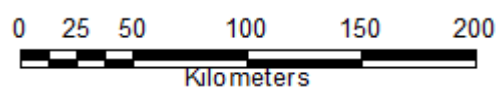
DATA USED
14 DECEMBER 2010
19 DECEMBER 2010



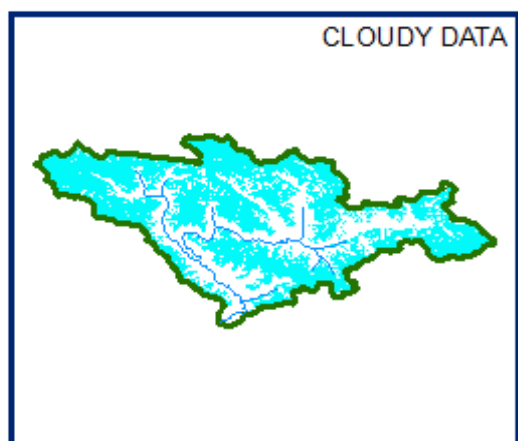
DATA USED
24 DECEMBER 2010



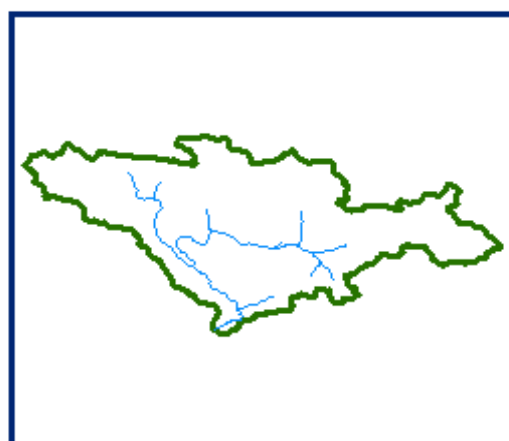
SNOW



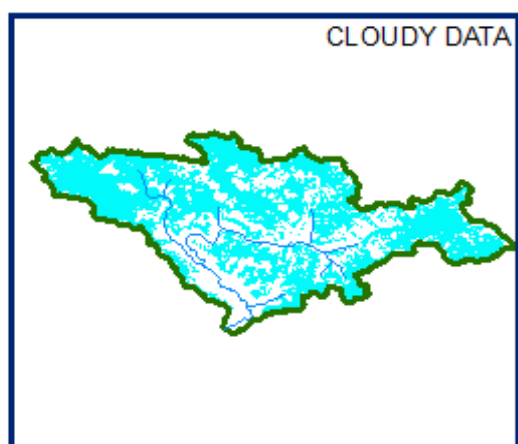
SNOW COVER MAP : SHIGAR BASIN



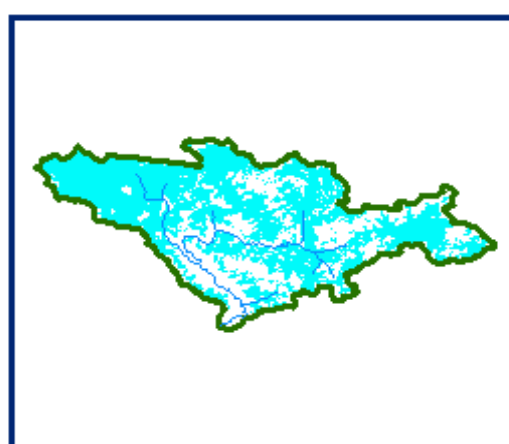
02 JANUARY 2011



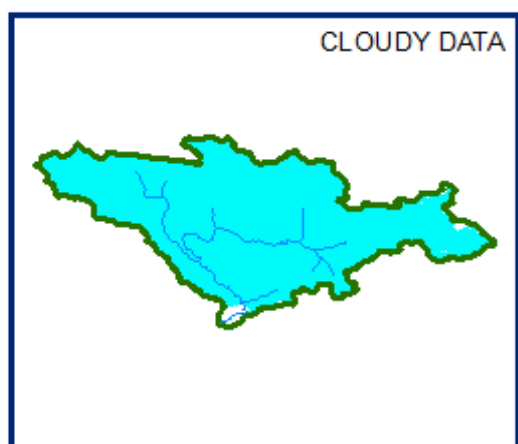
DATA NOT AVAILABLE



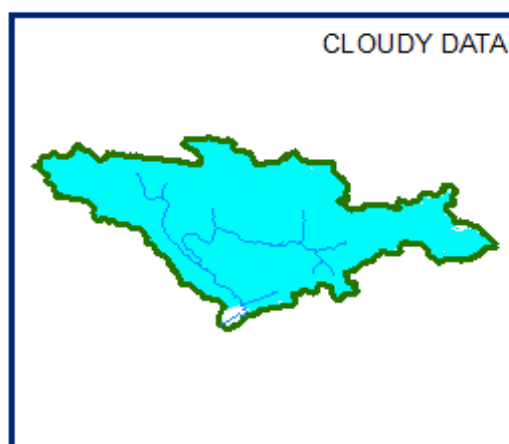
12 JANUARY 2011



21 JANUARY 2011



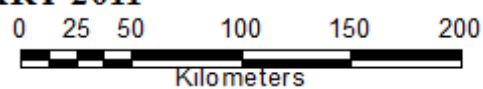
30 JANUARY 2011



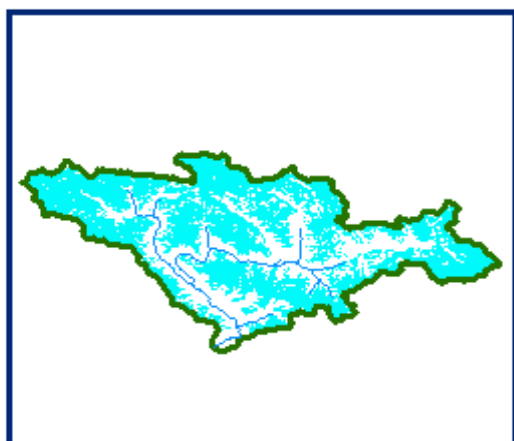
31 JANUARY 2011



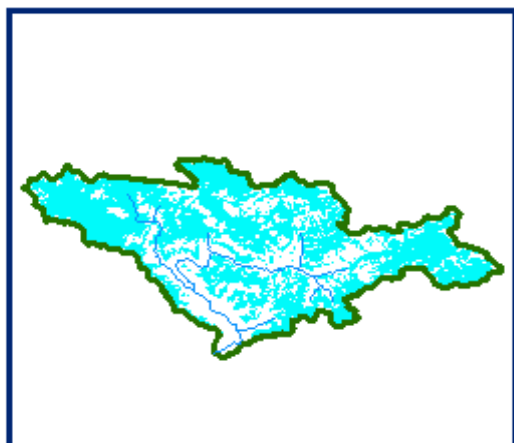
SNOW



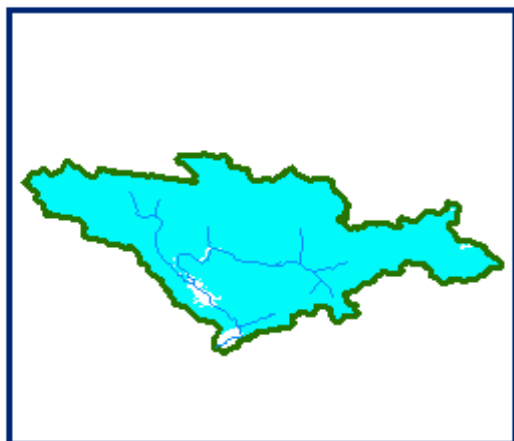
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
02 JANUARY 2011



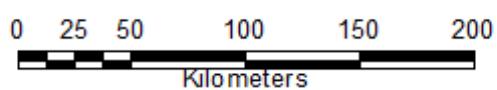
DATA USED
12 JANUARY 2011



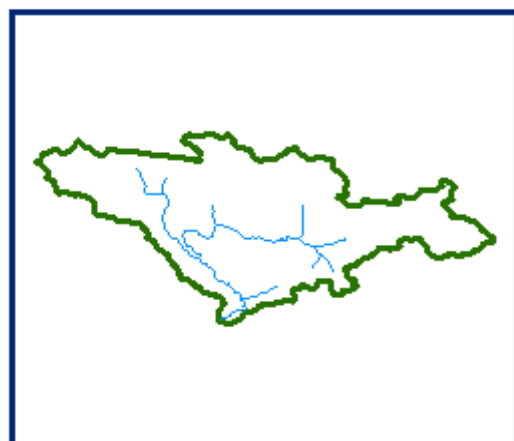
DATA USED
21 JANUARY 2011
30 JANUARY 2011
31 JANUARY 2011



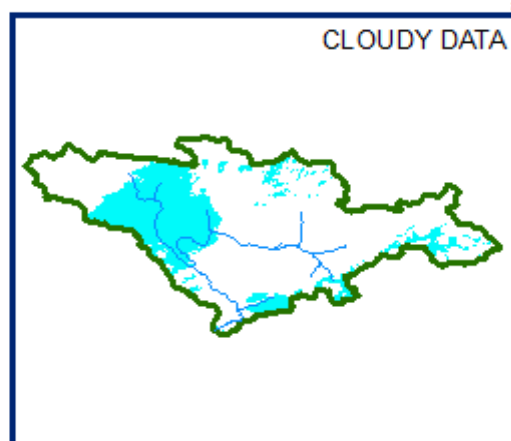
SNOW



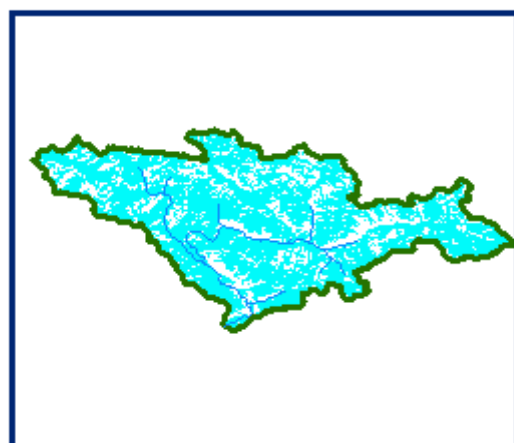
SNOW COVER MAP : SHIGAR BASIN



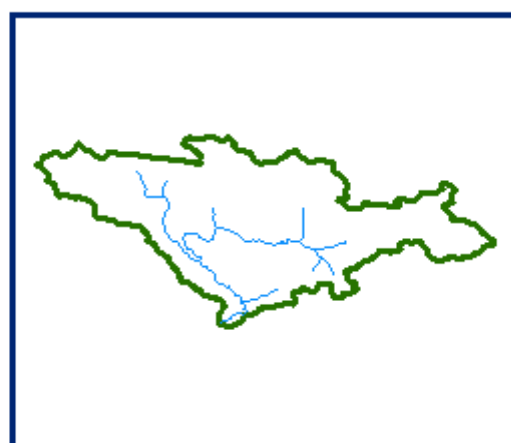
DATA NOT AVAILABLE



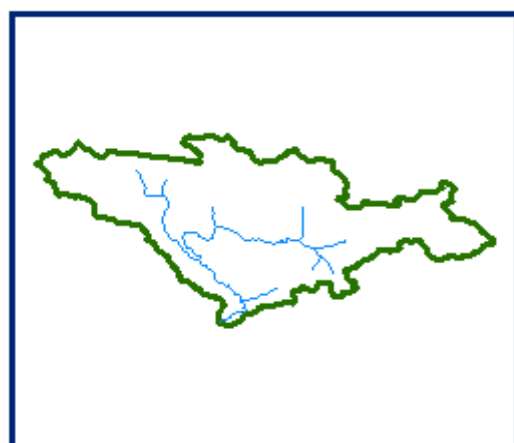
09 FEBRUARY 2011



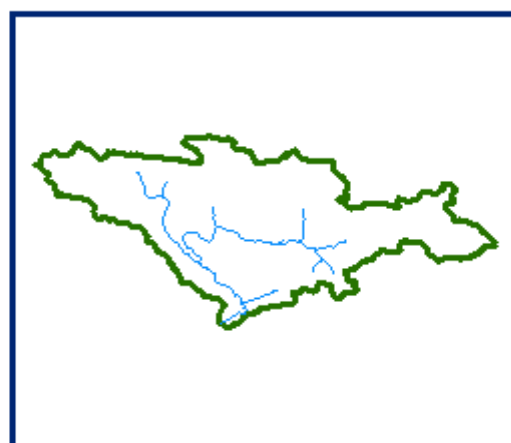
**10 FEBRUARY 2011
10 MARCH 2011**



DATA NOT AVAILABLE



DATA NOT AVAILABLE

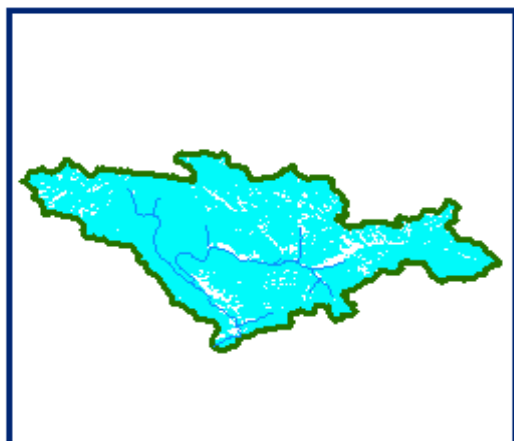


DATA NOT AVAILABLE

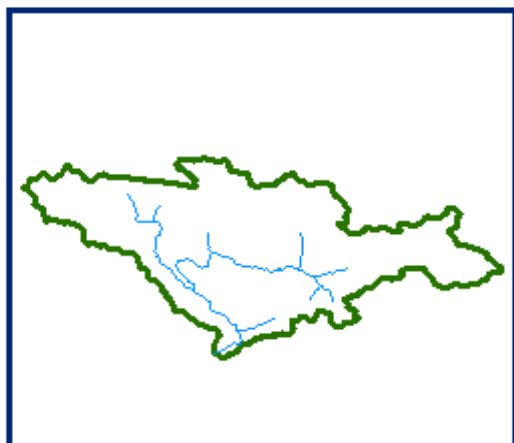
 SNOW

0 25 50 100 150 200
Kilometers

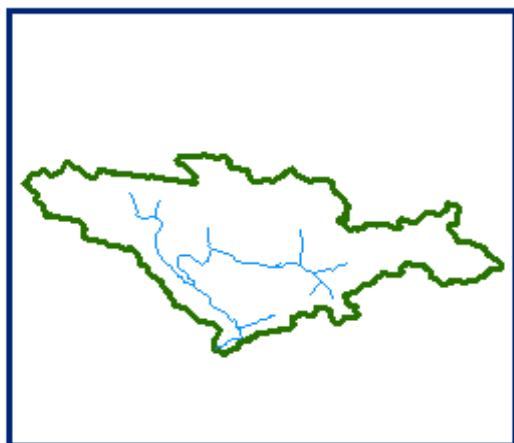
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
09 FEBRUARY 2011
10 FEBRUARY 2011



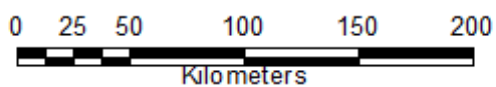
DATA USED
DATA NOT AVAILABLE



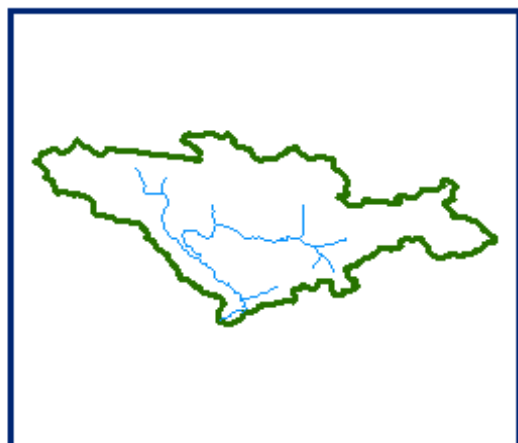
DATA USED
DATA NOT AVAILABLE



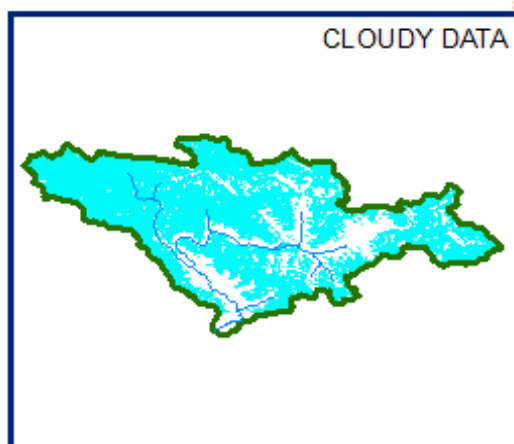
SNOW



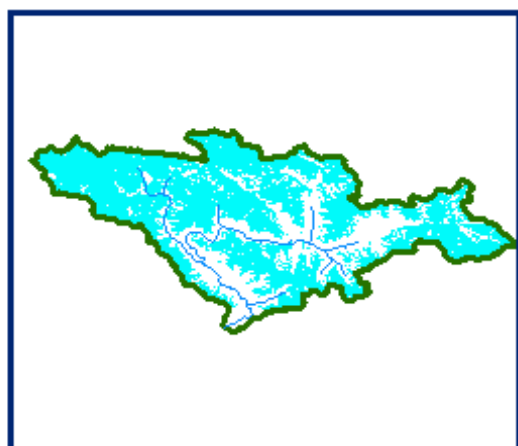
SNOW COVER MAP : SHIGAR BASIN



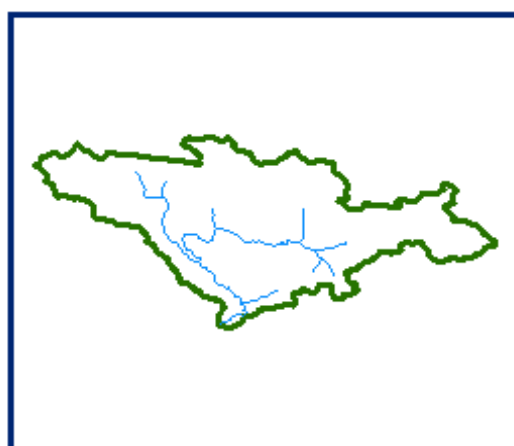
DATA NOT AVAILABLE



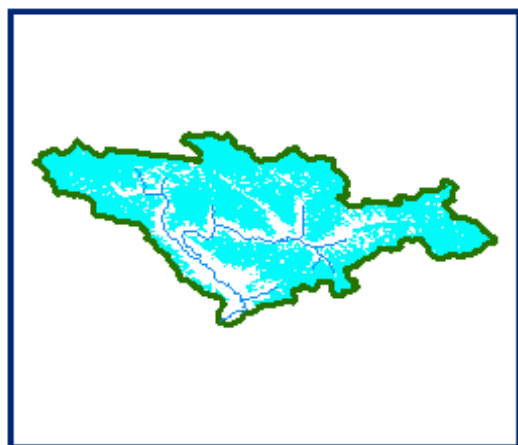
10 MARCH 2011



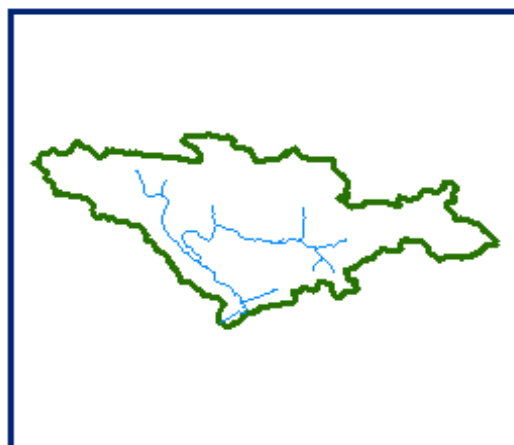
15 MARCH 2011



DATA NOT AVAILABLE



25 MARCH 2011

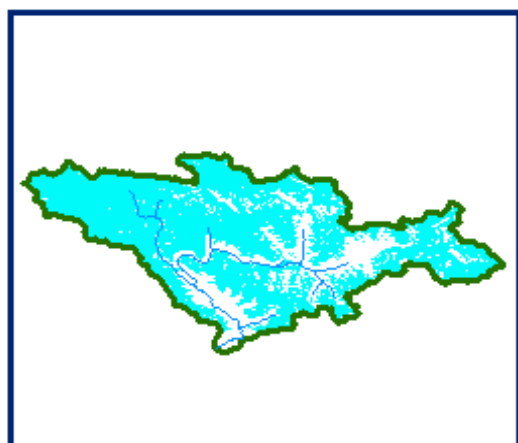


DATA NOT AVAILABLE

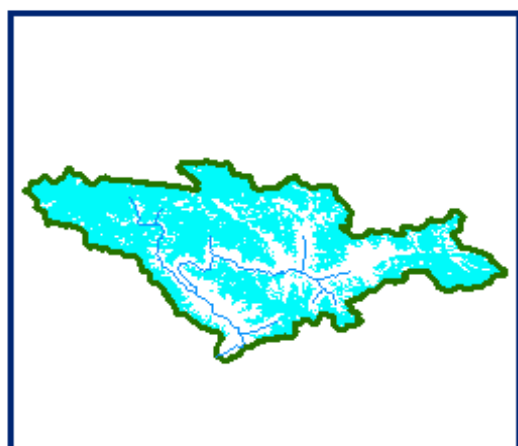
 SNOW

0 25 50 100 150 200
Kilometers

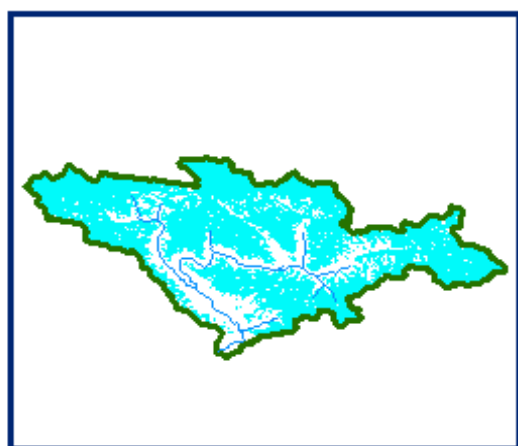
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
10 MARCH 2011



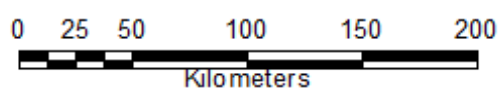
DATA USED
15 MARCH 2011



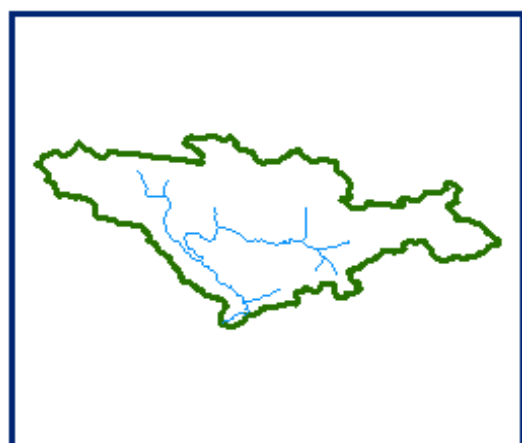
DATA USED
25 MARCH 2011



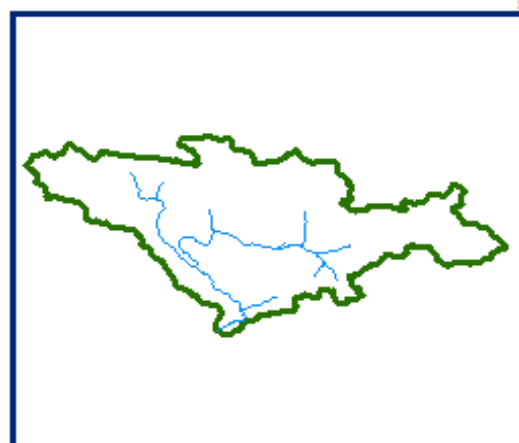
SNOW



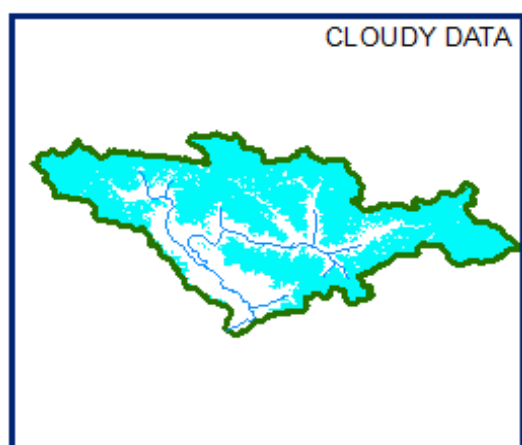
SNOW COVER MAP : SHIGAR BASIN



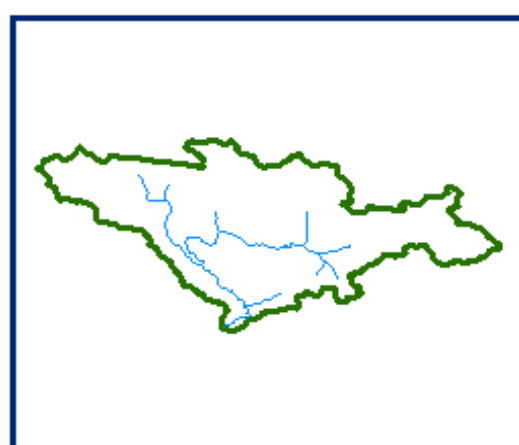
DATA NOT AVAILABLE



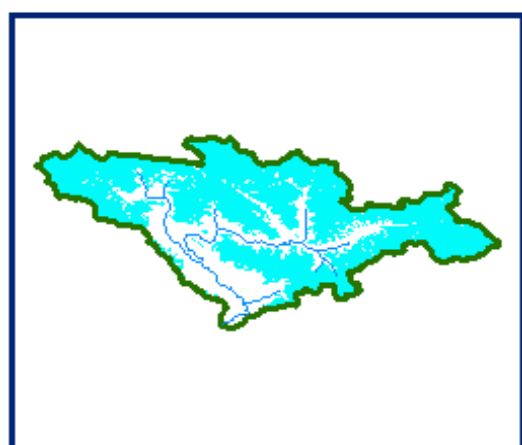
DATA NOT AVAILABLE



13 APRIL 2011

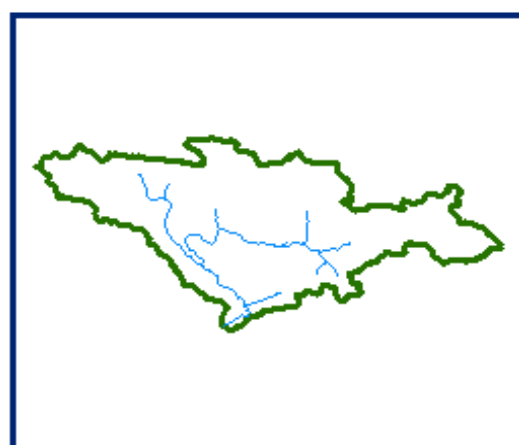


DATA NOT AVAILABLE



23 APRIL 2011

13 APRIL 2011

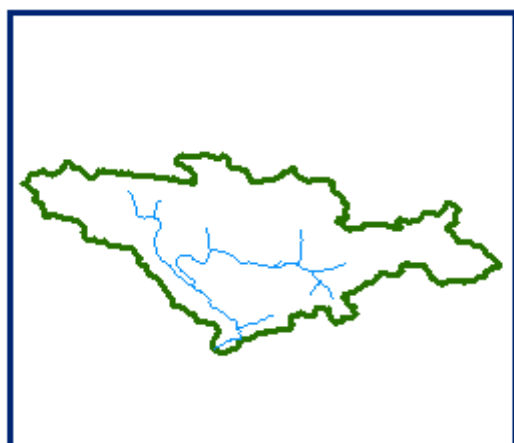


DATA NOT AVAILABLE

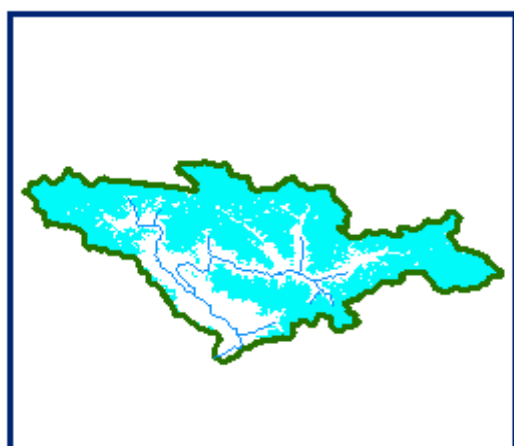
 SNOW

0 25 50 100 150 200
Kilometers

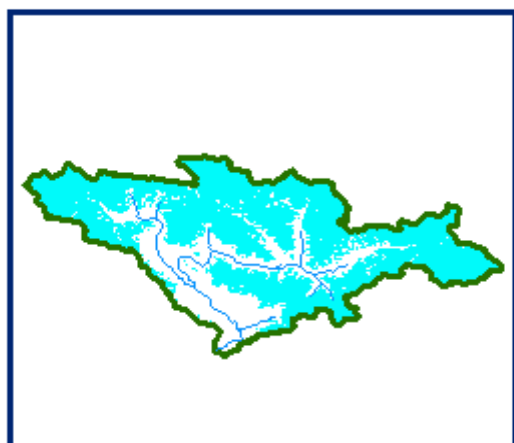
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
DATA NOT AVAILABLE



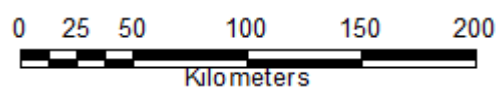
DATA USED
13 APRIL 2011



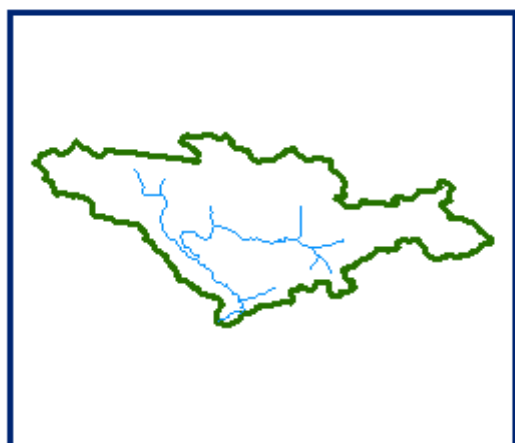
DATA USED
23 APRIL 2011



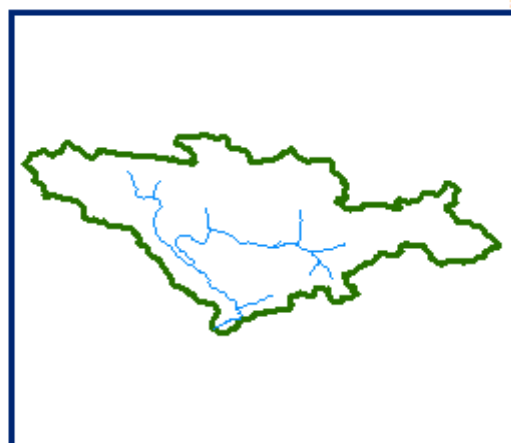
SNOW



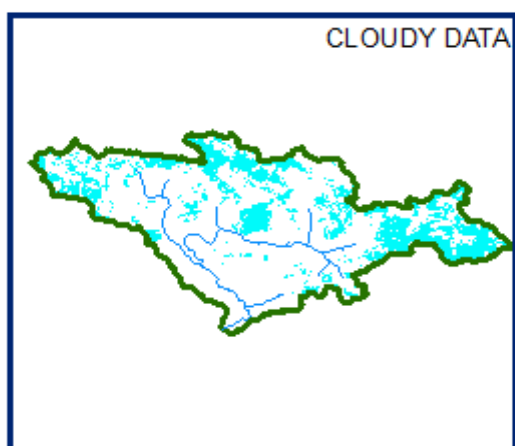
SNOW COVER MAP : SHIGAR BASIN



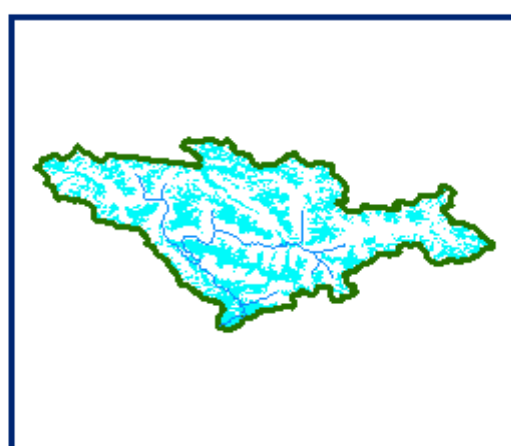
DATA NOT AVAILABLE



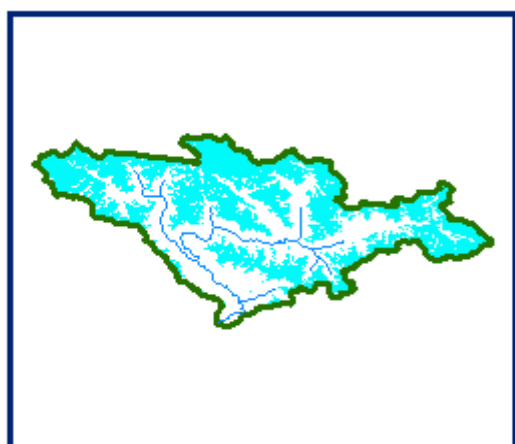
DATA NOT AVAILABLE



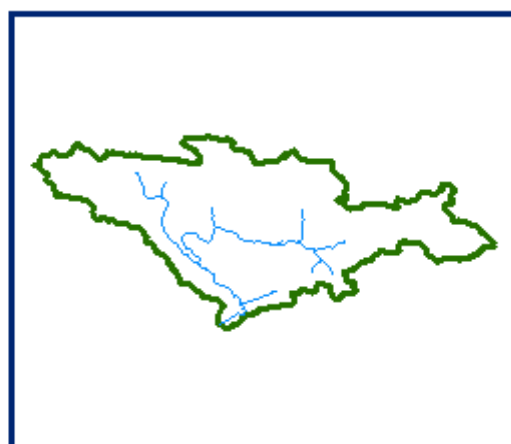
12 MAY 2011



**17 MAY 2011
20 MAY 2011**



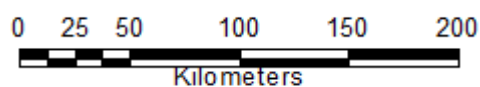
20 MAY 2011



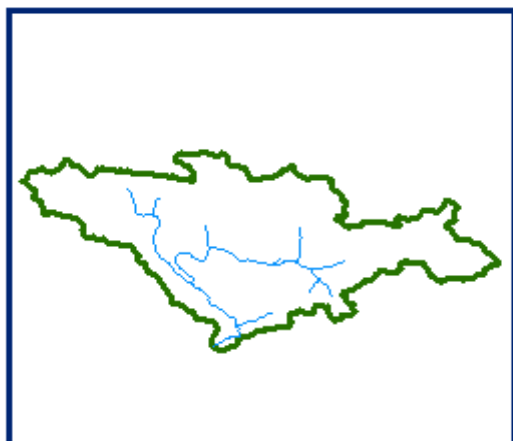
DATA NOT AVAILABLE



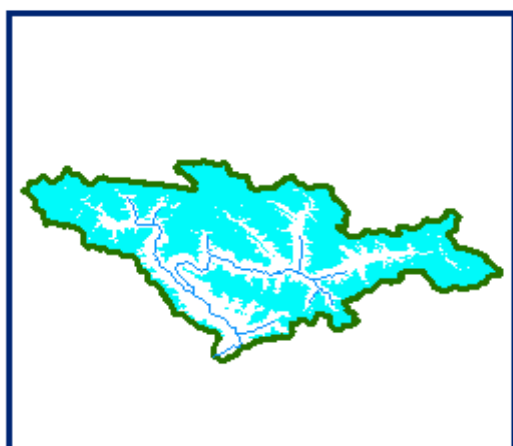
SNOW



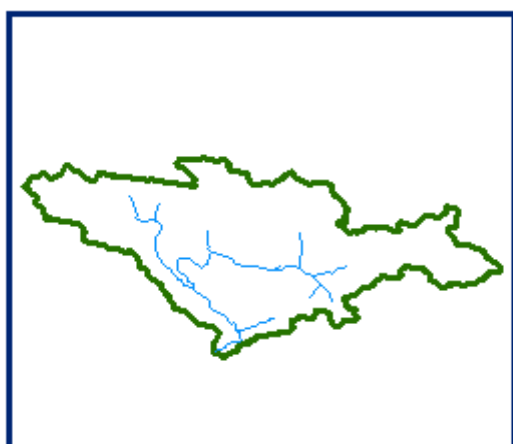
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
DATA NOT AVAILABLE



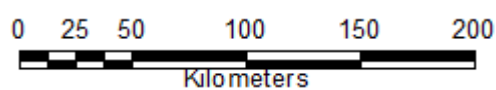
DATA USED
12 MAY 2011
17 MAY 2011
20 MAY 2011



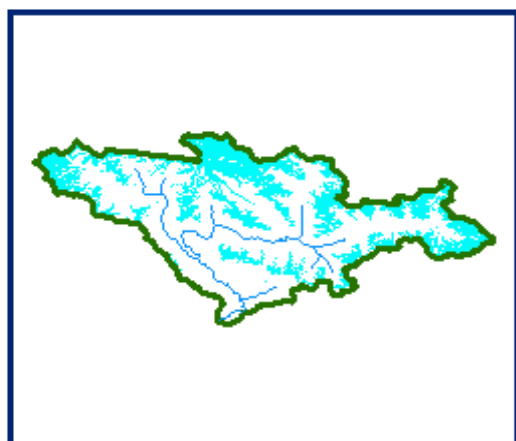
DATA USED
DATA NOT AVAILABLE



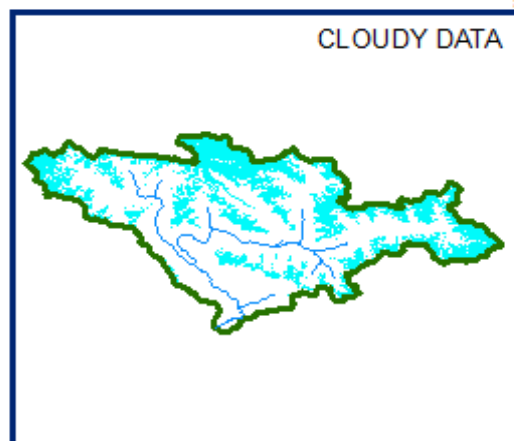
SNOW



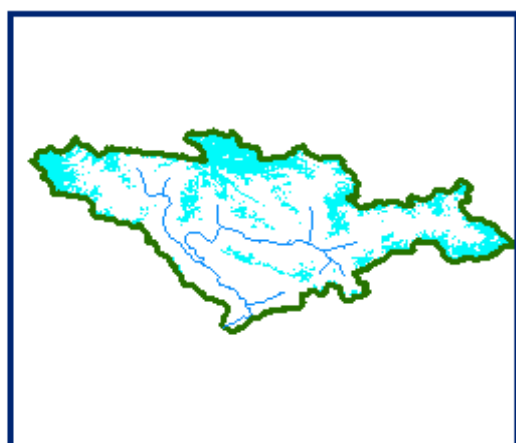
SNOW COVER MAP : SHIGAR BASIN



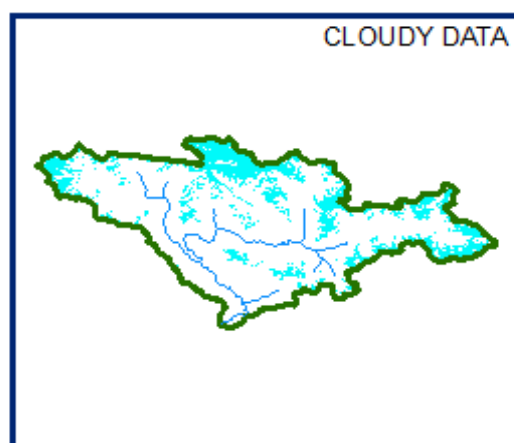
09 JUNE 2011



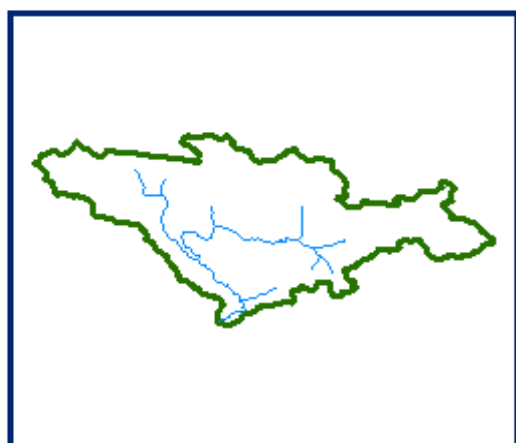
10 JUNE 2011



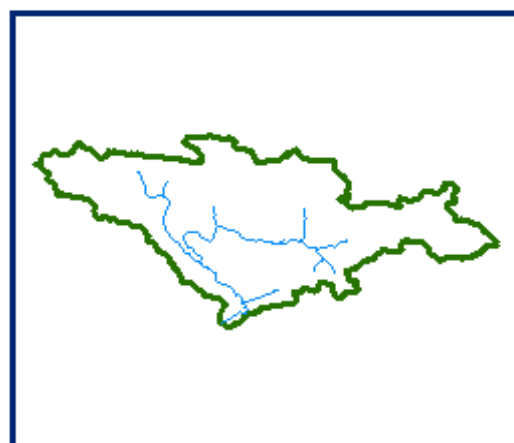
14 JUNE 2011



19 JUNE 2011



DATA NOT AVAILABLE

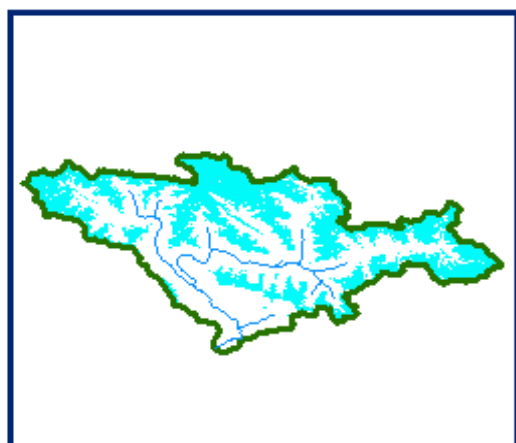


DATA NOT AVAILABLE

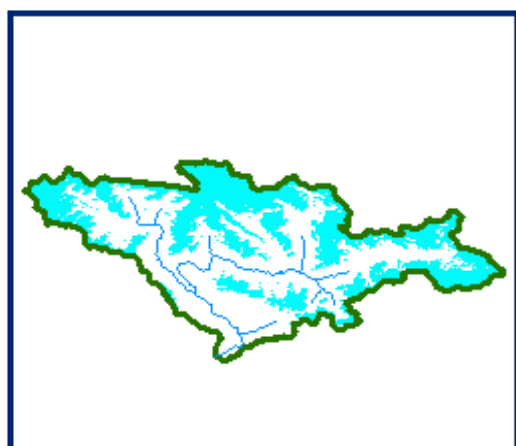
 SNOW

0 25 50 100 150 200
Kilometers

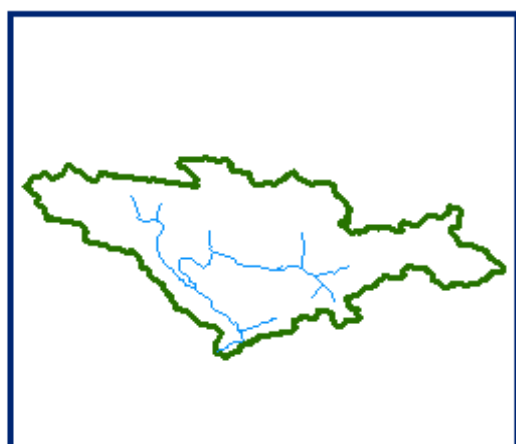
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
09 JUNE 2011
10 JUNE 2011



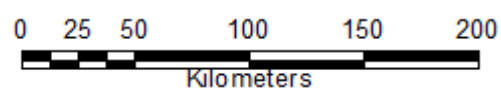
DATA USED
14 JUNE 2011
19 JUNE 2011



DATA USED
DATA NOT AVAILABLE



SNOW



HANZA BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: HANZA

BASIN AREA: 13711 sq km

S. No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010							
1	2-Oct-10	806301	59	2	3-Oct-10	7466.14	54
3	7-Oct-10	6808.29	50				
November 2010							
4	10-Nov-10	6198.62	45	5	15-Nov-10	5714.22	42
6	29-Nov-10	7462.21	54				
December 2010							
7	14-Dec-10	5698.30	42				
January 2011							
8	2-Jan-11	9420.29	69	9	12-Jan-11	9840.67	72
10	21-Jan-11	10794.40	79	11	30-Jan-11	9685.96	71
12	31-Jan-11	11135.10	81				
February 2011							
March 2011							
13	10- Mar-11	10221.60	75	14	25- Mar-11	9181.94	67
April 2011							
15	13-Apr-11	9157.48	67				
May 2011							
16	20-May-11	8004.79	58				
June 2011							
17	9-Jun-11	4877.83	36	18	19-Jun-11	4057.96	30

AREAL EXTENT OF SNOW (10 DAILY)

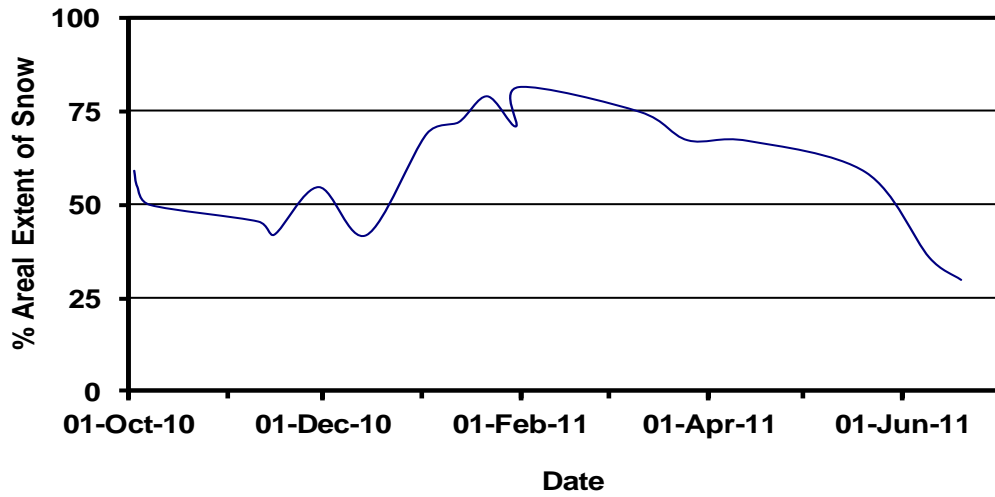
BASIN NAME: HANZA

BASIN AREA: 13711 sq km

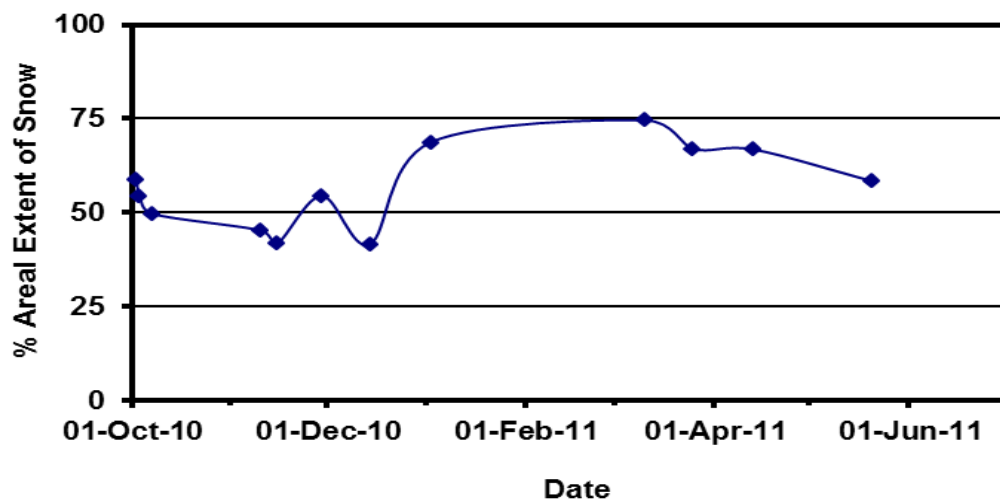
S. No	Date	Snow cover (sq km)	Snow cover (%)	S. No	Date	Snow cover (sq km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	8514.98	62	2	10-Nov-10	6198.62	45
				3	15-Nov-10	5714.22	42
				4	29-Nov-10	7462.21	54
December 2010				January 2011			
5	14-Dec-10	5698.30	42	6	02-Jan-11	9420.29	69
				7	12-Jan-11	9840.67	72
				8	25-Jan-11	12174.30	89
February 2011				March 2011			
				9	10-Mar-11	10221.60	75
				10	25-Mar-11	9181.94	67
April 2011				May 2011			
11	13-Apr-11	9157.48	67	12	20-May-11	8004.79	58
June 2011							
13	9-Jun-11	4877.83	36				
14	19-Jun-11	4057.96	30				

Snow cover depletion curve

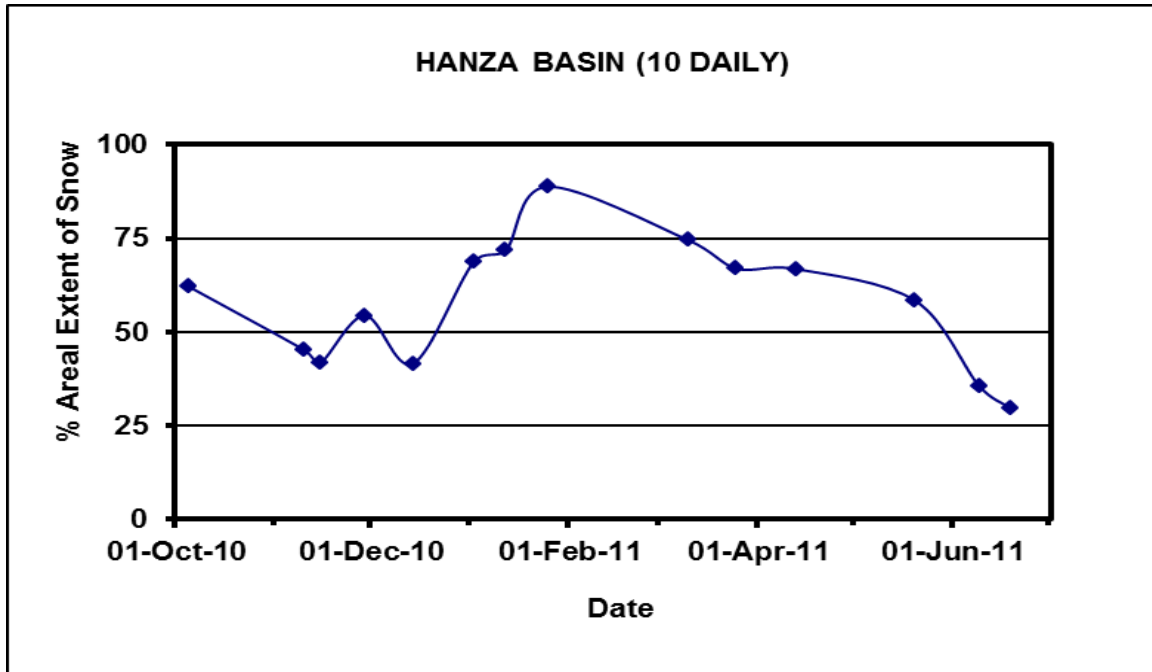
HANZA BASIN (5 DAILY) : WITH CLOUDY DATA



HANZA BASIN (5 DAILY) : WITHOUT CLOUDY DATA

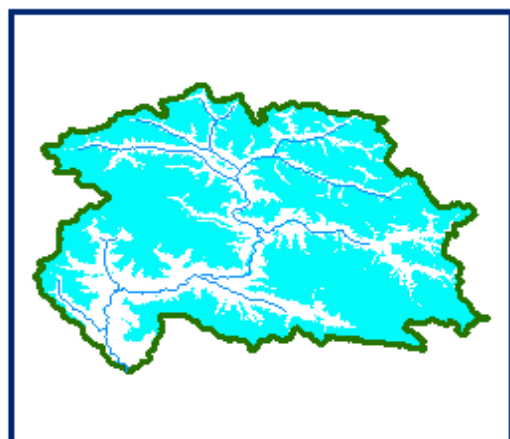


Snow cover depletion curve

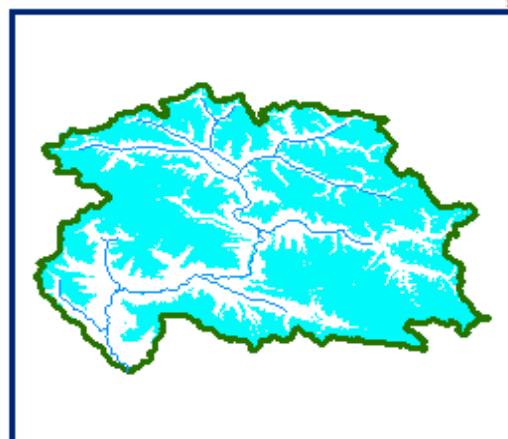


SNOW COVER MAP

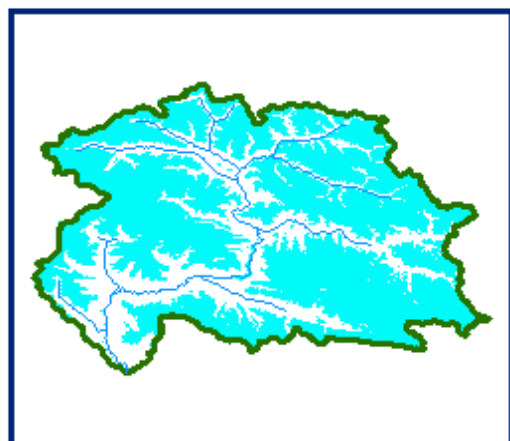
SNOW COVER MAP : HANZA BASIN



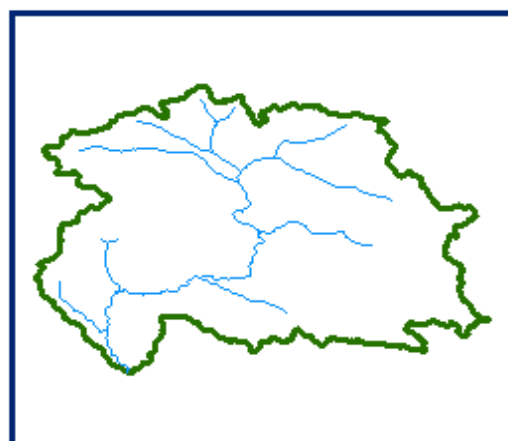
02 OCTOBER 2010



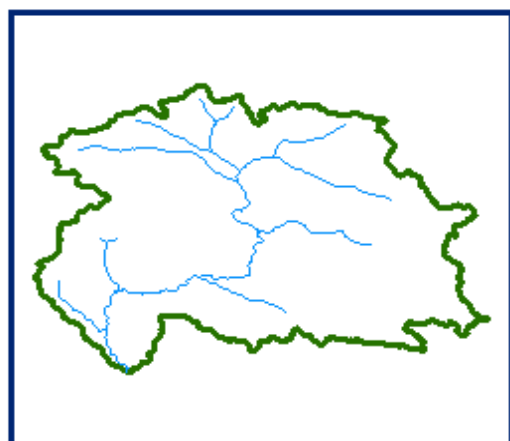
03 OCTOBER 2010



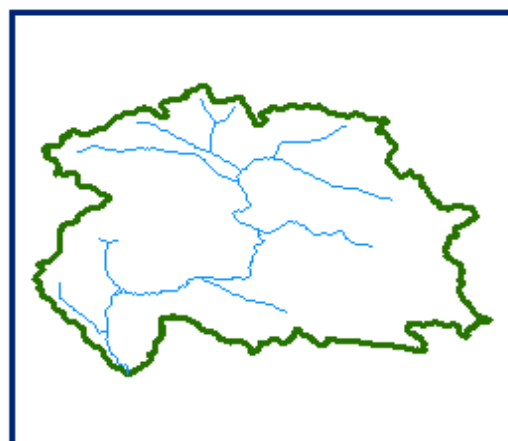
07 OCTOBER 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE

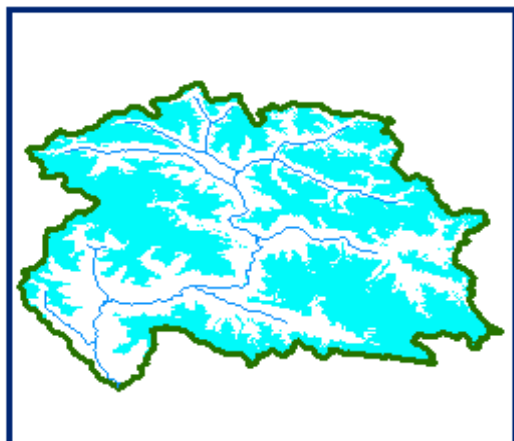


DATA NOT AVAILABLE

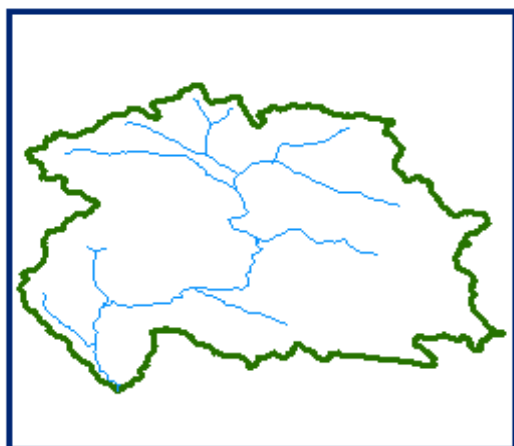
 SNOW

0 25 50 100 150 200
Kilometers

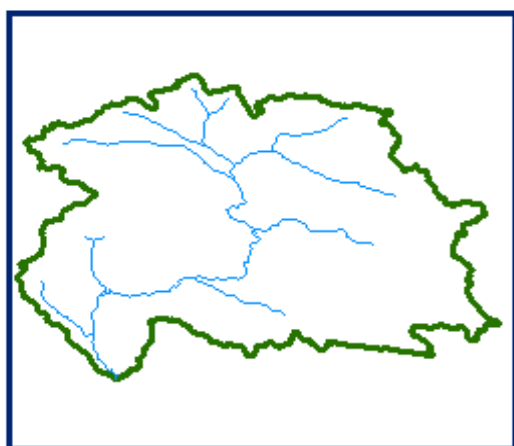
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
02 OCTOBER 2010
03 OCTOBER 2010
07 OCTOBER 2010



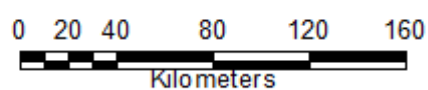
DATA USED
DATA NOT AVAILABLE



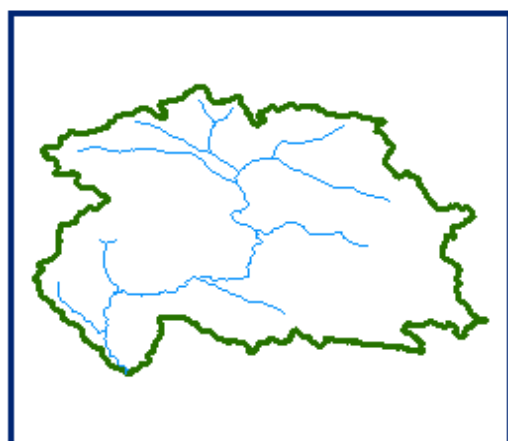
DATA USED
DATA NOT AVAILABLE



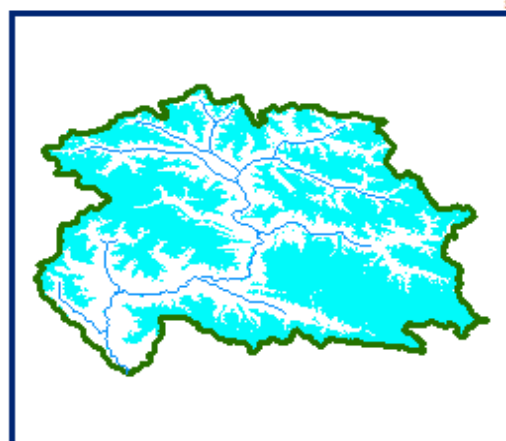
SNOW



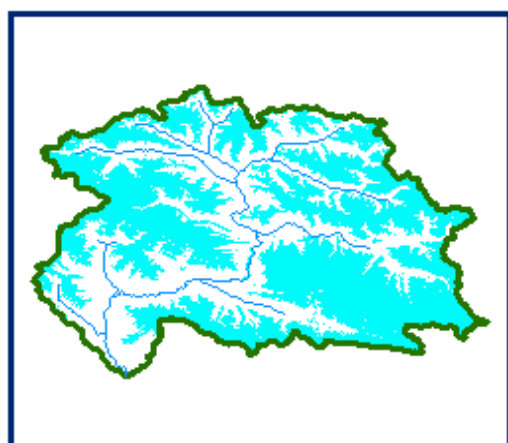
SNOW COVER MAP : HANZA BASIN



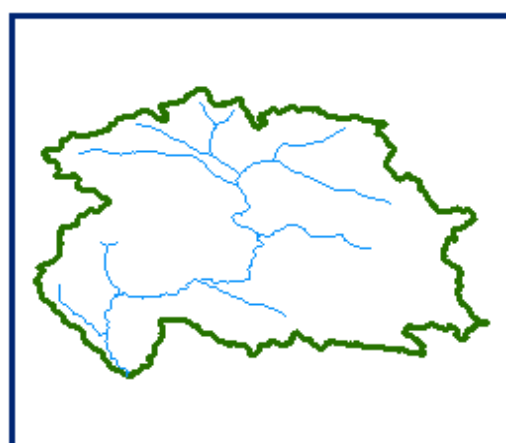
DATA NOT AVAILABLE



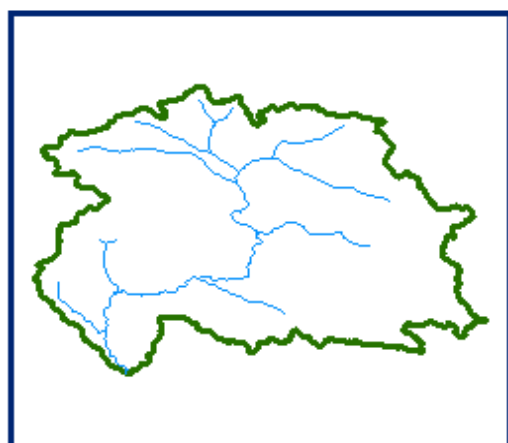
10 NOVEMBER 2010



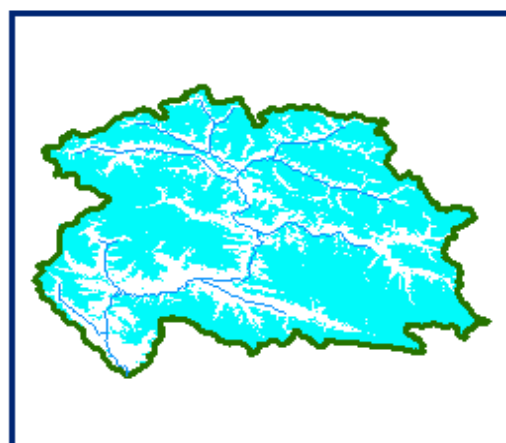
15 NOVEMBER 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE

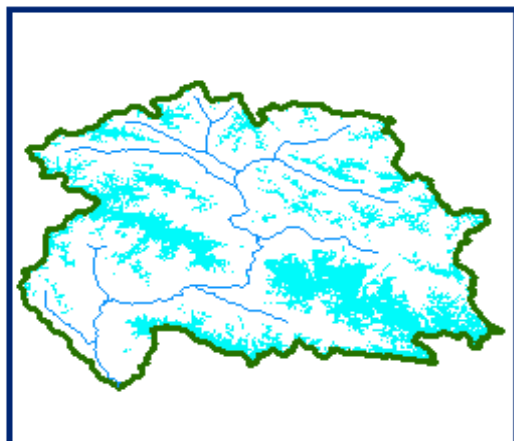


29 NOVEMBER 2010

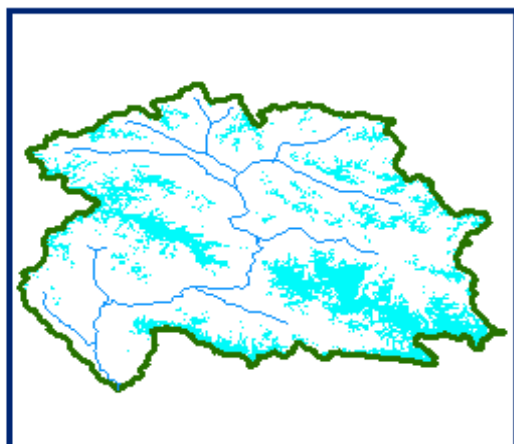
 SNOW

0 25 50 100 150 200
Kilometers

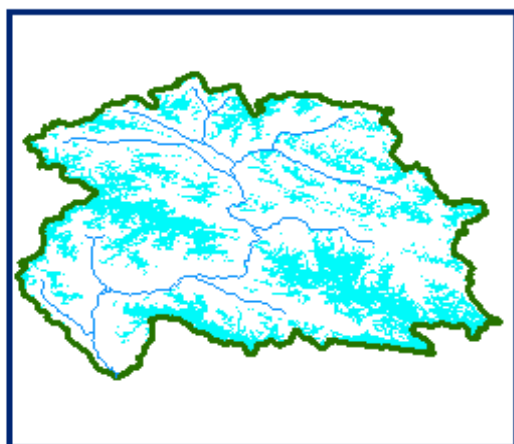
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
10 NOVEMBER 2010



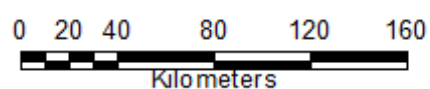
DATA USED
15 NOVEMBER 2010



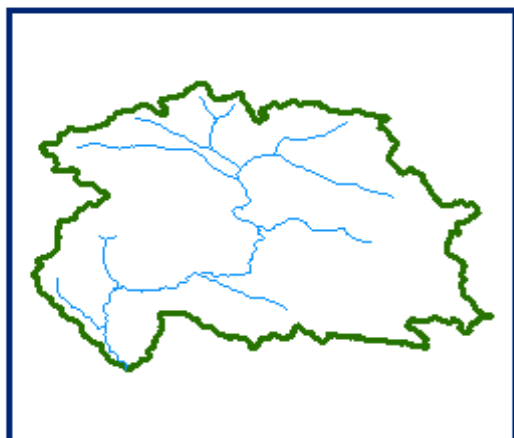
DATA USED
29 NOVEMBER 2010



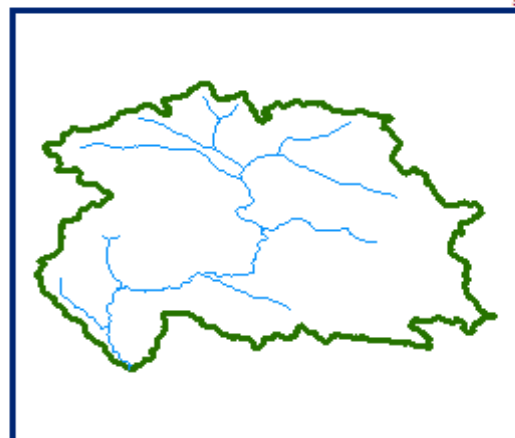
SNOW



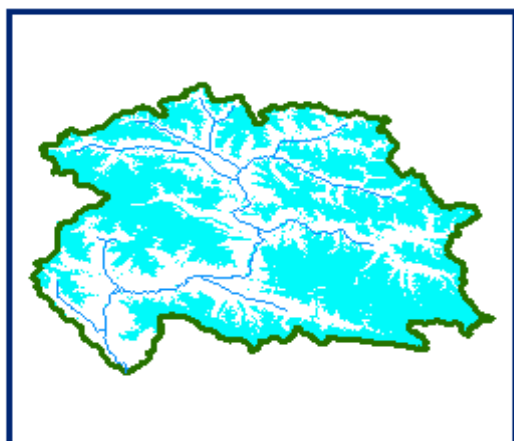
SNOW COVER MAP : HANZA BASIN



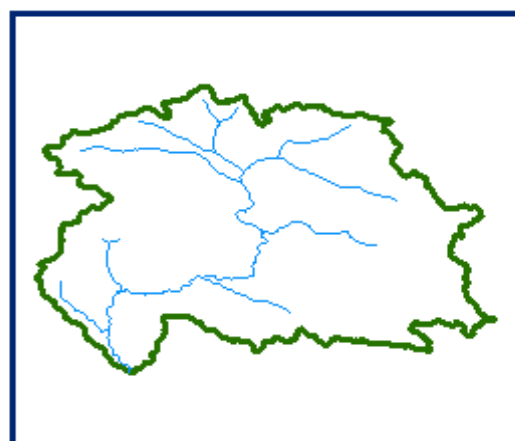
DATA NOT AVAILABLE



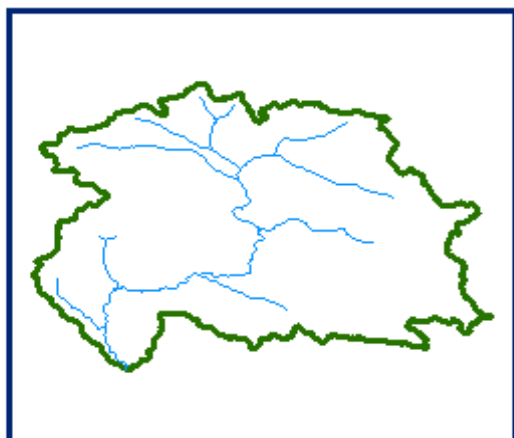
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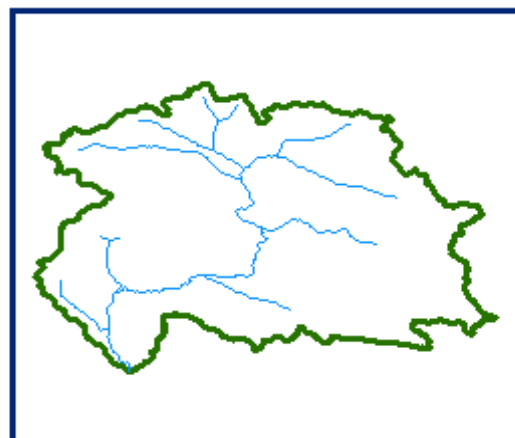
14 DECEMBER 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE

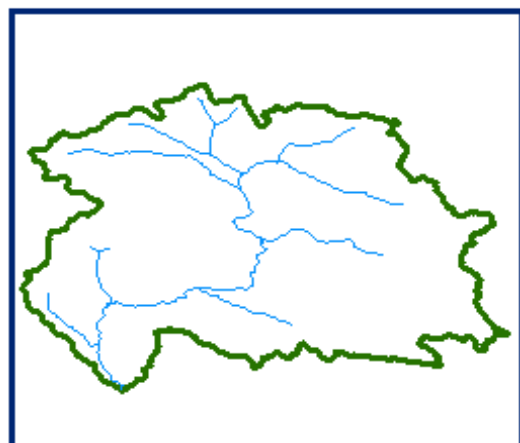


DATA NOT AVAILABLE

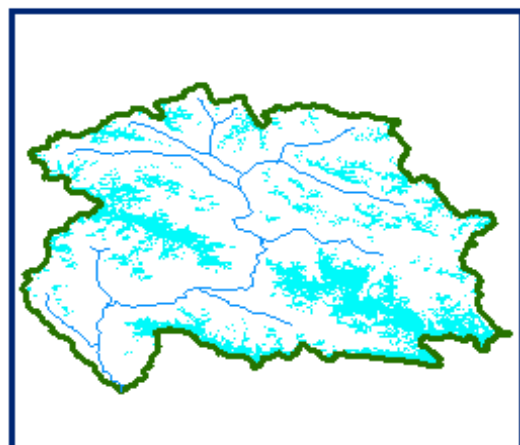
 SNOW

0 25 50 100 150 200
Kilometers

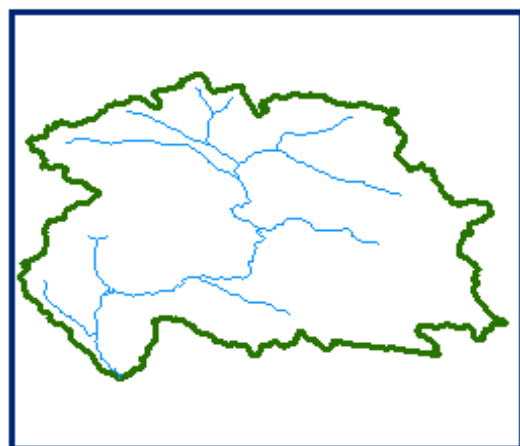
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
DATA NOT AVAILABLE



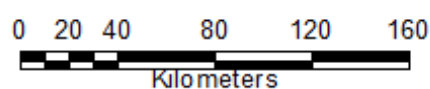
DATA USED
14 DECEMBER 2010



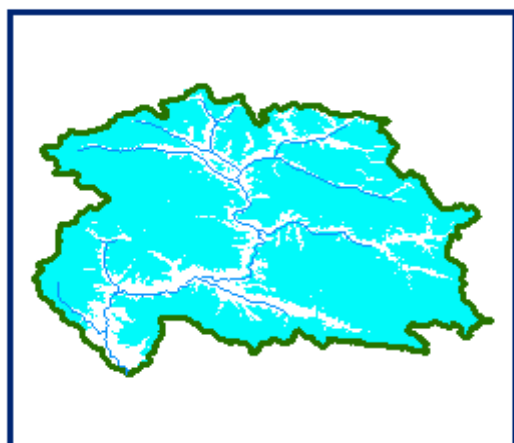
DATA USED
DATA NOT AVAILABLE



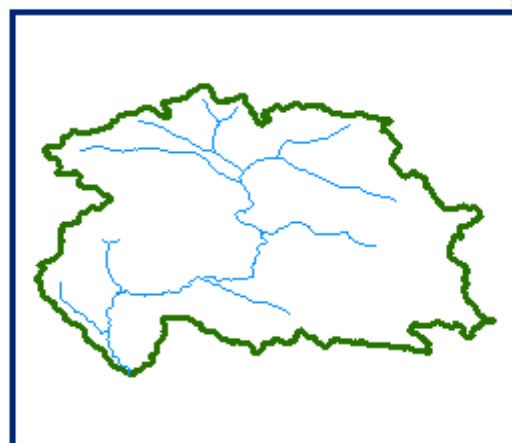
SNOW



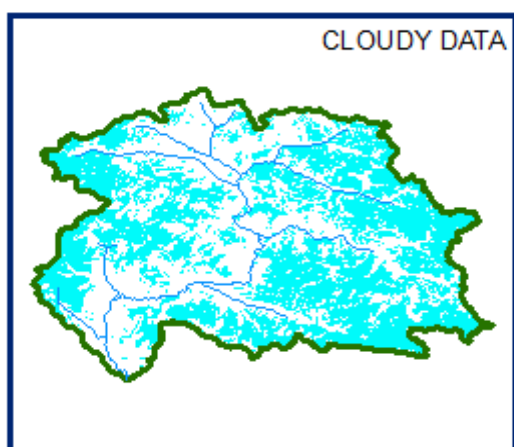
SNOW COVER MAP : HANZA BASIN



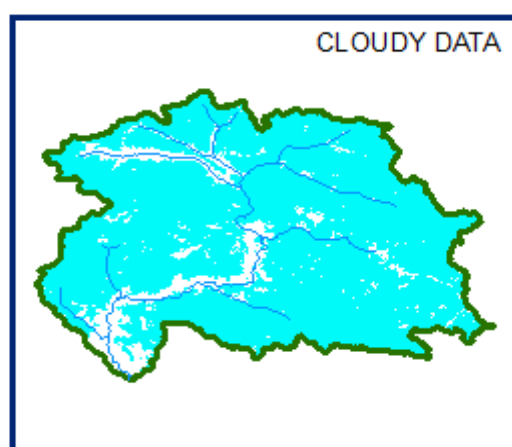
02 JANUARY 2011



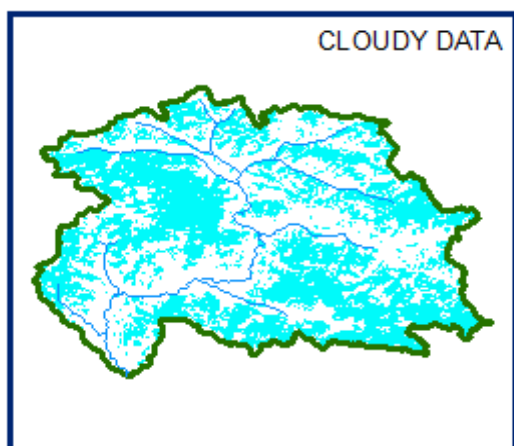
DATA NOT AVAILABLE



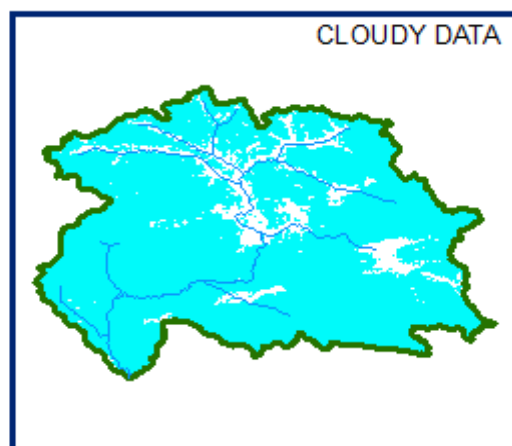
12 JANUARY 2011
02 JANUARY 2011



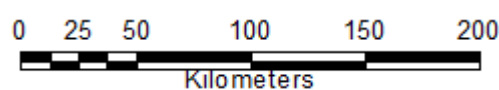
21 JANUARY 2011



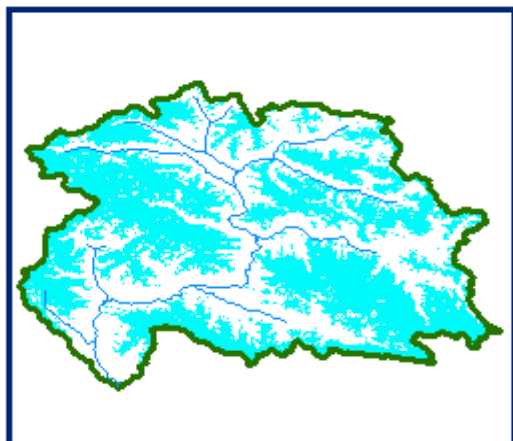
30 JANUARY 2011



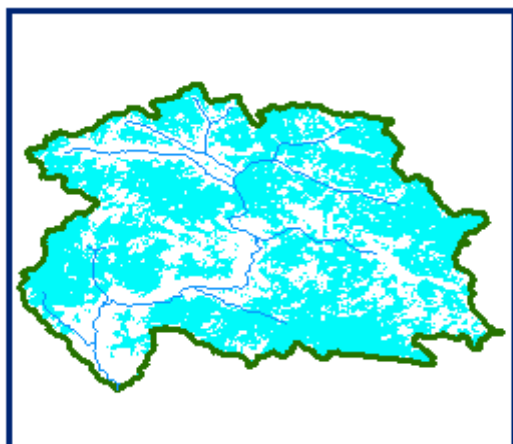
31 JANUARY 2011



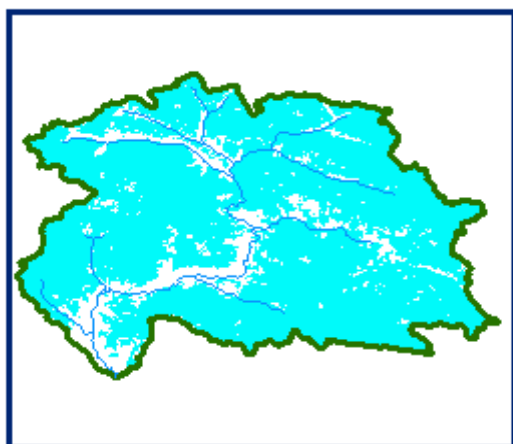
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
02 JANUARY 2011



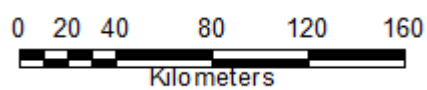
DATA USED
12 JANUARY 2011



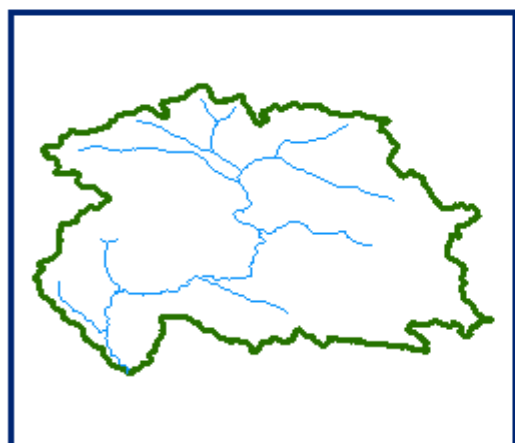
DATA USED
21 JANUARY 2011
30 JANUARY 2011
31 JANUARY 2011



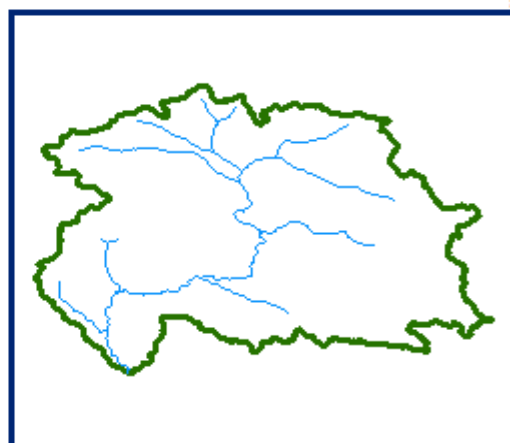
SNOW



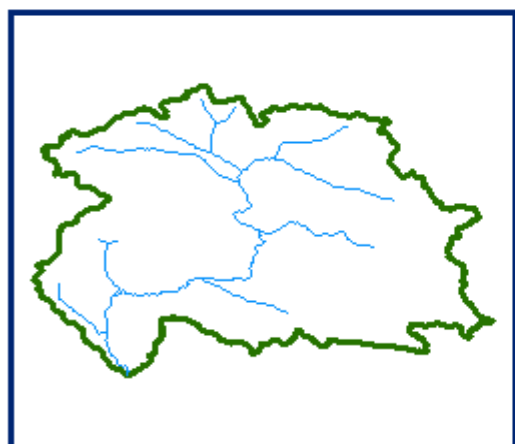
SNOW COVER MAP : HANZA BASIN



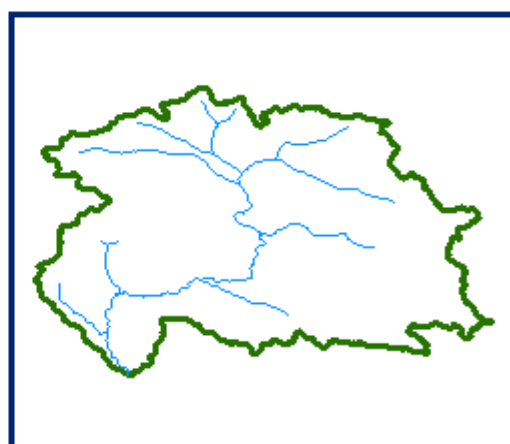
DATA NOT AVAILABLE



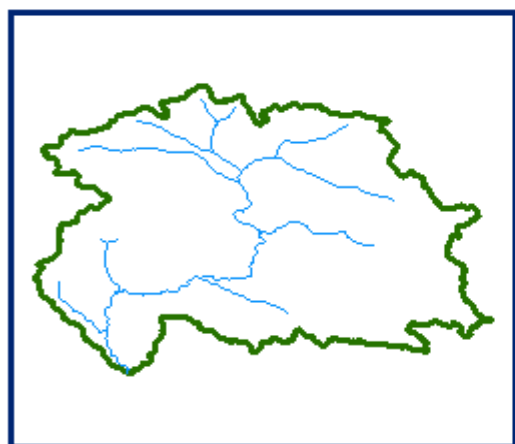
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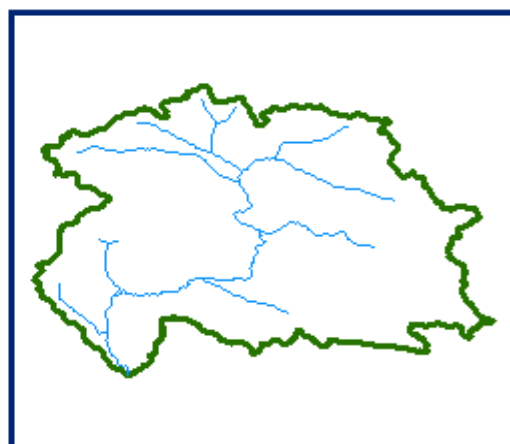
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE

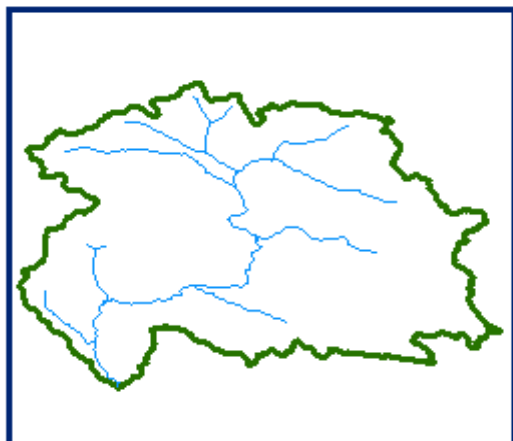


DATA NOT AVAILABLE

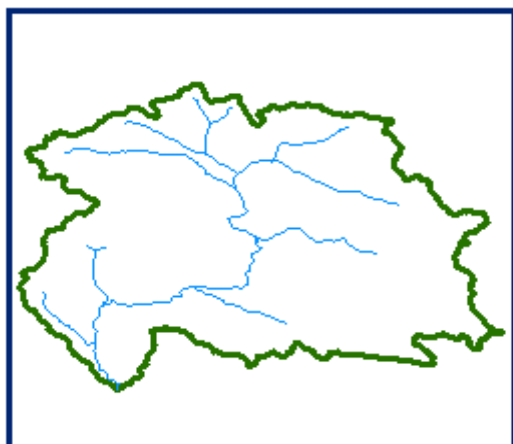
 SNOW

0 25 50 100 150 200
Kilometers

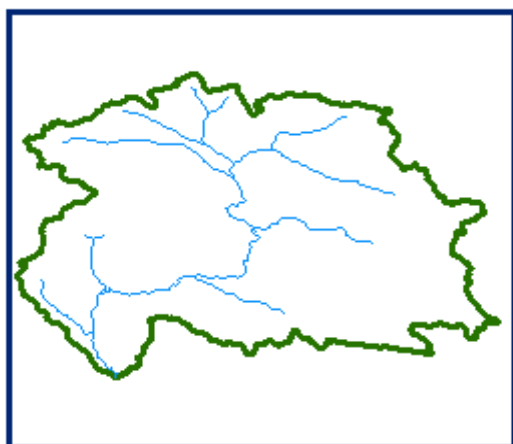
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
DATA NOT AVAILABLE



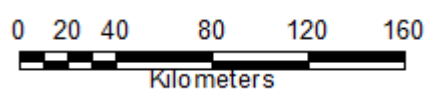
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DATA NOT AVAILABLE



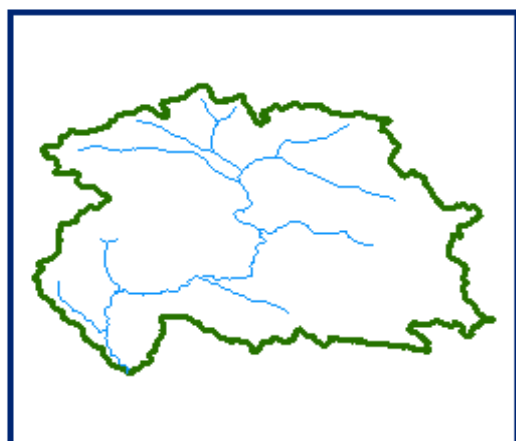
DATA USED
DATA NOT AVAILABLE



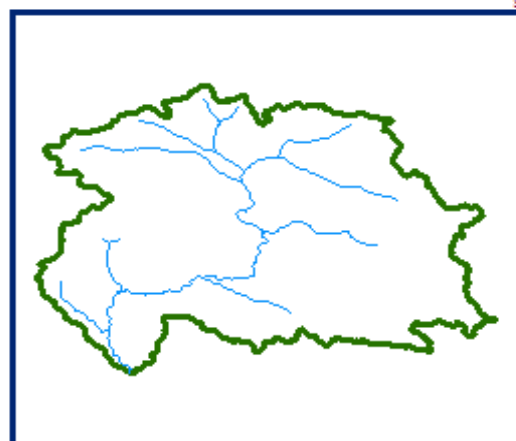
SNOW



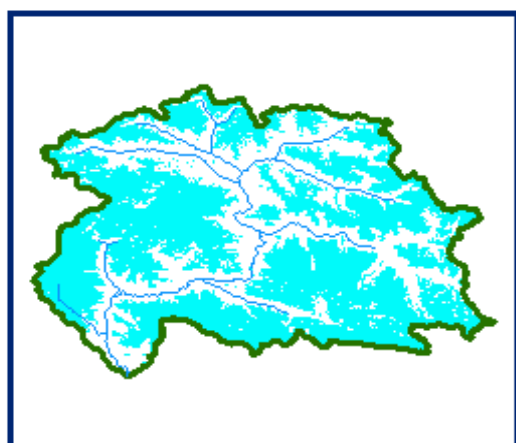
SNOW COVER MAP : HANZA BASIN



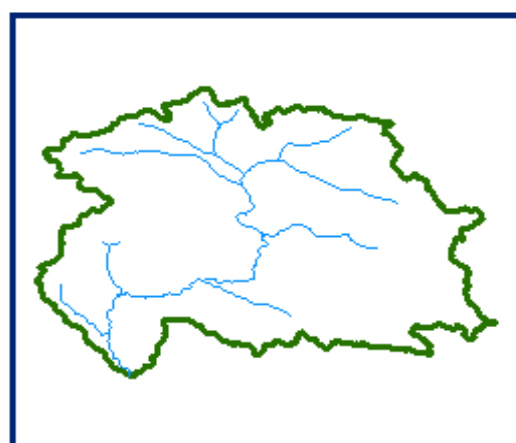
DATA NOT AVAILABLE



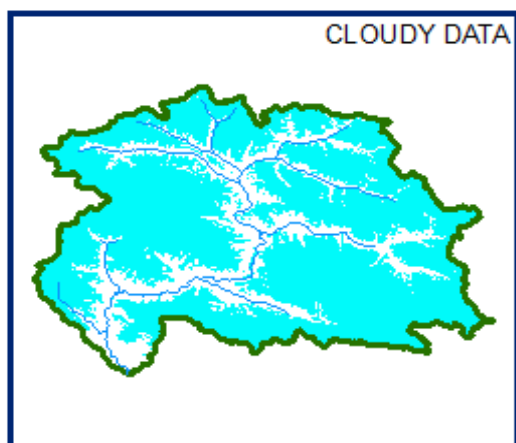
DATA NOT AVAILABLE



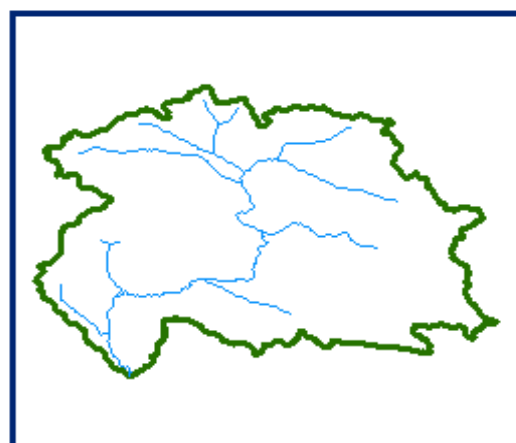
10 MARCH 2011
13 APRIL 2011



DATA NOT AVAILABLE



25 MARCH 2011

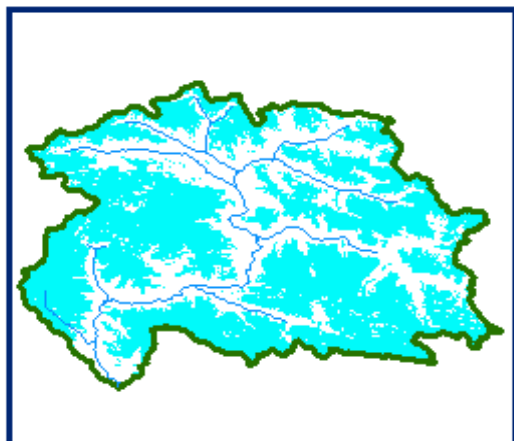


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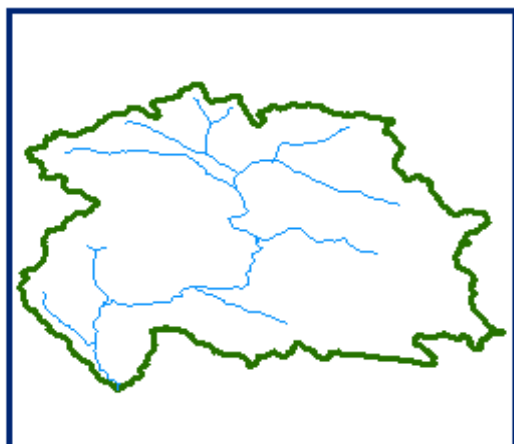
 SNOW

0 25 50 100 150 200
Kilometers

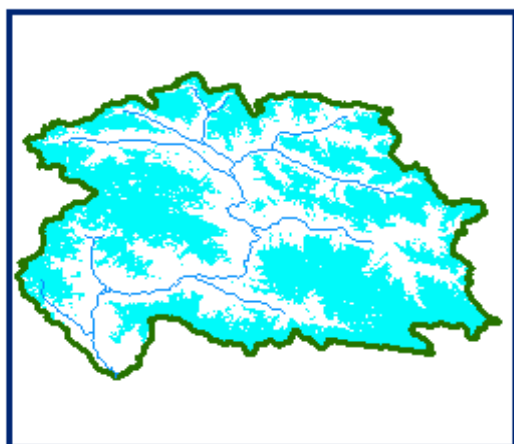
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
10 MARCH 2011



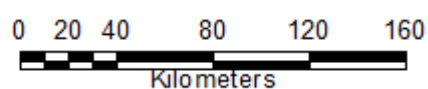
DATA USED
DATA NOT AVAILABLE



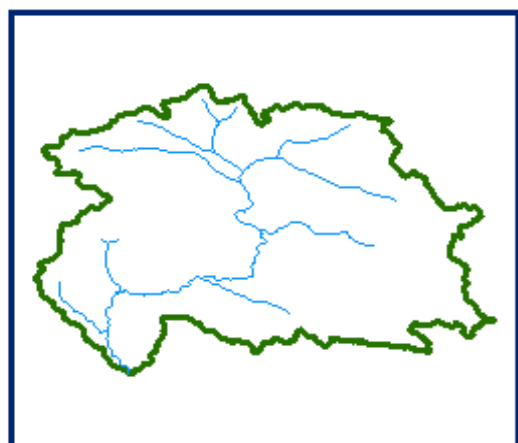
DATA USED
25 MARCH 2011



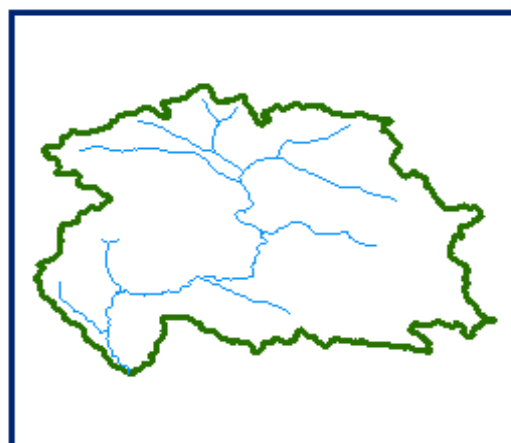
SNOW



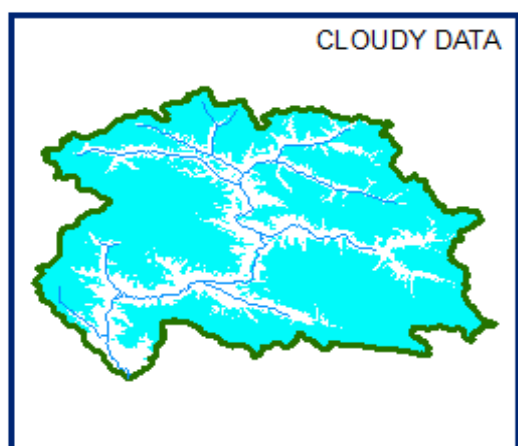
SNOW COVER MAP : HANZA BASIN



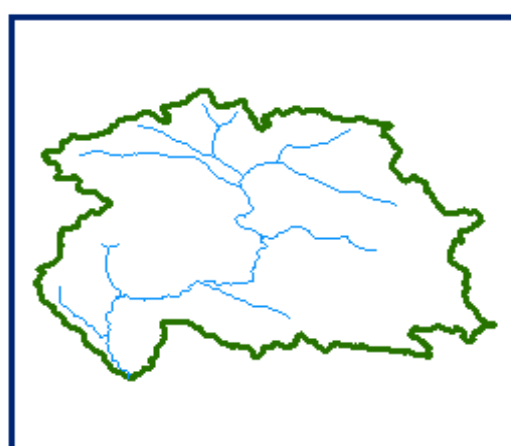
DATA NOT AVAILABLE



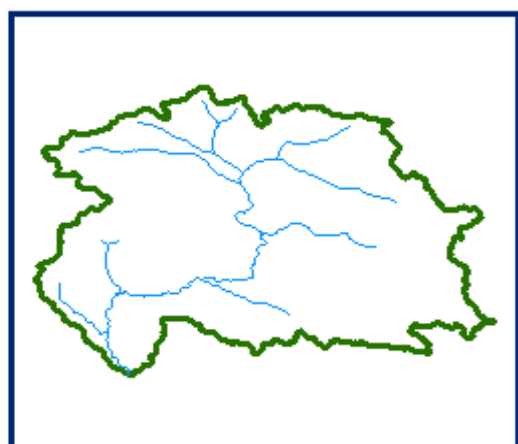
DATA NOT AVAILABLE



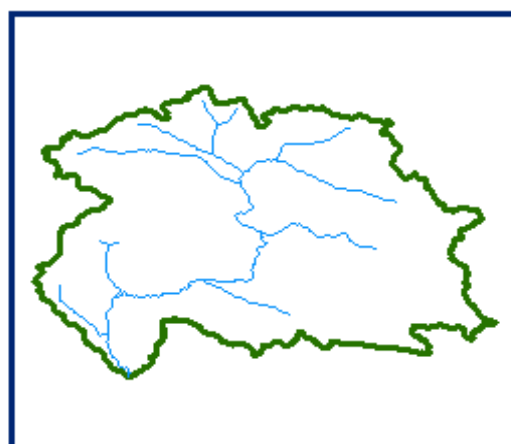
13 APRIL 2011



DATA NOT AVAILABLE



DATA NOT AVAILABLE

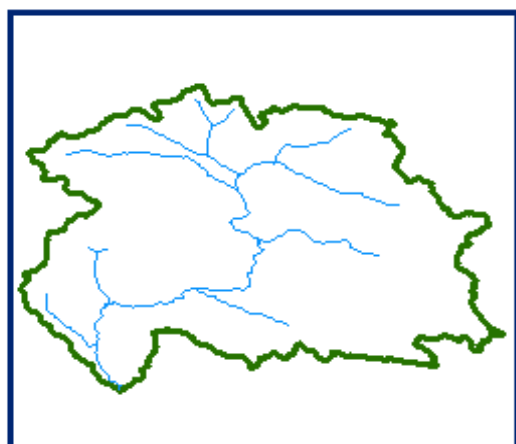


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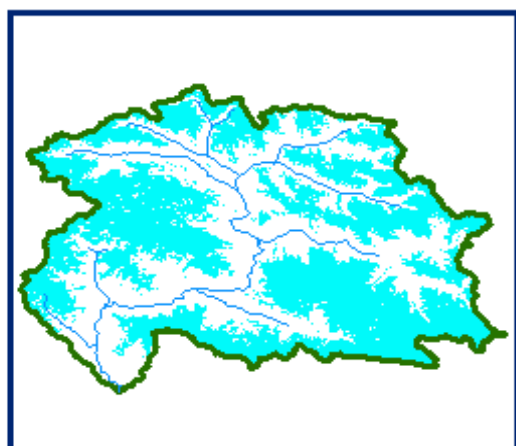
 SNOW

0 25 50 100 150 200
Kilometers

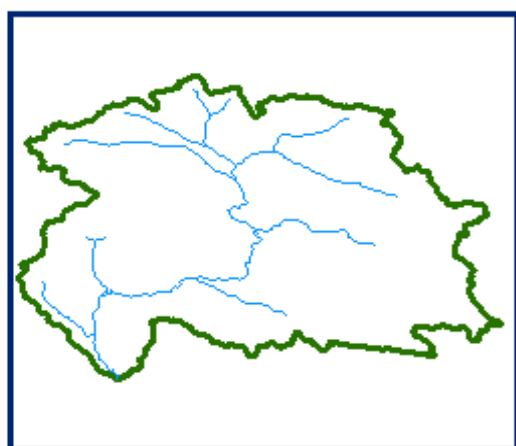
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
DATA NOT AVAILABLE



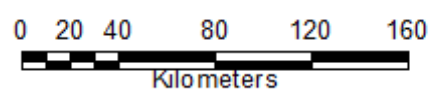
DATA USED
13 APRIL 2011



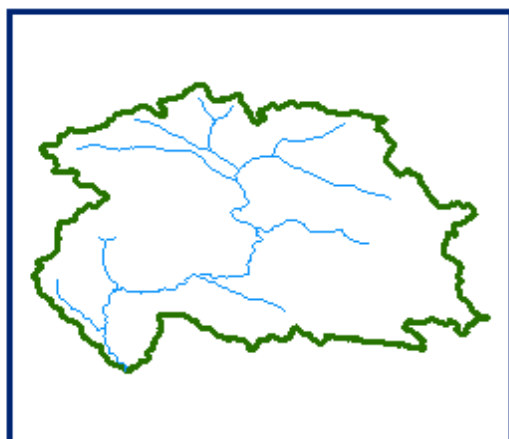
DATA USED
DATA NOT AVAILABLE



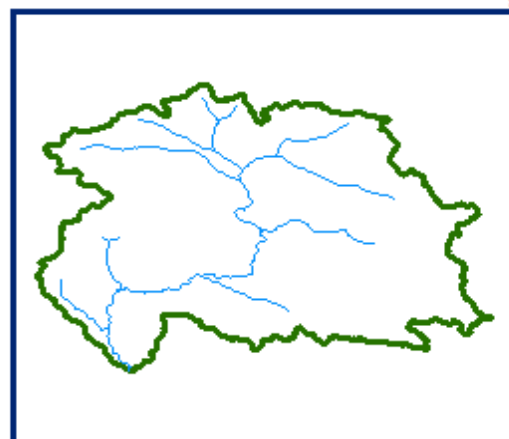
SNOW



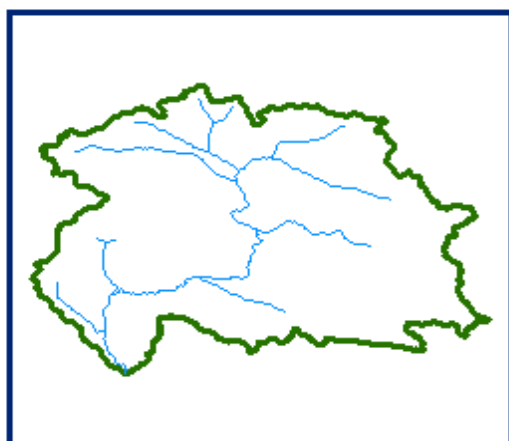
SNOW COVER MAP : HANZA BASIN



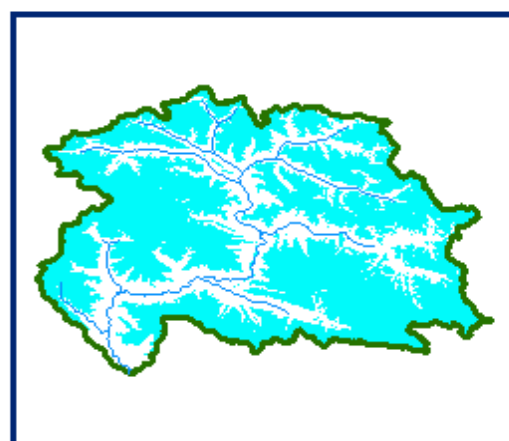
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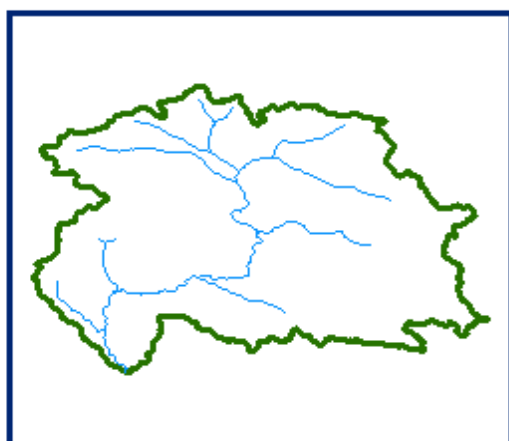
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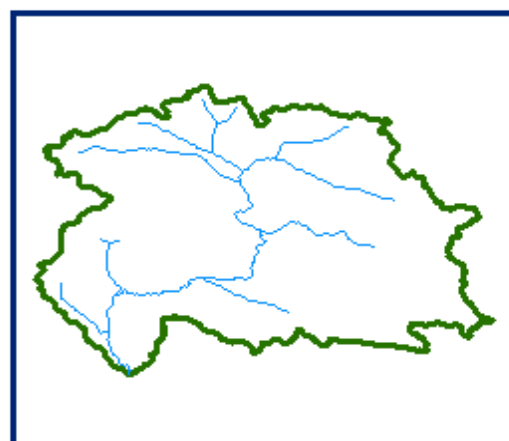
DATA NOT AVAILABLE



20 MAY 2011



DATA NOT AVAILABLE

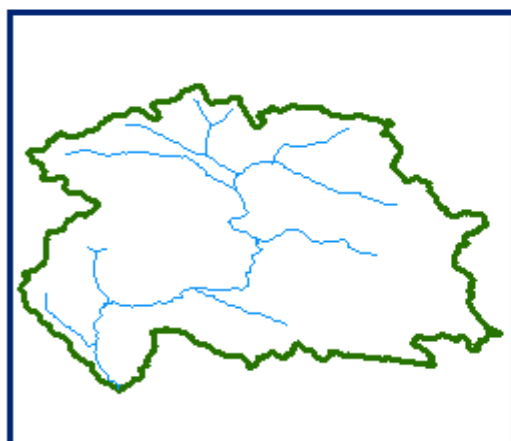


DATA NOT AVAILABLE

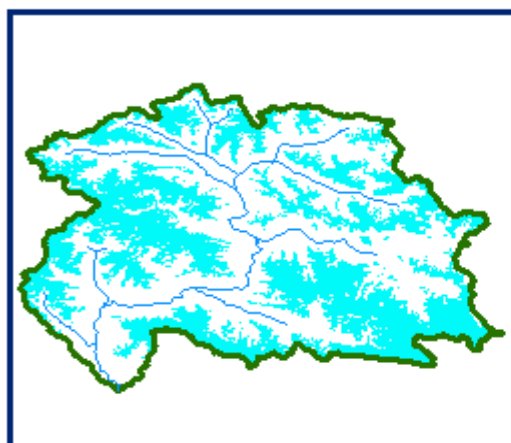
 SNOW

0 25 50 100 150 200
Kilometers

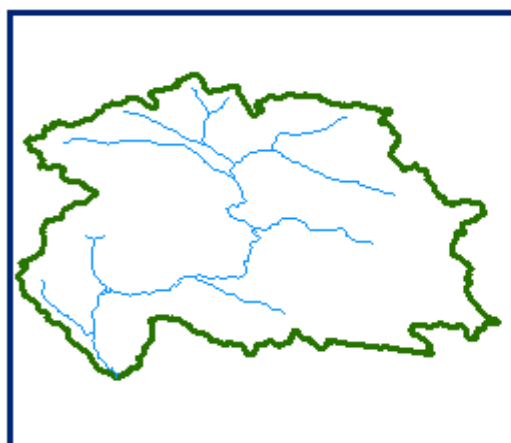
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
DATA NOT AVAILABLE



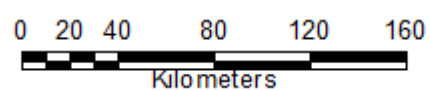
DATA USED
20 MAY 2011



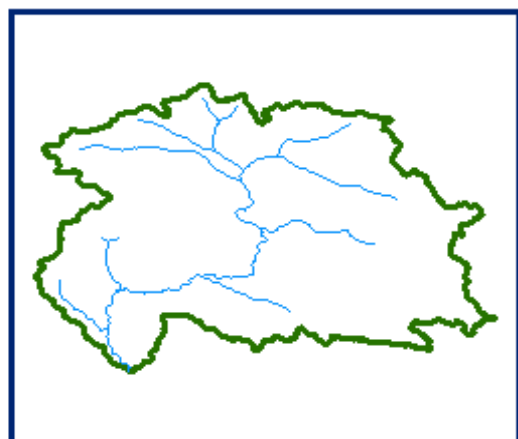
DATA USED
DATA NOT AVAILABLE



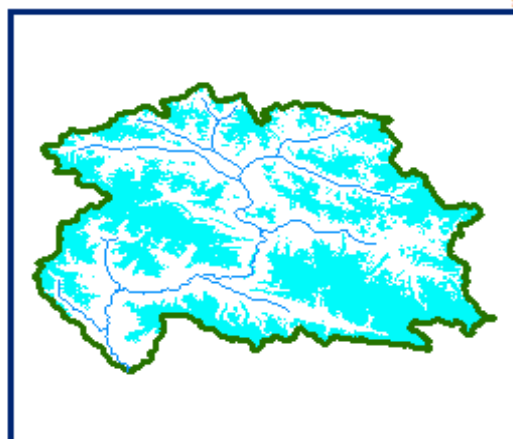
SNOW



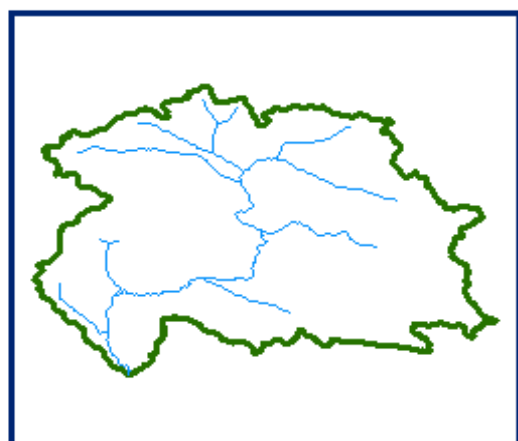
SNOW COVER MAP : HANZA BASIN



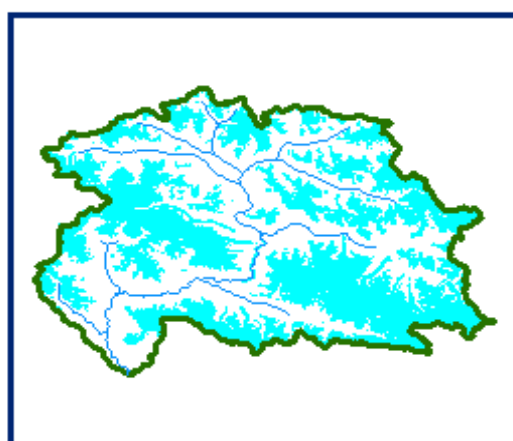
DATA NOT AVAILABLE



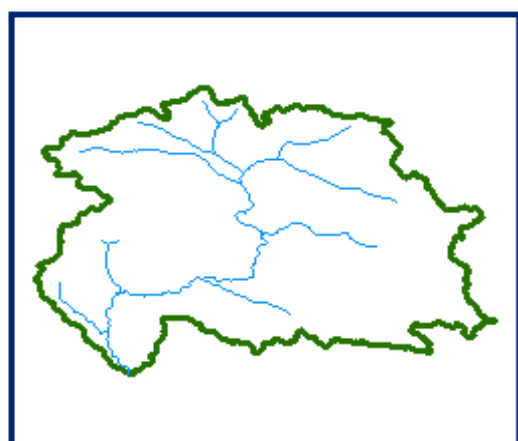
09 JUNE 2011



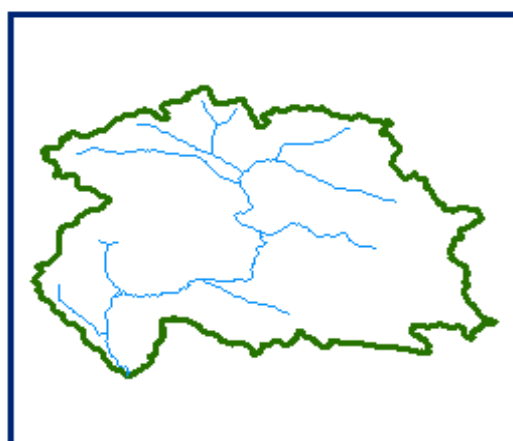
DATA NOT AVAILABLE



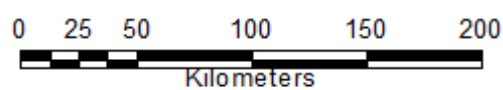
19 JUNE 2011



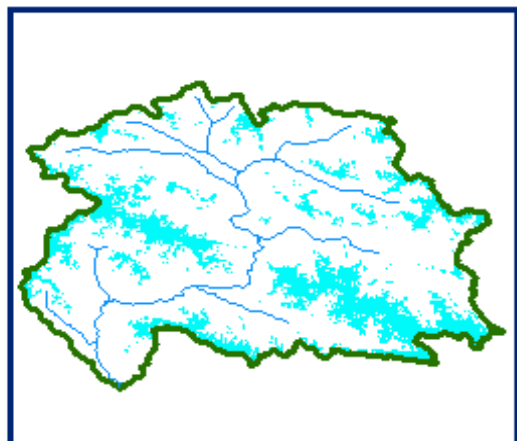
DATA NOT AVAILABLE



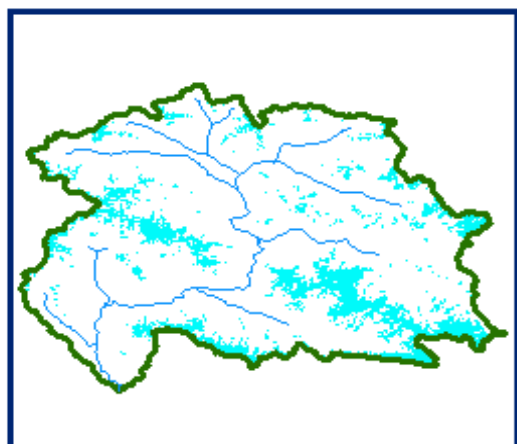
DATA NOT AVAILABLE



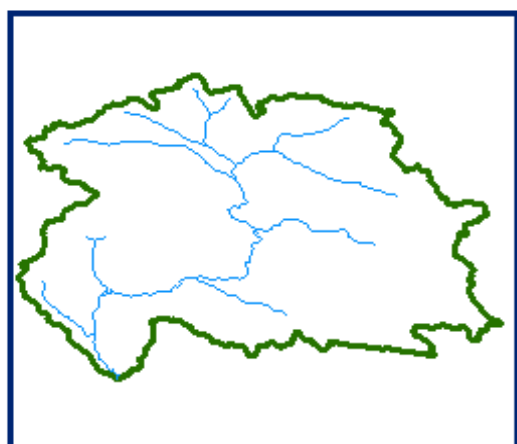
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
09 JUNE 2011



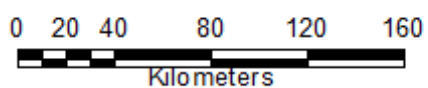
DATA USED
09 JUNE 2011



DATA USED
DATA NOT AVAILABLE



SNOW



GILGIT BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: GILGIT

BASIN AREA: 13615 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010							
1	02-Oct-10	5795.64	43	2	07-Oct-10	4259.03	31
3	17-Oct-10	4261.06	31				
November 2010							
4	10-Nov-10	3157.49	23	5	15-Nov-10	2393.60	18
6	24-Nov-10	2164.90	16	7	29-Nov-10	4085.06	30
December 2010							
8	04-Dec-10	3143.53	23	9	14-Dec-10	4086.20	30
10	19-Dec-10	4278.97	31				
January 2011							
11	2-Jan-11	9943.10	73	12	21-Jan-11	8706.74	64
13	30-Jan-11	10656.80	78				
February 2011							
14	09-Feb-11	12967.40	95				
March 2011							
15	10-Mar-11	12025.00	88	16	16-Mar-11	11249.20	83
April 2011							
17	13-Apr-11	9412.99	69				
May 2011							
18	20-May-11	8613.55	63				
June 2011							
19	9-Jun-11	3644.13	27	20	14-Jun-11	2806.08	21
21	19-Jun-11	2271.51	17				

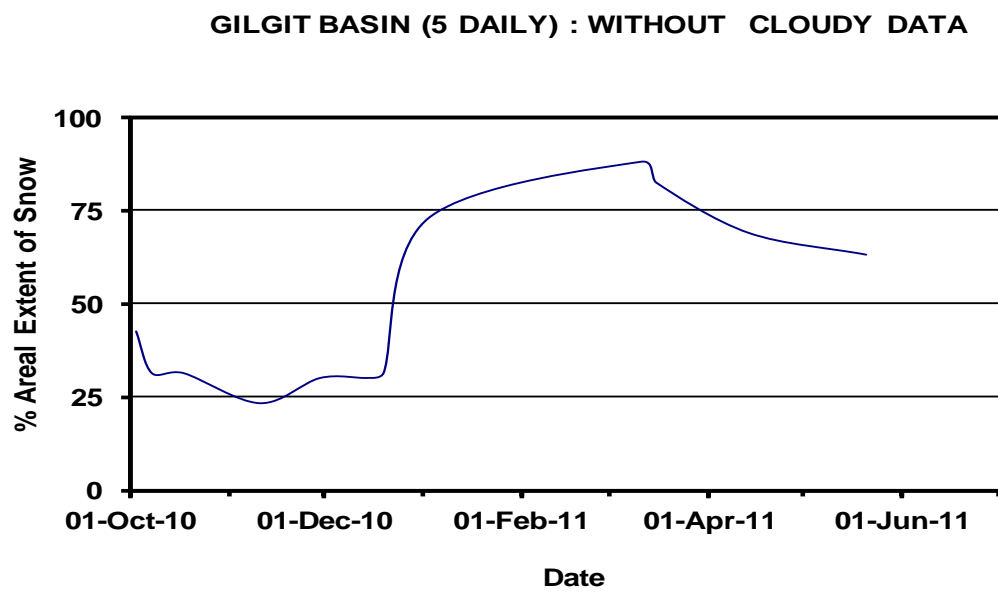
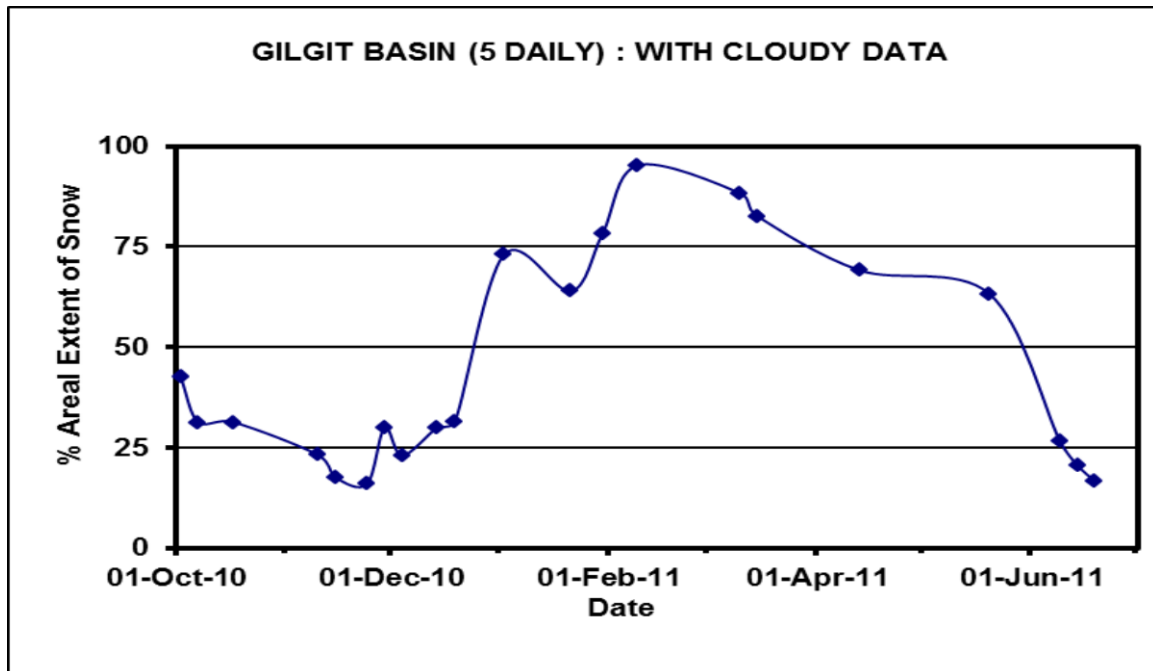
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: GILGIT

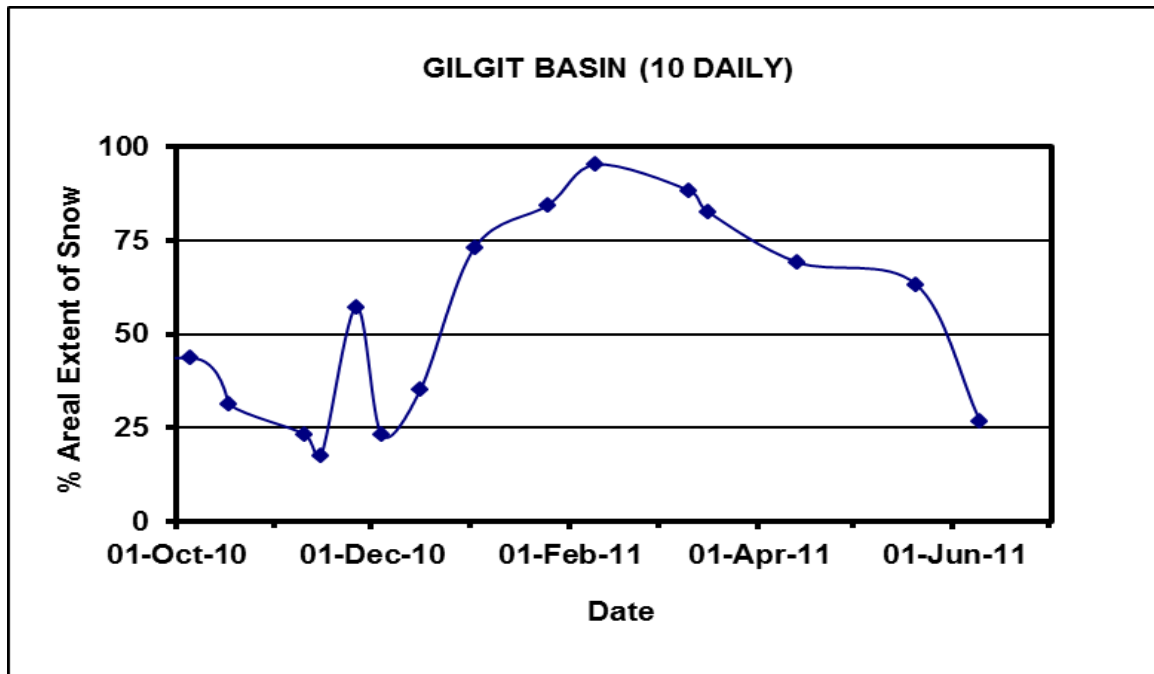
BASIN AREA: 13615 sq km

S. No	Date	Snow cover (sq. km)	Snow cover (%)	S. No	Date	Snow cover (sq. km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	5941.56	44	3	10-Nov-10	3157.49	23
2	17-Oct-10	4261.06	31	4	15-Nov-10	2393.60	18
				5	26-Nov-10	7785.69	57
December 2010				January 2011			
6	4-Dec-10	3143.53	23	7	2-Jan-11	9943.10	73
8	16-Dec-10	4773.53	35	9	25-Jan-11	11500.01	84
February 2011				March 2011			
10	9-Feb-11	12967.40	95	11	10-Mar-11	12025.00	88
				12	15-Mar-11	11249.20	83
April 2011				May 2011			
13	13-Apr-11	9412.99	69	14	20-May-11	8613.55	63
June 2011							
15	09-Jun-11	3644.13	27				
16	16-Jun-05	2983.88	22				

Snow cover depletion curve

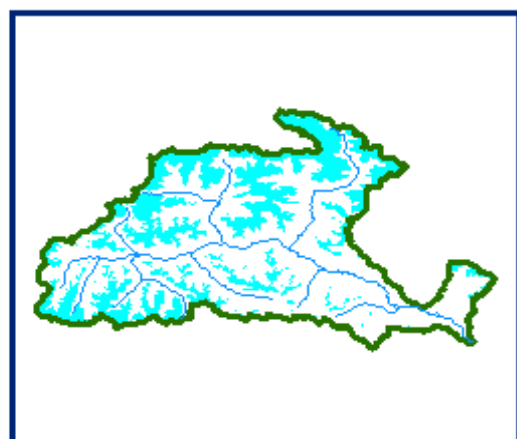


Snow cover depletion curve

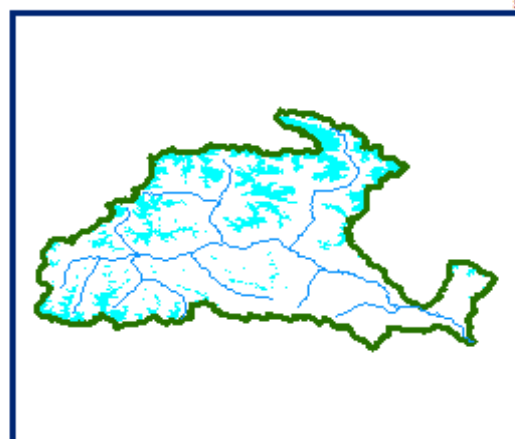


SNOW COVER MAP

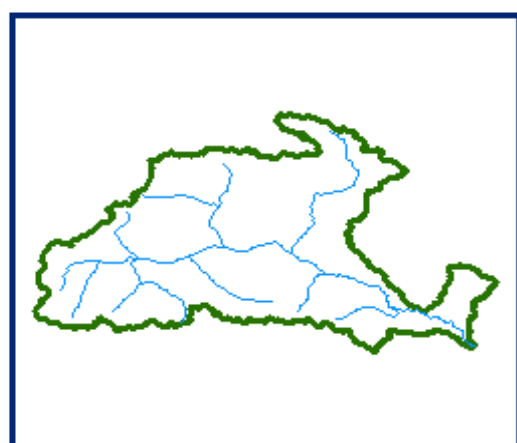
SNOW COVER MAP : GILGIT BASIN



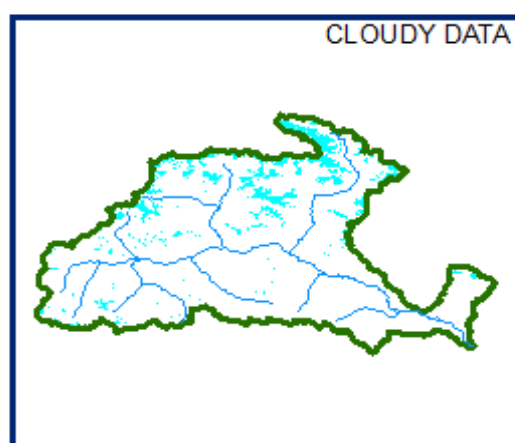
02 OCTOBER 2010



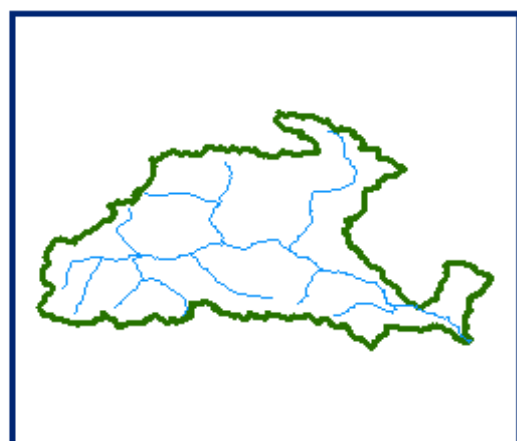
07 OCTOBER 2010



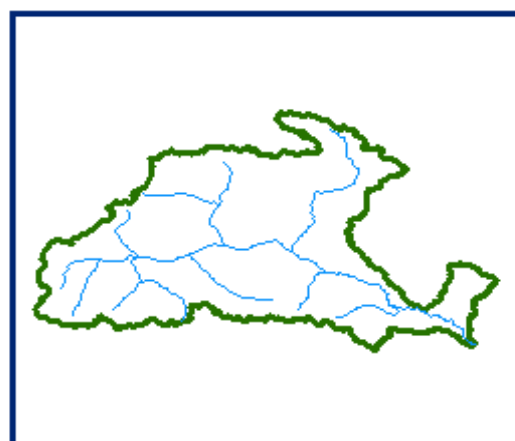
DATA NOT AVAILABLE



**17 OCTOBER 2010
07 OCTOBER 2010**



DATA NOT AVAILABLE

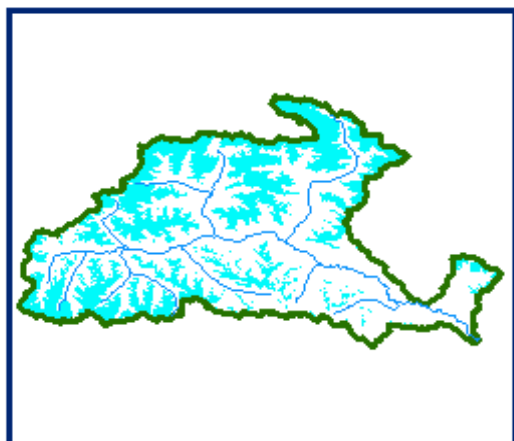


DATA NOT AVAILABLE

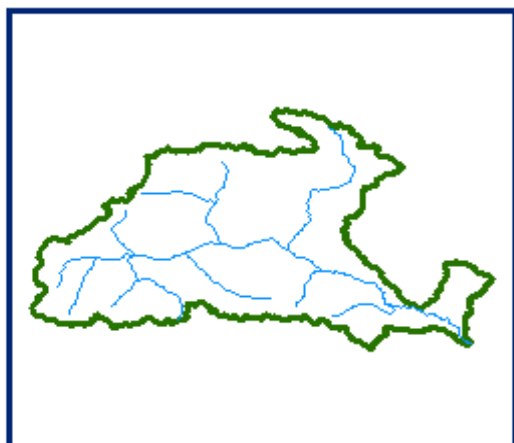
 SNOW

0 30 60 120 180 240
Kilometers

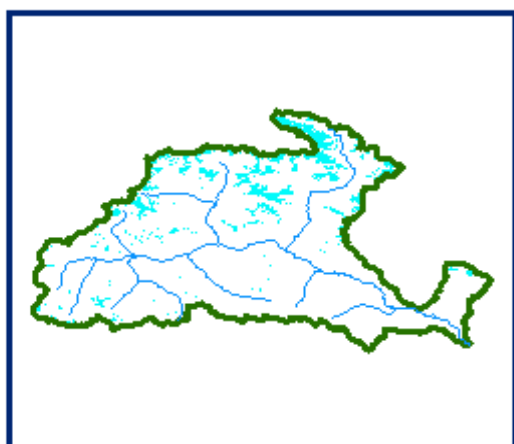
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
02 OCTOBER 2010
07 OCTOBER 2010



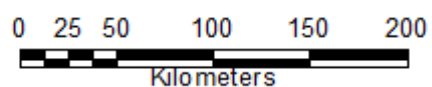
DATA USED
DATA NOT AVAILABLE



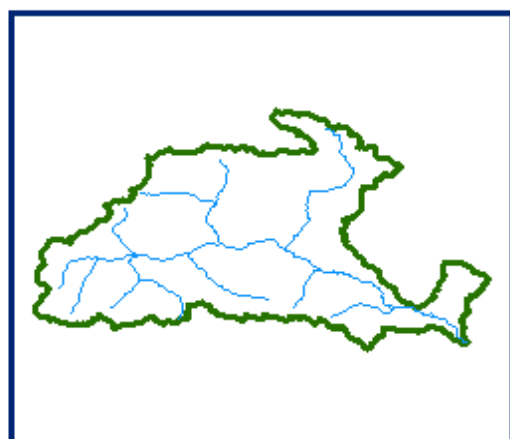
DATA USED
17 OCTOBER 2010



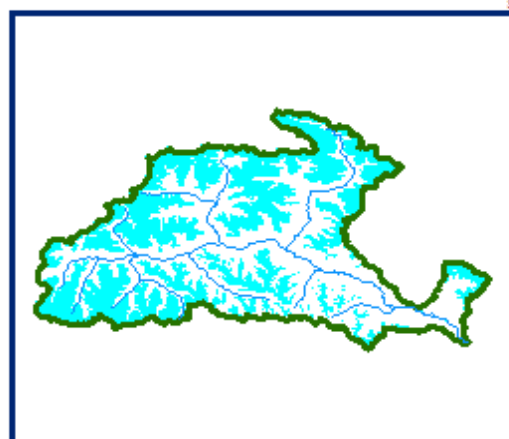
SNOW



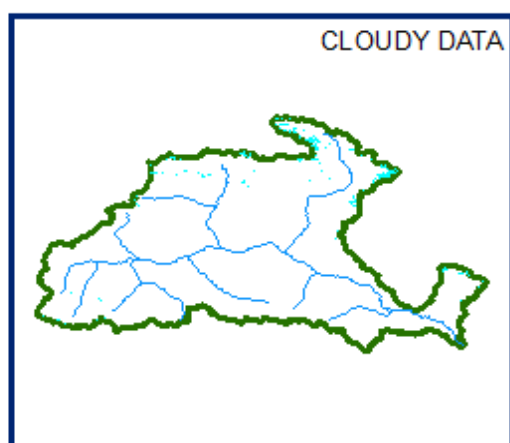
SNOW COVER MAP : GILGIT BASIN



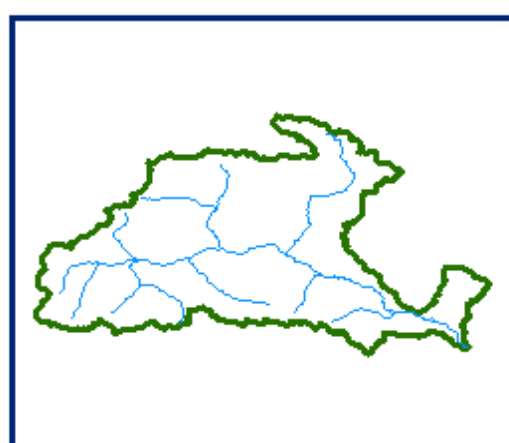
DATA NOT AVAILABLE



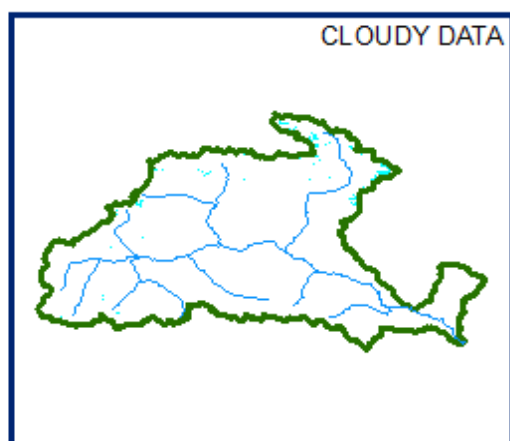
10 NOVEMBER 2010



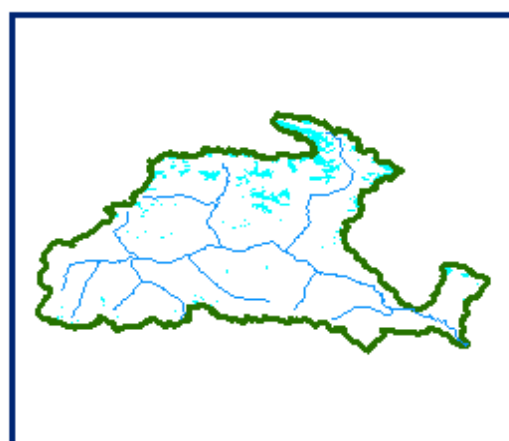
15 NOVEMBER 2010



DATA NOT AVAILABLE



24 NOVEMBER 2010
15 NOVEMBER 2010

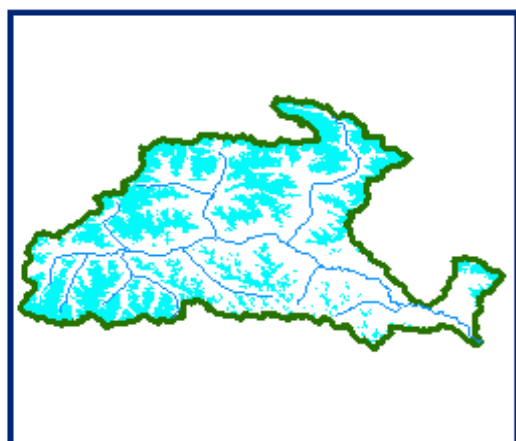


29 NOVEMBER 2010

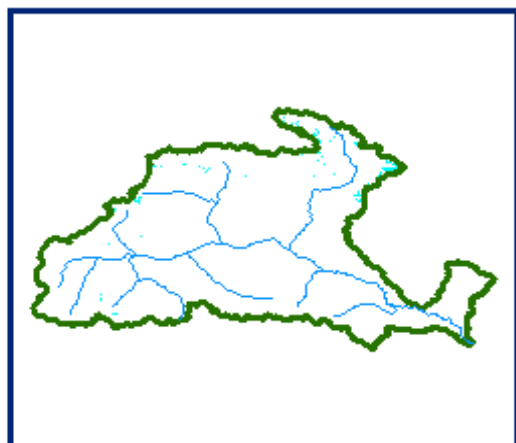
 SNOW

0 30 60 120 180 240
Kilometers

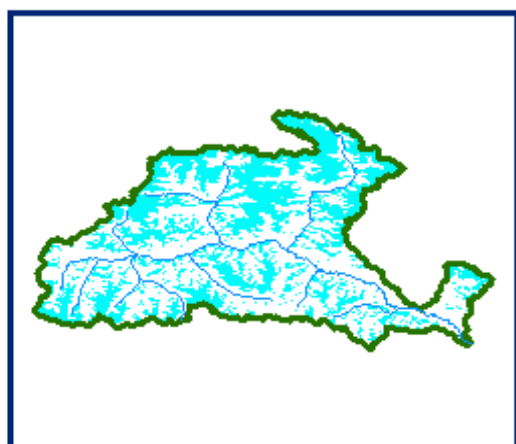
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
10 NOVEMBER 2010



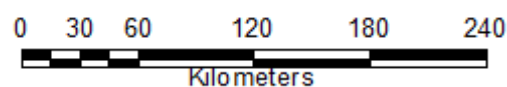
DATA USED
15 NOVEMBER 2010



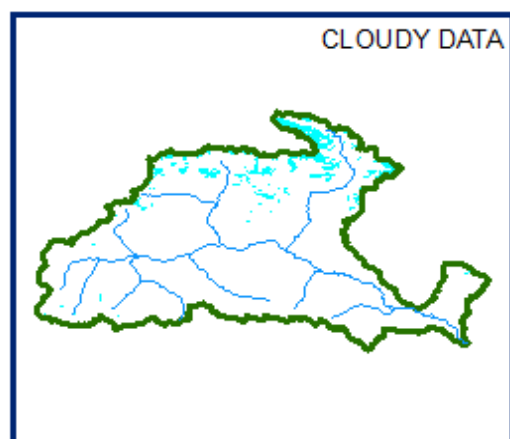
DATA USED
24 NOVEMBER 2010
29 NOVEMBER 2010



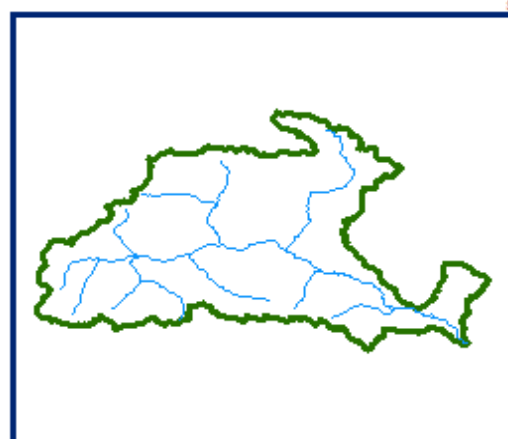
SNOW



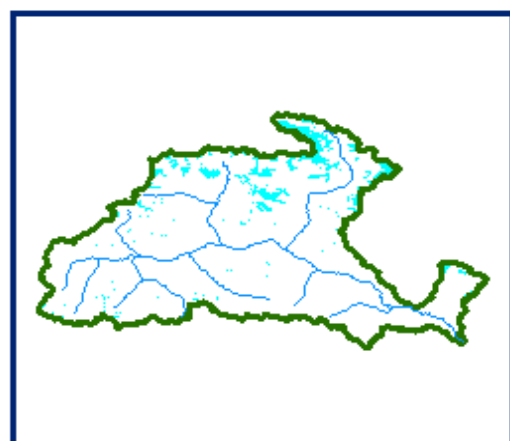
SNOW COVER MAP : GILGIT BASIN



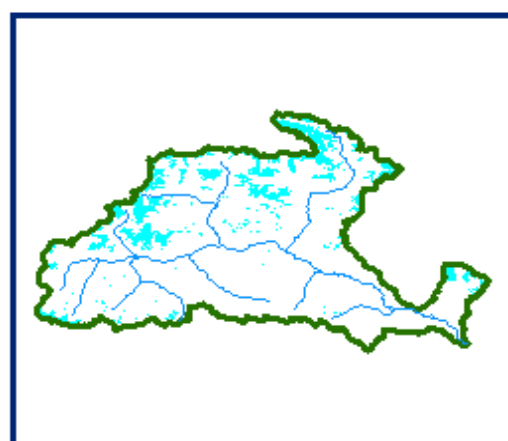
04 DECEMBER 2010



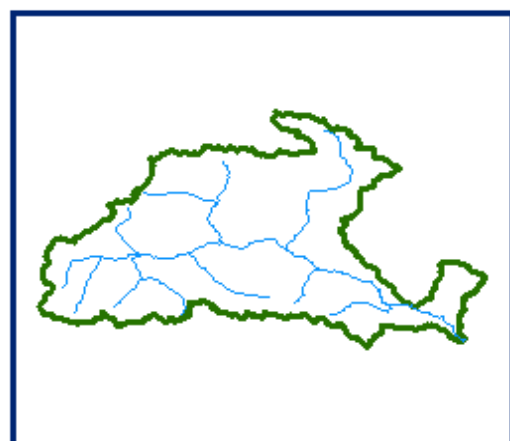
DATA NOT AVAILABLE



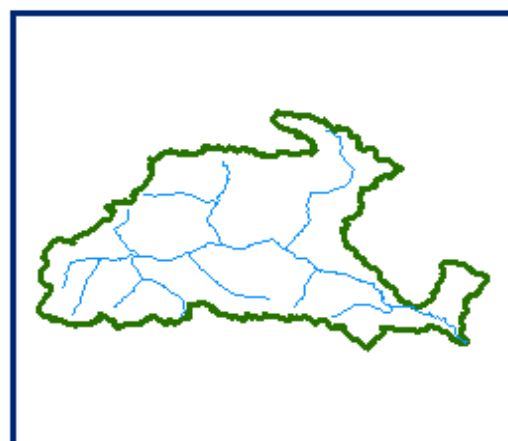
14 DECEMBER 2010



18 DECEMBER 2010



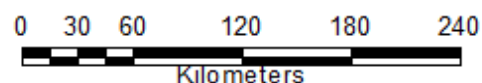
DATA NOT AVAILABLE



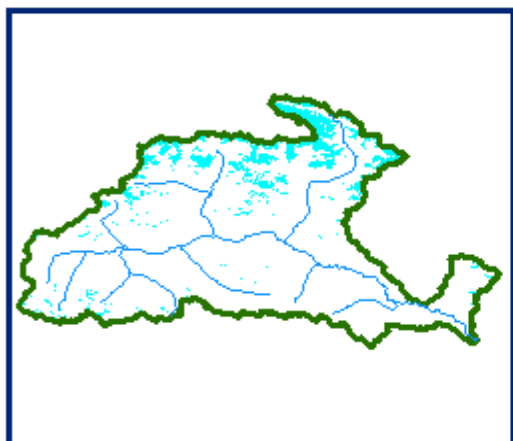
DATA NOT AVAILABLE



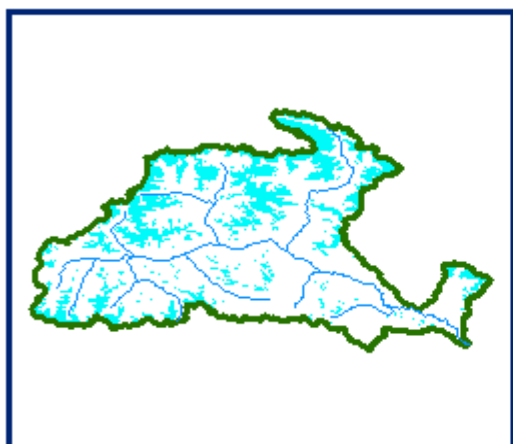
SNOW



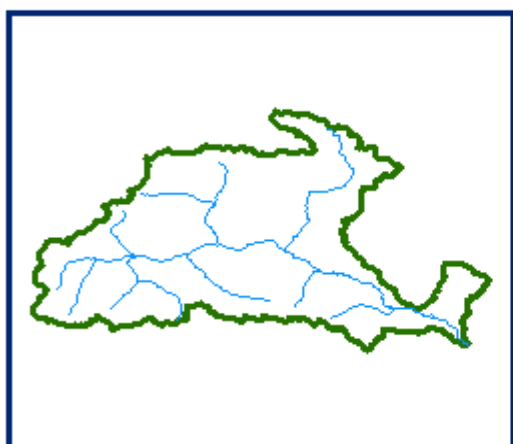
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
04 DECEMBER 2010



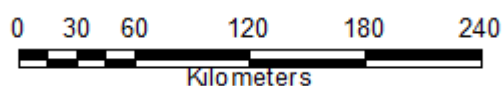
DATA USED
14 DECEMBER 2010
19 DECEMBER 2010



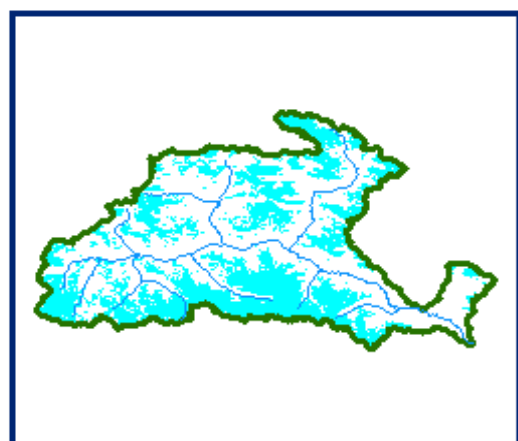
DATA USED
DATA NOT AVAILABLE



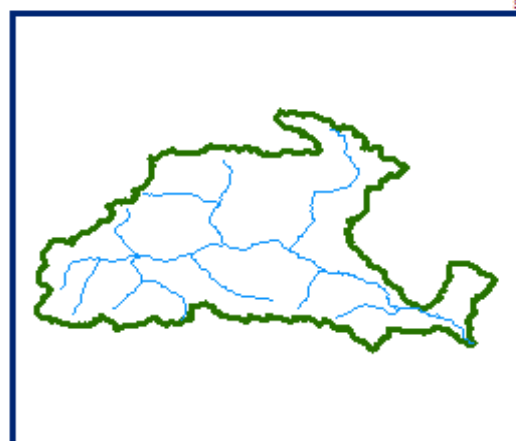
SNOW



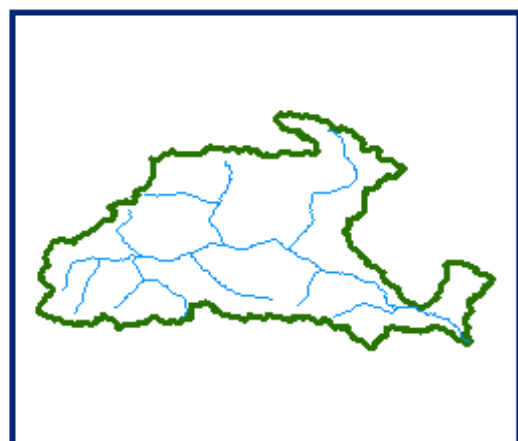
SNOW COVER MAP : GILGIT BASIN



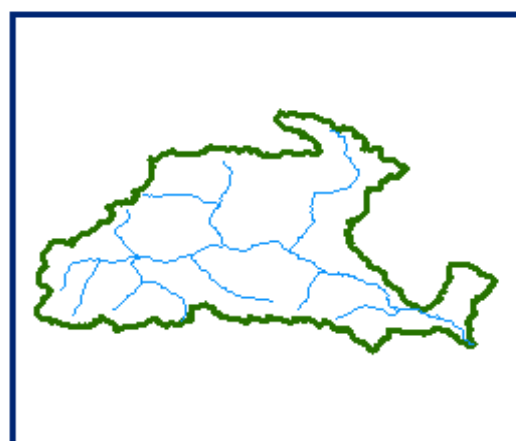
02 JANUARY 2011



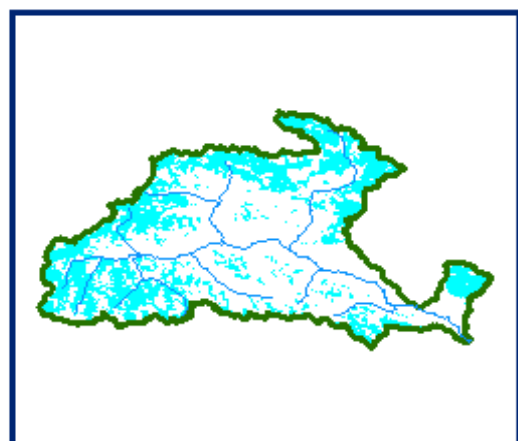
DATA NOT AVAILABLE



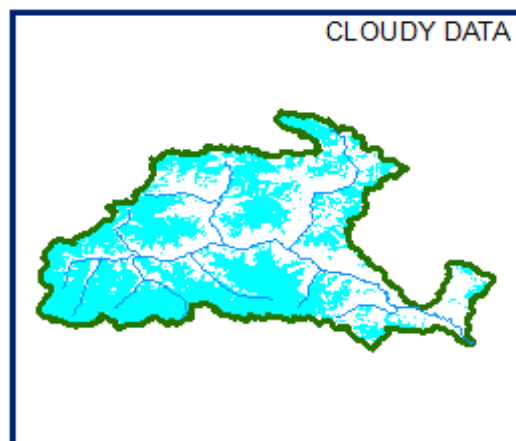
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 JANUARY 2011

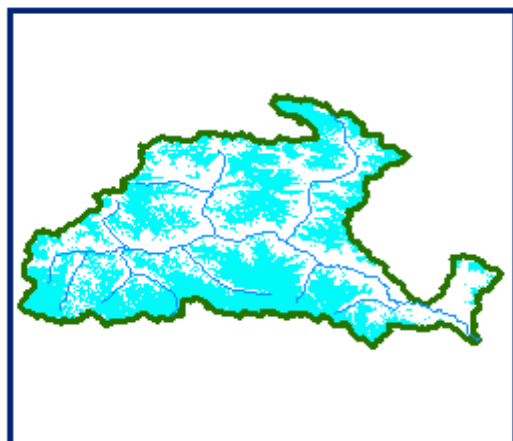


30 JANUARY 2011

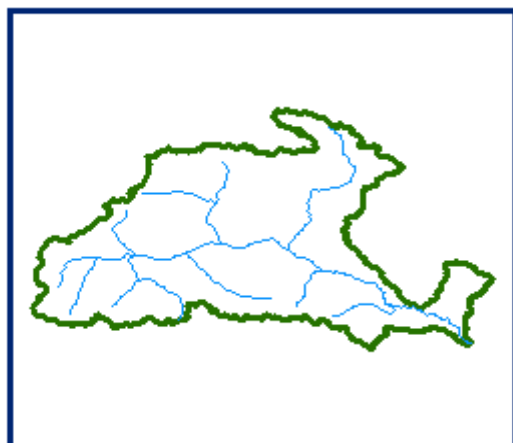
 SNOW

0 30 60 120 180 240
Kilometers

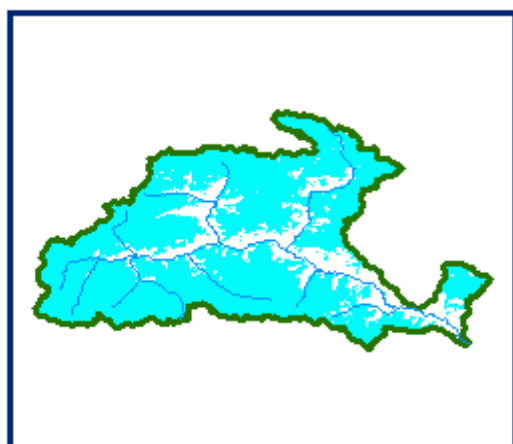
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
02 JANUARY 2011



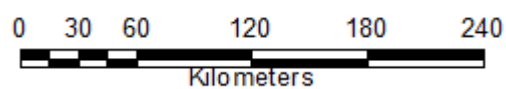
DATA USED
DATA NOT AVAILABLE



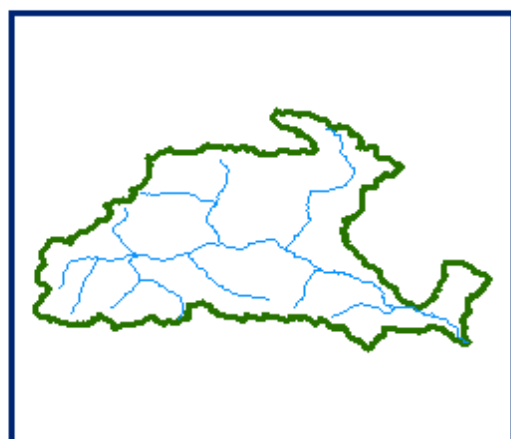
DATA USED
21 JANUARY 2011
30 JANUARY 2011



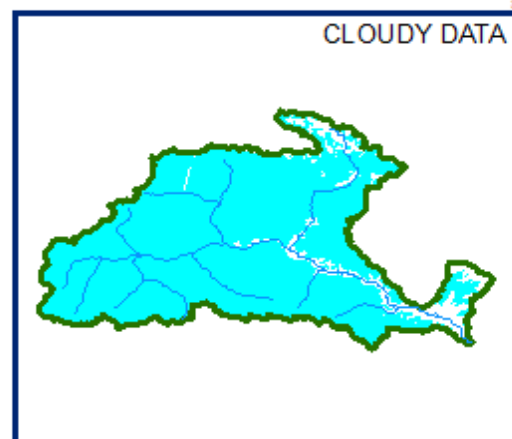
SNOW



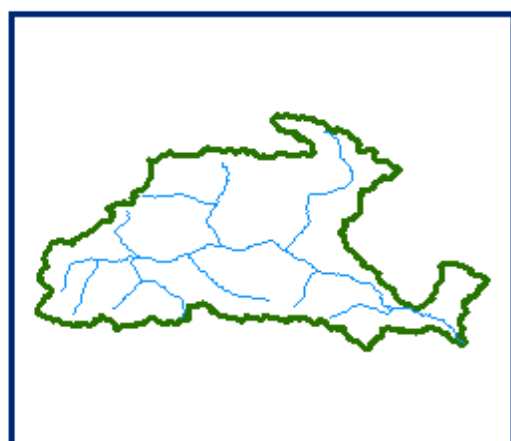
SNOW COVER MAP : GILGIT BASIN



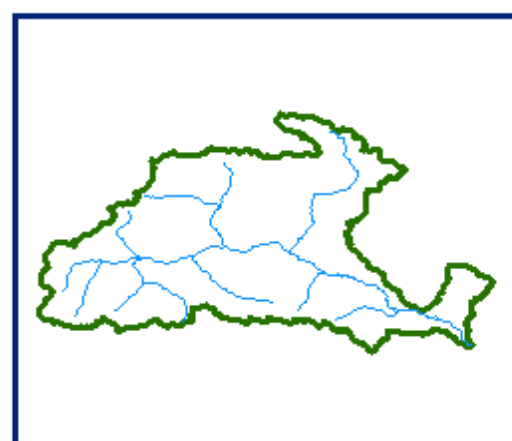
DATA NOT AVAILABLE



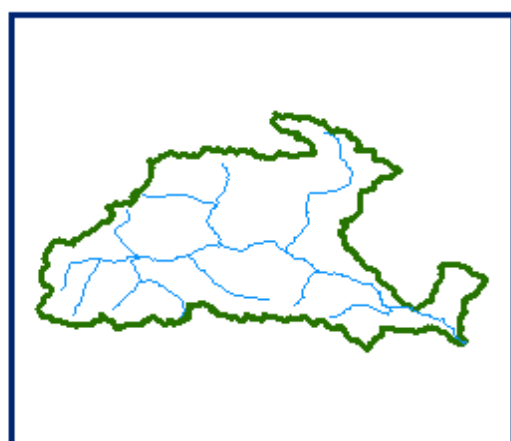
09 FEBRUARY 2011



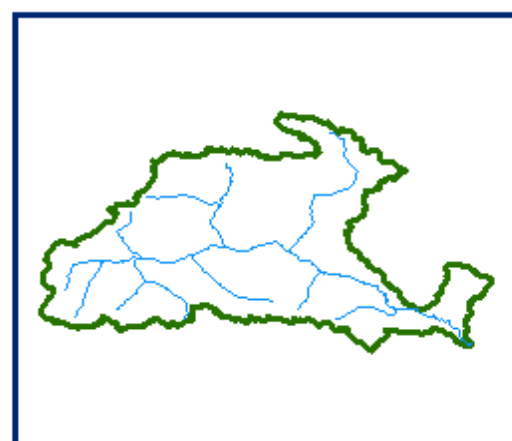
DATA NOT AVAILABLE



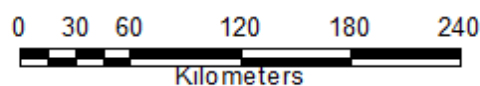
DATA NOT AVAILABLE



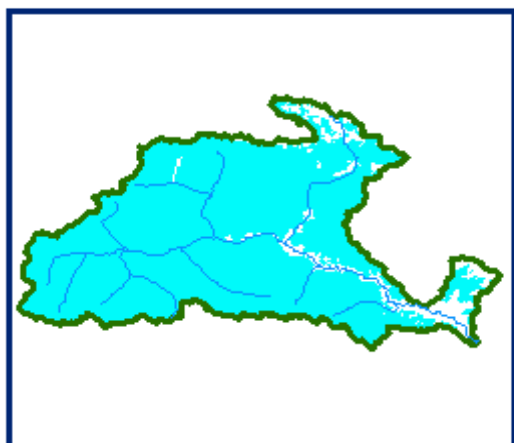
DATA NOT AVAILABLE



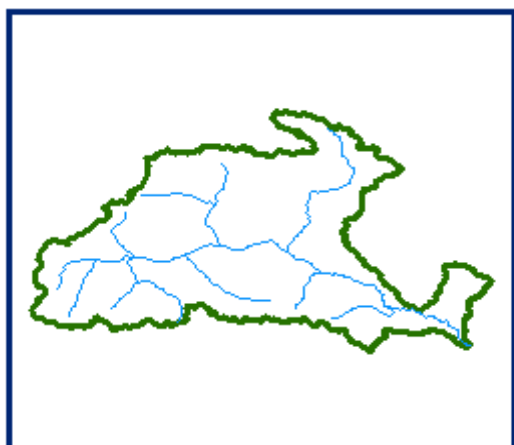
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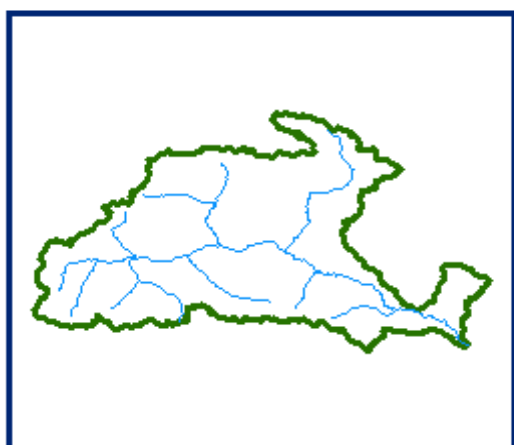
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
09 FEBRUARY 2011



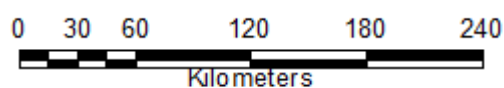
DATA USED
DATA NOT AVAILABLE



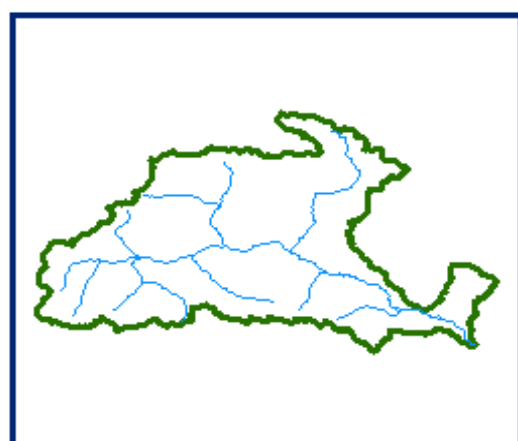
DATA USED
DATA NOT AVAILABLE



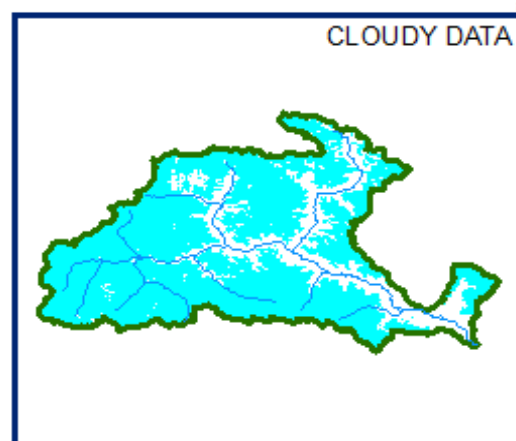
SNOW



SNOW COVER MAP : GILGIT BASIN

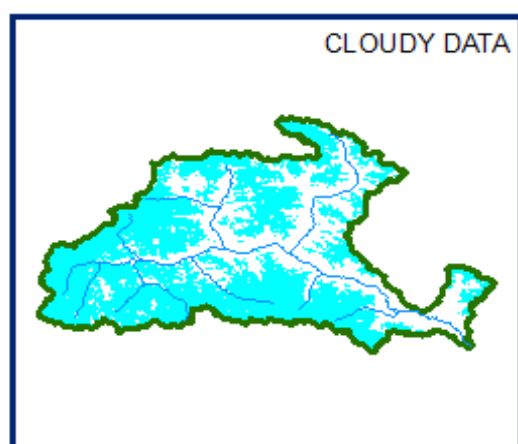


DATA NOT AVAILABLE



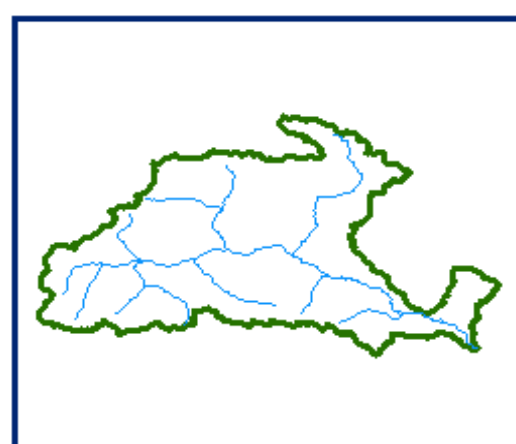
CLOUDY DATA

**10 MARCH 2011
13 APRIL 2011**

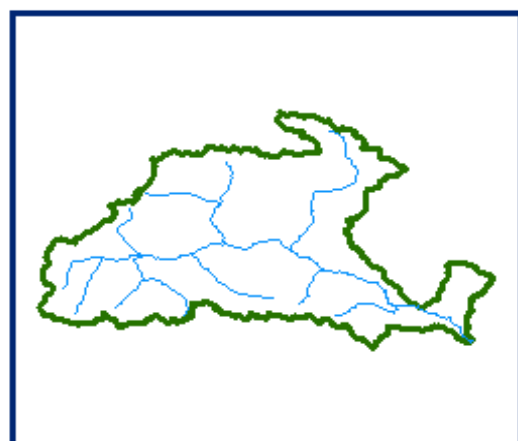


CLOUDY DATA

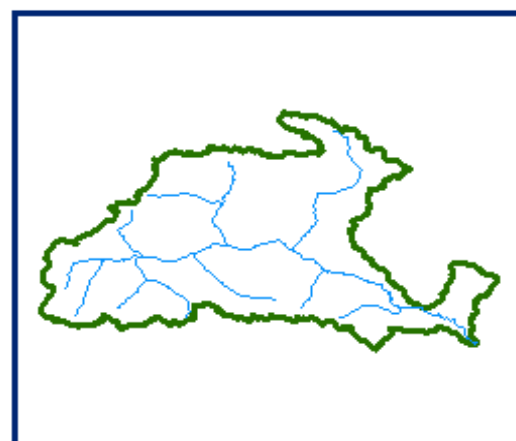
**15 MARCH 2011
13 APRIL 2011**



DATA NOT AVAILABLE



DATA NOT AVAILABLE

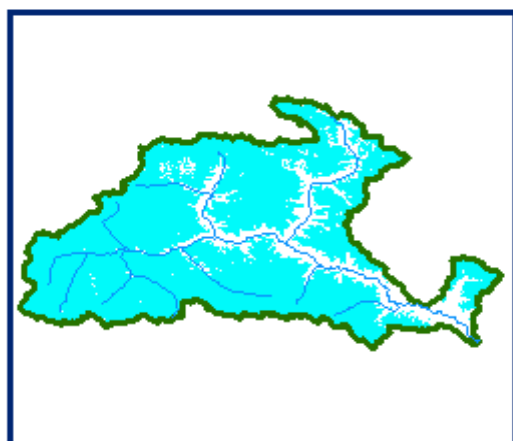


DATA NOT AVAILABLE

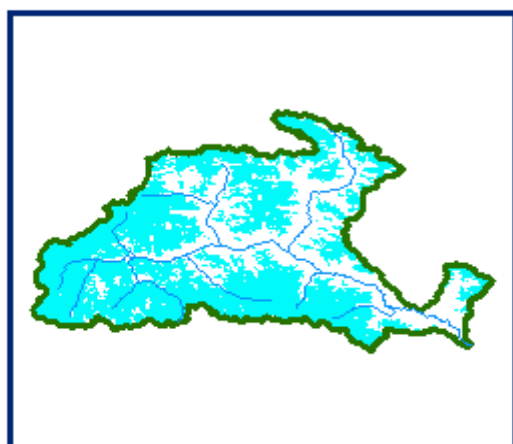
 SNOW

0 30 60 120 180 240
Kilometers

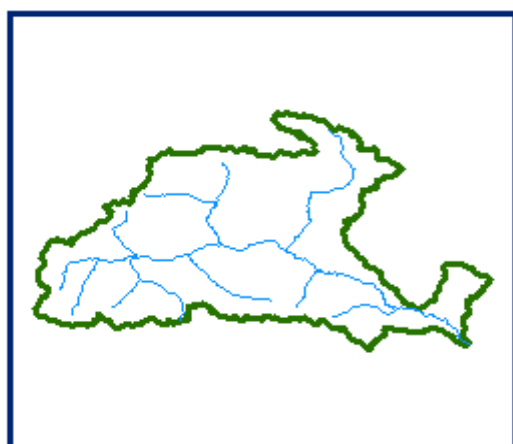
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
10 MARCH 2011



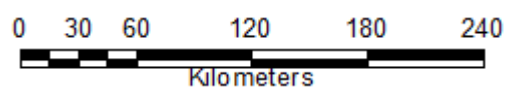
DATA USED
15 MARCH 2011



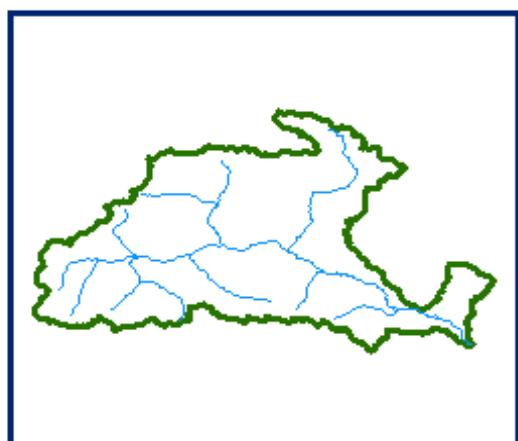
DATA USED
DATA NOT AVAILABLE



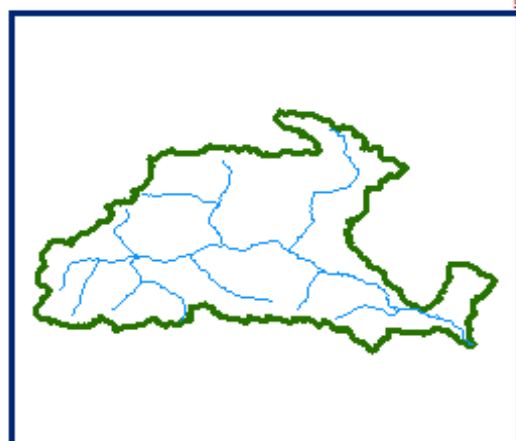
SNOW



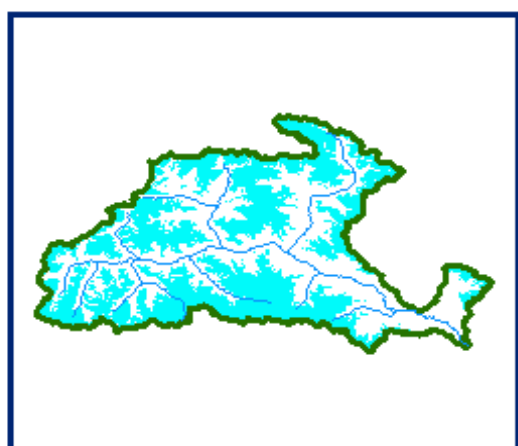
SNOW COVER MAP : GILGIT BASIN



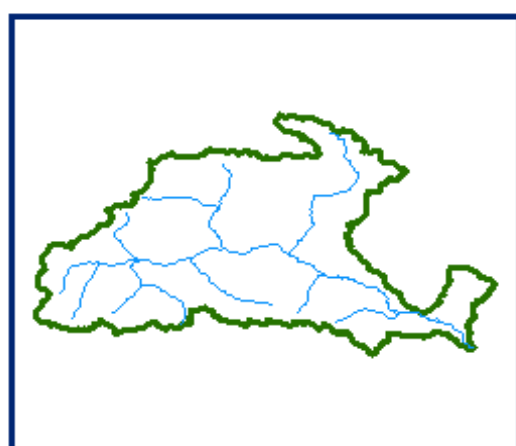
DATA NOT AVAILABLE



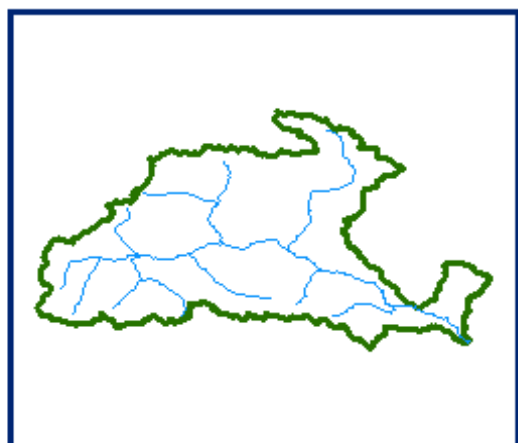
DATA NOT AVAILABLE



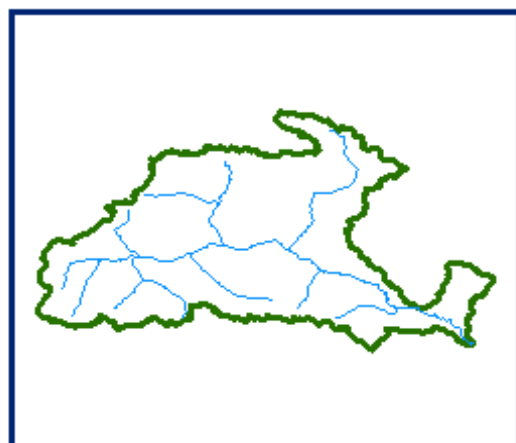
13 APRIL 2011
20 MAY 2011



DATA NOT AVAILABLE



DATA NOT AVAILABLE

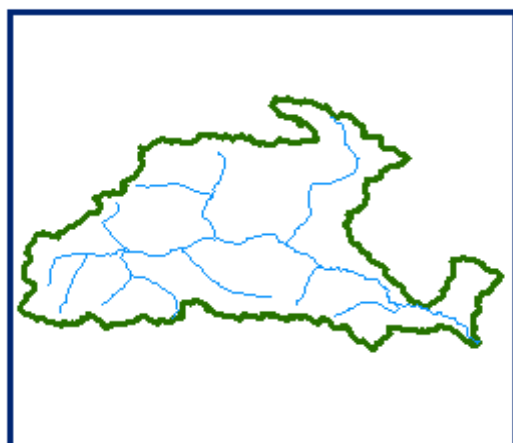


DATA NOT AVAILABLE

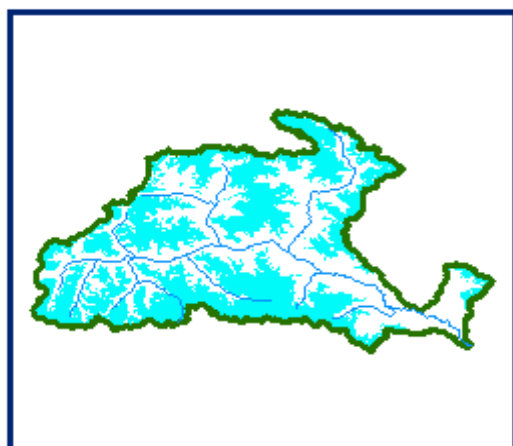
 SNOW

0 30 60 120 180 240
Kilometers

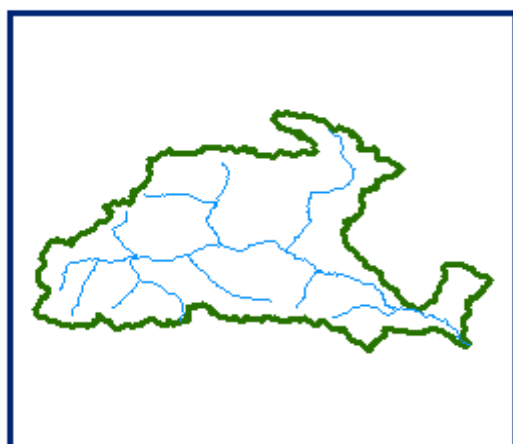
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
DATA NOT AVAILABLE



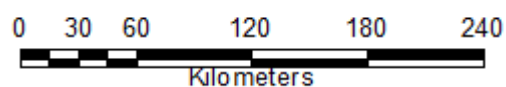
DATA USED
13 APRIL 2011



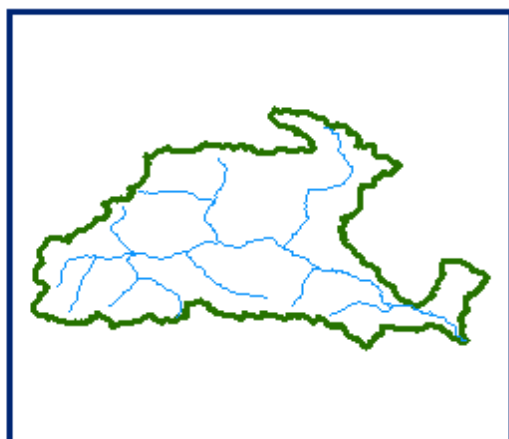
DATA USED
DATA NOT AVAILABLE



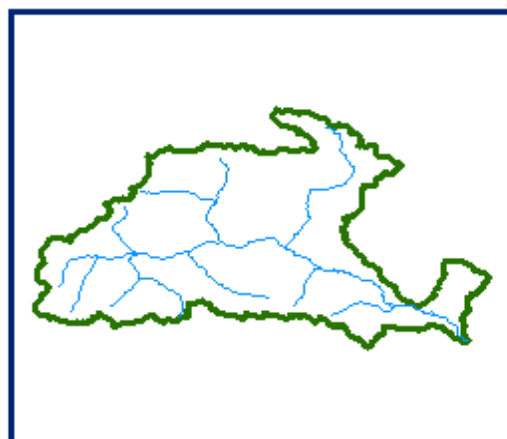
SNOW



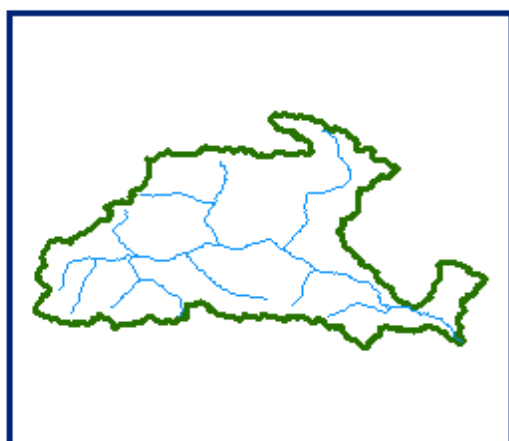
SNOW COVER MAP : GILGIT BASIN



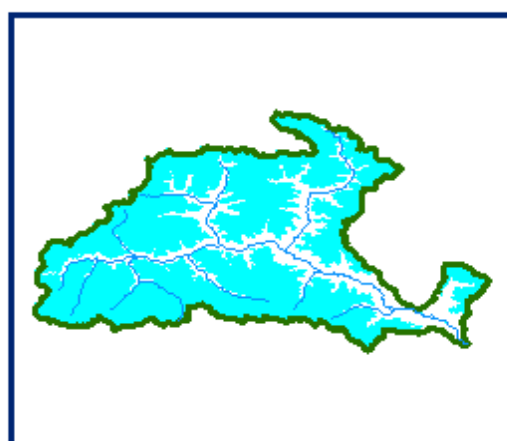
DATA NOT AVAILABLE



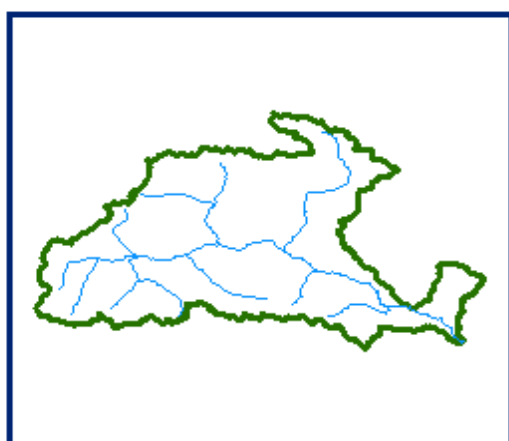
DATA NOT AVAILABLE



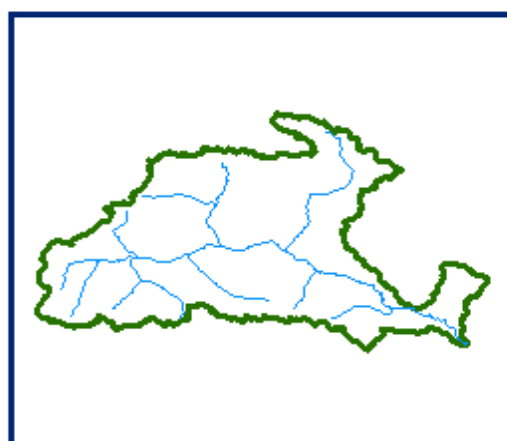
DATA NOT AVAILABLE



20 MAY 2011



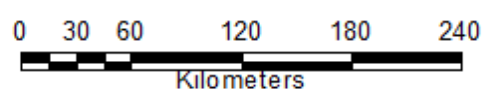
DATA NOT AVAILABLE



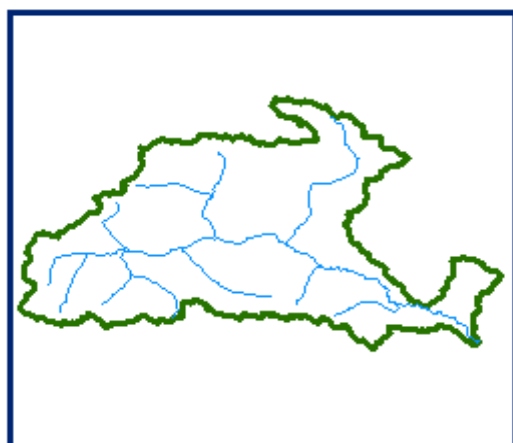
DATA NOT AVAILABLE



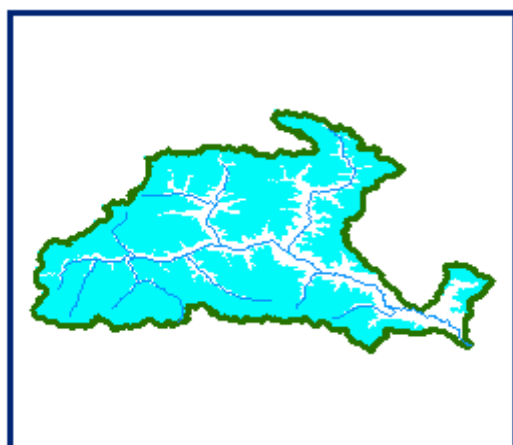
SNOW



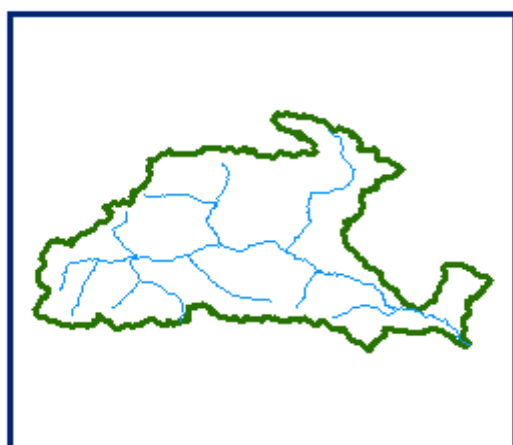
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
DATA NOT AVAILABLE



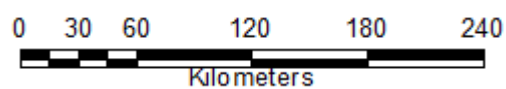
DATA USED
20 MAY 2011



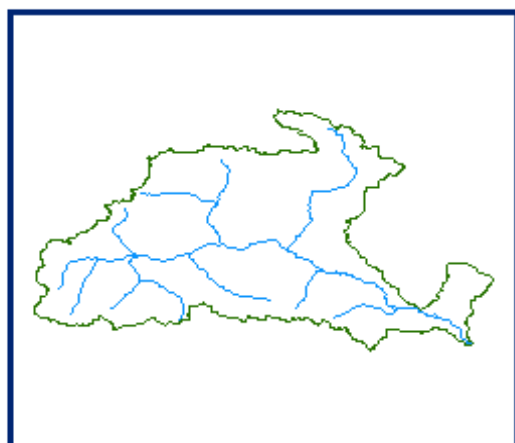
DATA USED
DATA NOT AVAILABLE



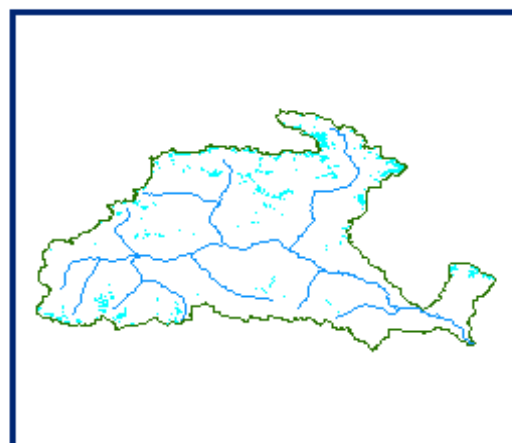
SNOW



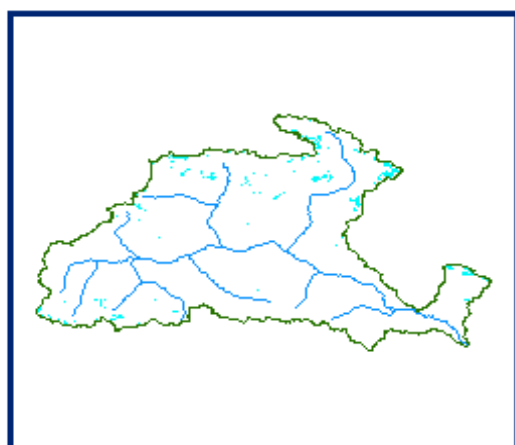
SNOW COVER MAP : GILGIT BASIN



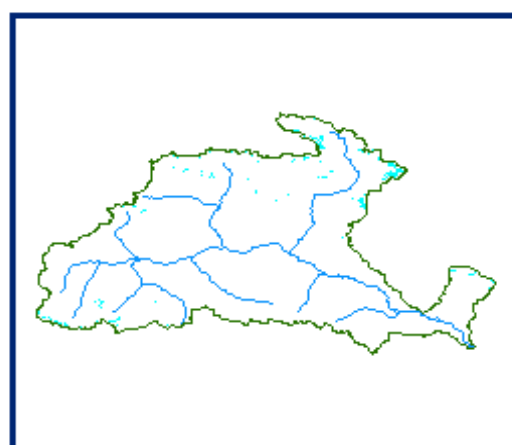
DATA NOT AVAILABLE



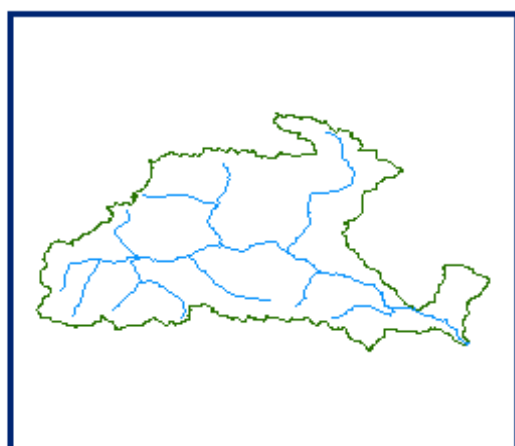
09 JUNE 2011



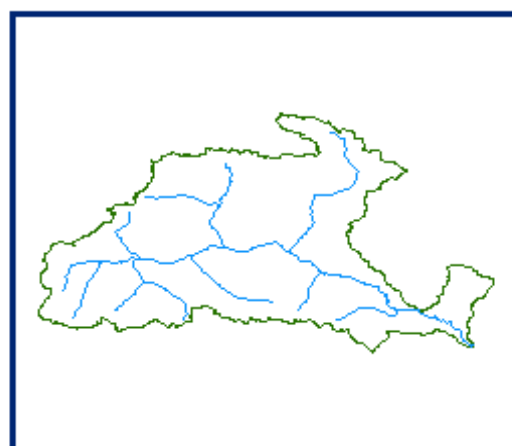
**14 JUNE 2011
19 JUNE 2011**



19 JUNE 2011



DATA NOT AVAILABLE

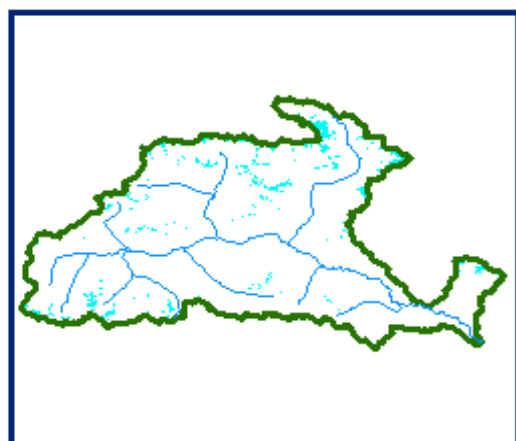


DATA NOT AVAILABLE

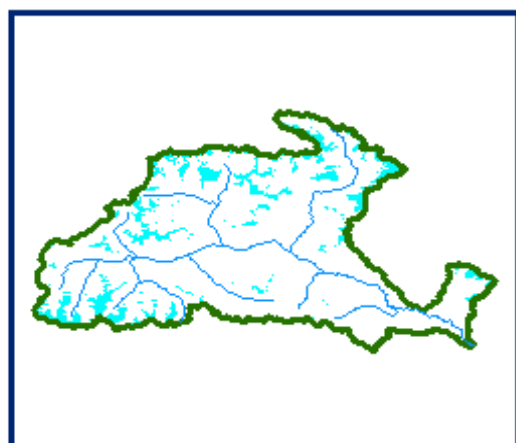
 SNOW

0 30 60 120 180 240
Kilometers

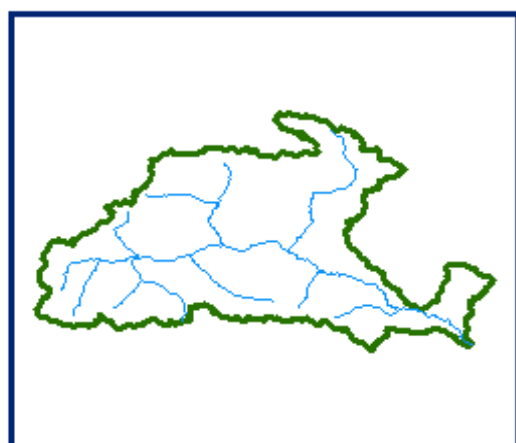
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA USED
09 JUNE 2011



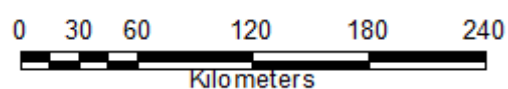
DATA USED
14 JUNE 2011
19 JUNE 2011



DATA USED
DATA NOT AVAILABLE



SNOW



SHASGAN BASIN

AREAL EXTENT OF SNOW (5 DAILY)

BASIN NAME: SHASGAN

BASIN AREA: 7613 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2010							
1	3-Oct-10	3353.27	44	2	8-Oct-10	2831.86	37
November 2010							
3	6-Nov-10	4365.01	57	5	15-Nov-10	4026.54	53
4	10-Nov-10	4350.82	57	6	29-Nov-10	4026.70	53
December 2010							
7	14-Dec-10	3480.03	46	8	19-Dec-10	3593.29	47
January 2011							
9	2-Jan-11	6100.55	80	10	12-Jan-11	3886.70	51
11	21-Jan-11	3074.92	40				
February 2011							
12	10-Feb-11	5092.80	67				
March 2011							
13	25-Mar-11	5950.01	78				
April 2011							
14	13-Apr-11	5617.90	74	15	23-Apr-11	5198.69	68
May 2011							
16	12-May-11	3709.20	49	17	17-May-11	3460.55	45
18	20-May-11	4405.90	58				
June 2011							
19	9-Jun-11	3286.97	43	20	10-Jun-11	3117.53	41
21	19-Jun-11	3552.91	47				

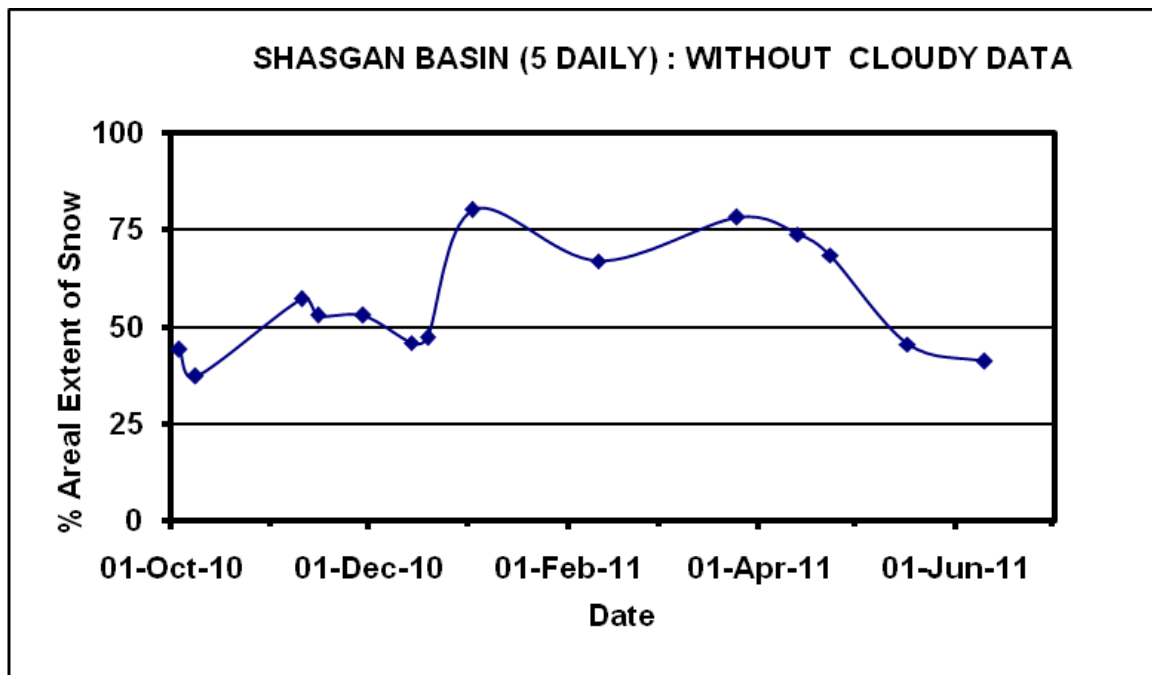
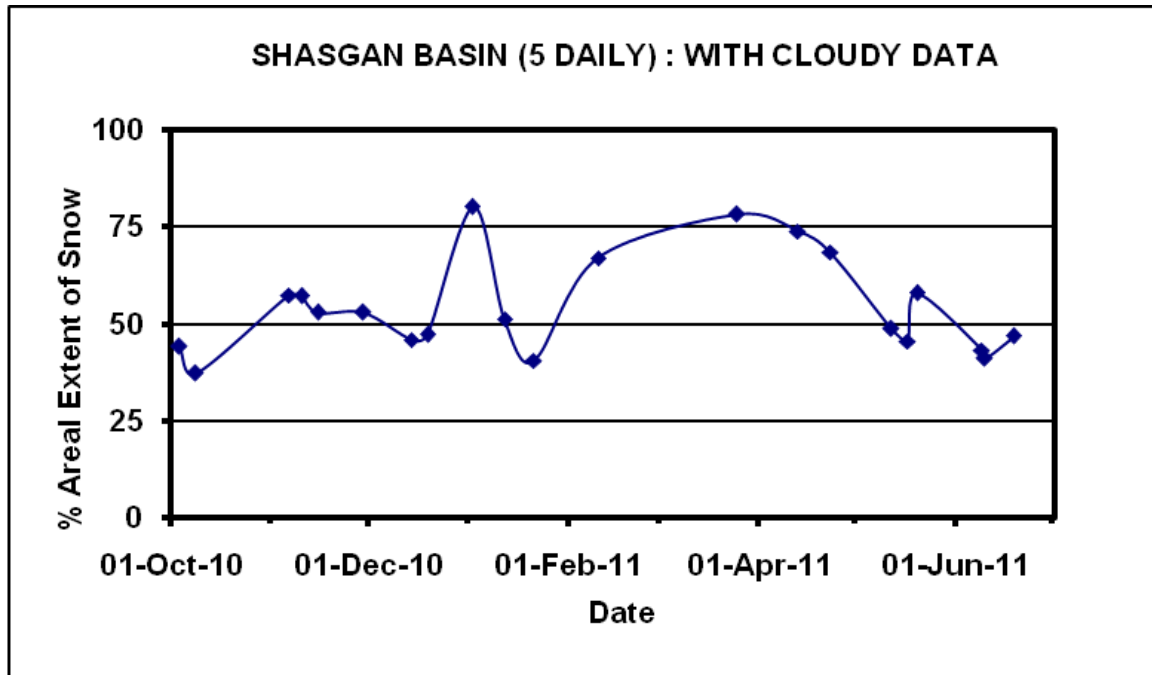
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHASGAN

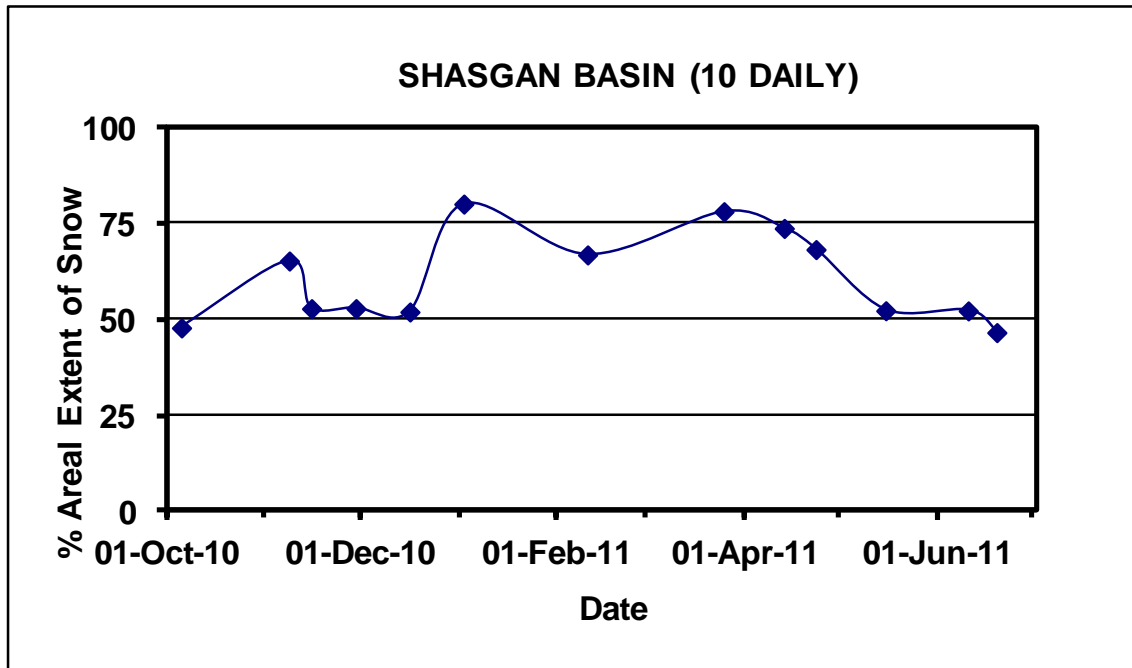
BASIN AREA: 7613 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq. km)	Snow cover (%)
October 2010				November 2010			
1	5-Oct-10	3645.35	48	2	8-Nov-10	4971.72	65
				3	15-Nov-10	4026.54	53
				4	29-Nov-10	4026.70	53
December 2010				January 2011			
5	16-Dec-10	3961.27	52	6	2-Jan-11	6100.55	80
				7	12-Jan-11	3886.70	51
				8	21-Jan-11	3074.92	40
February 2011				March 2011			
9	10-Feb-11	5092.80	67	10	25-Mar-11	5950.01	78
April 2011				May 2011			
11	13-Apr-11	5617.90	74	13	15-May-11	3985.80	52
12	23-Apr-11	5198.69	68				
June 2011							
14	10-Jun-11	3982.58	52				
15	19-Jun-11	3552.91	47				

Snow cover depletion curve



Snow cover depletion curve

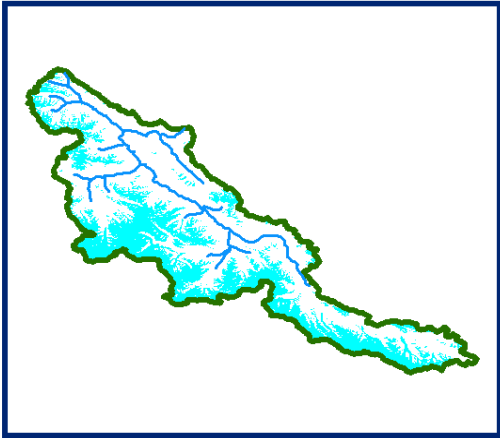


SNOW COVER MAP

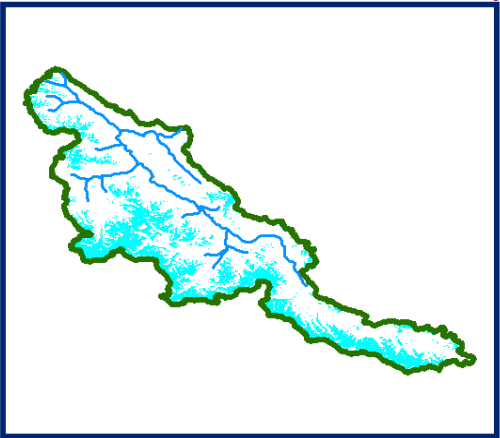
SNOW COVER MAP

:

SHASGAN BASIN



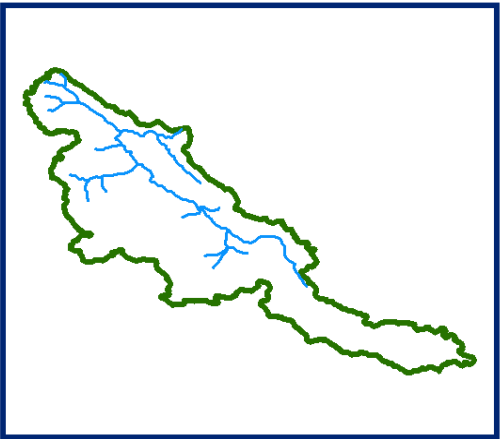
3 OCTOBER 2010



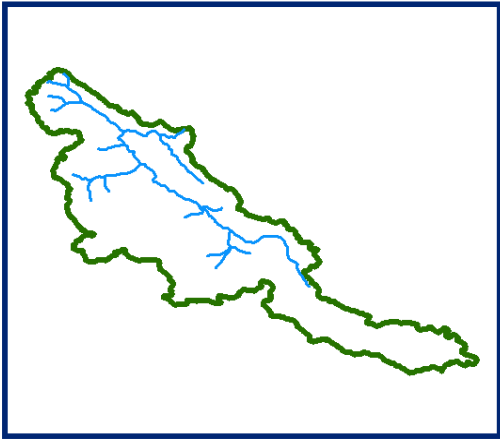
8 OCTOBER 2010



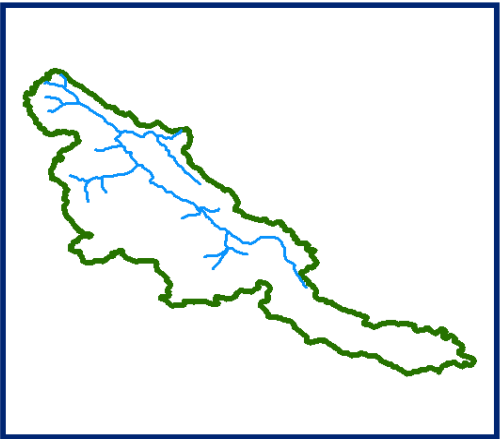
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



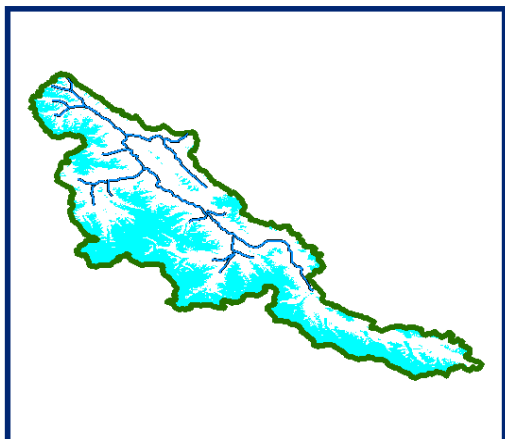
DATA NOT AVAILABLE



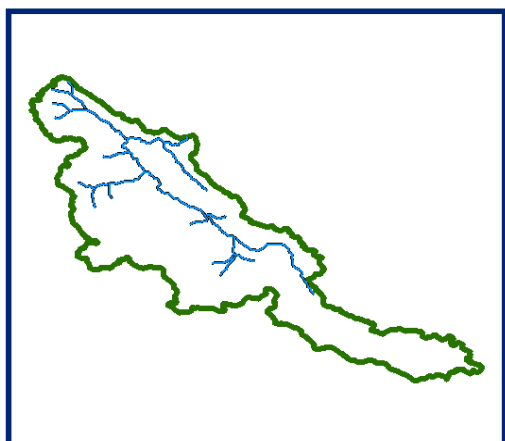
SNOW

0 1530 60 90 120

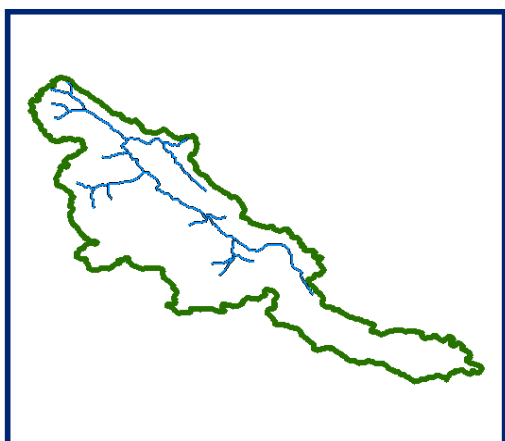
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
3 OCTOBER 2010
8 OCTOBER 2010



DATA USED
DATA NOT AVAILABLE



DATA USED
DATA NOT AVAILABLE



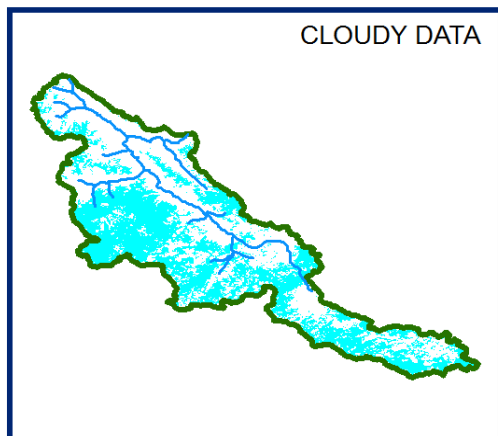
SNOW

0 15 30 60 90 120

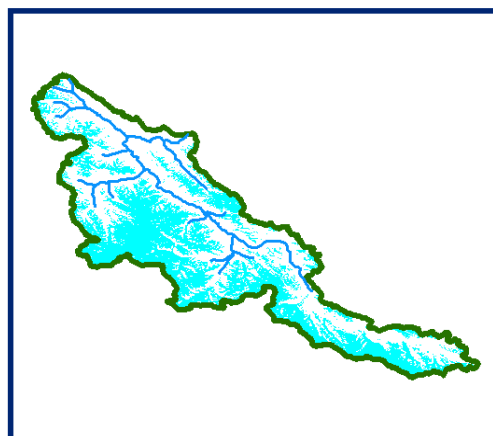
SNOW COVER MAP

:

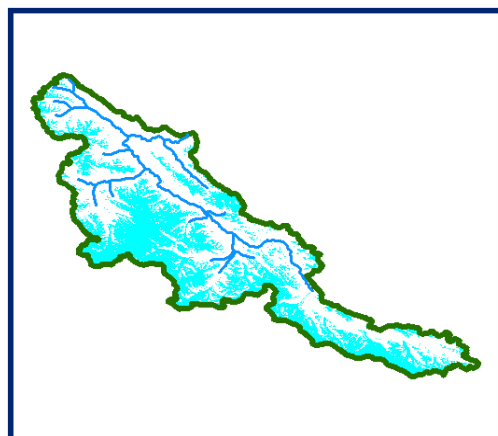
SHASGAN BASIN



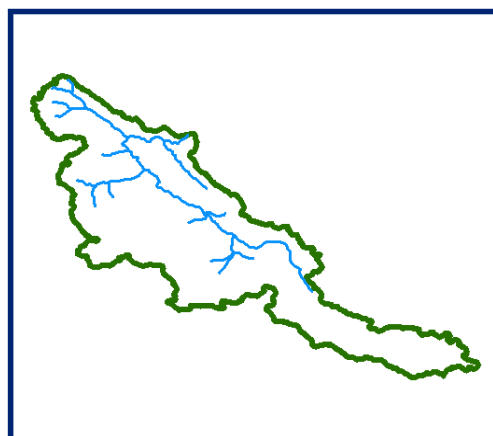
6 NOVEMBER 2010



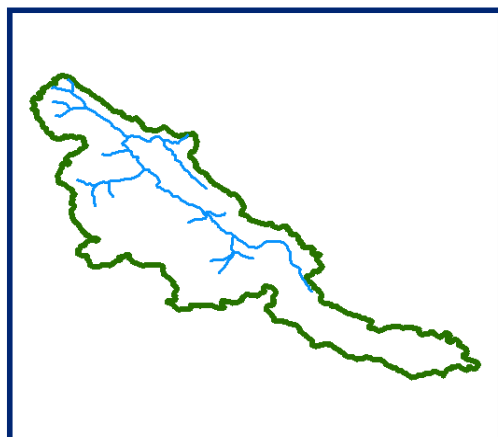
10 NOVEMBER 2010



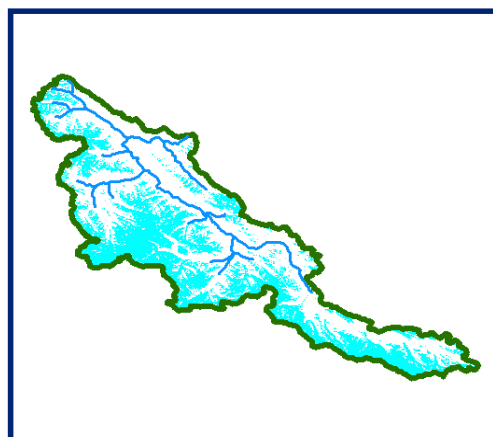
15 NOVEMBER 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE



29 NOVEMBER 2010

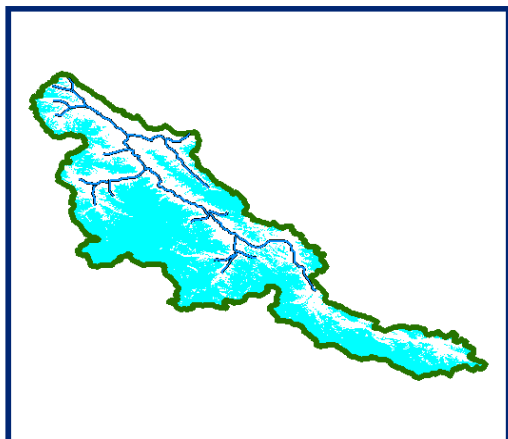


SNOW

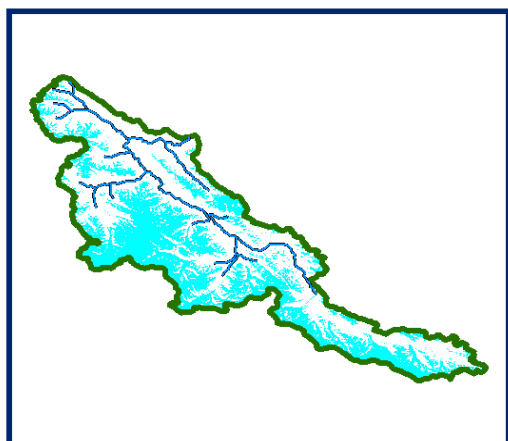
0 1530 60 90 120



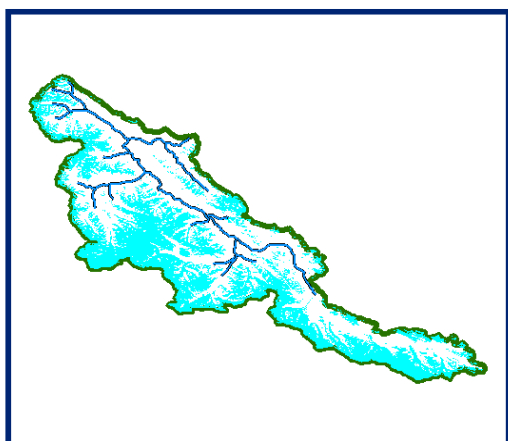
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
6 NOVEMBER 2010
10 NOVEMBER 2010



DATA USED
15 NOVEMBER 2010

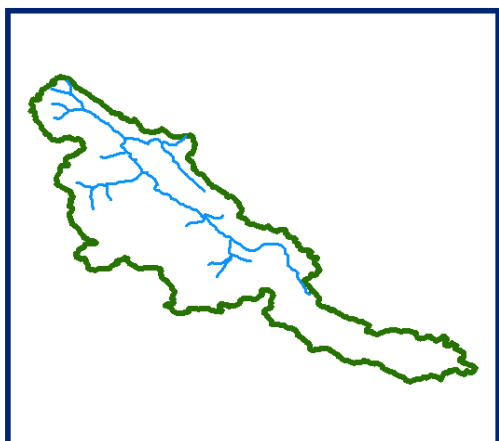


DATA USED
29 NOVEMBER 2010

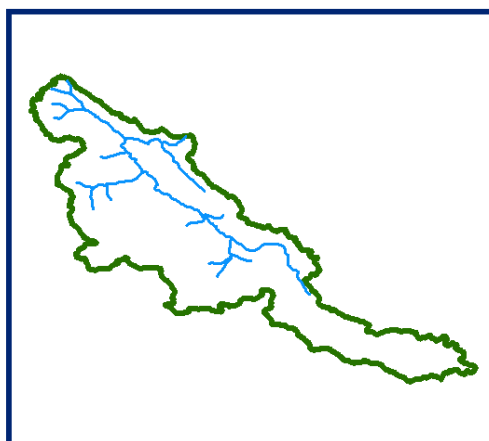
0 15 30 60 90 120

SNOW

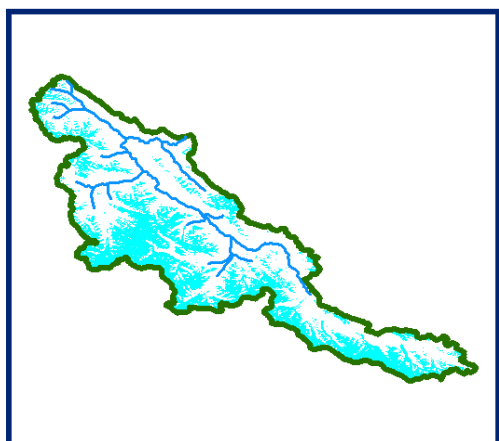
SNOW COVER MAP : SHASGAN BASIN



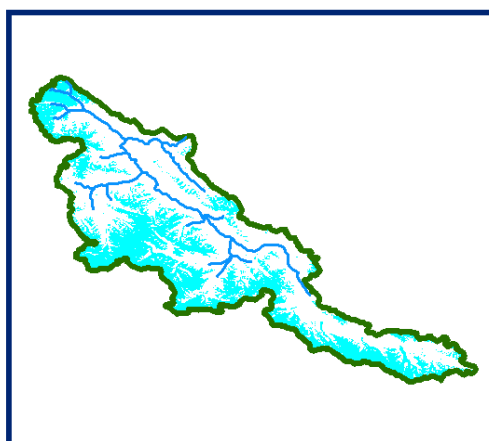
DATA NOT AVAILABLE



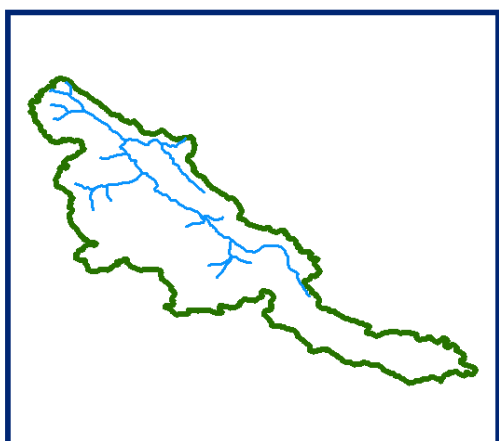
DATA NOT AVAILABLE



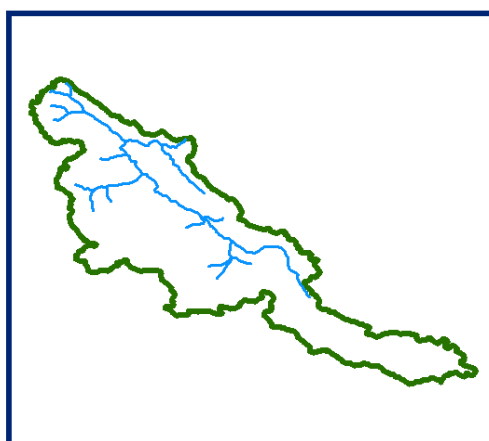
14 DECEMBER 2010



19 DECEMBER 2010



DATA NOT AVAILABLE



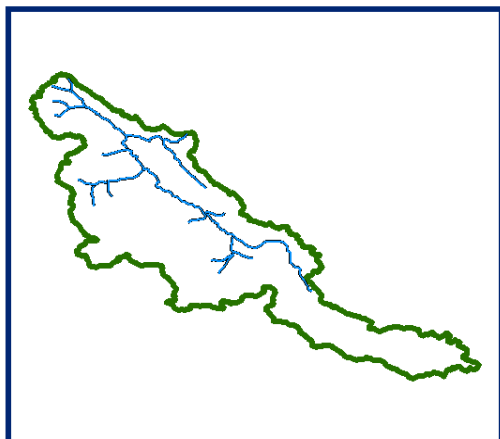
DATA NOT AVAILABLE



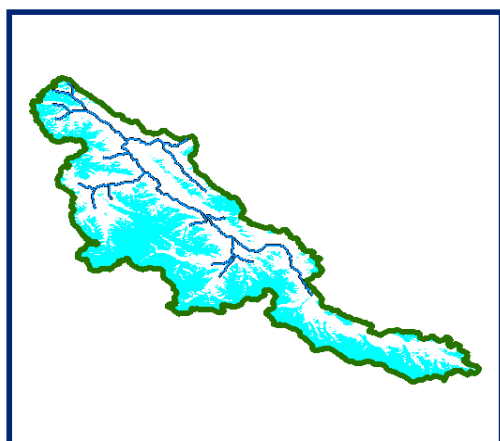
SNOW

0 1530 60 90 120

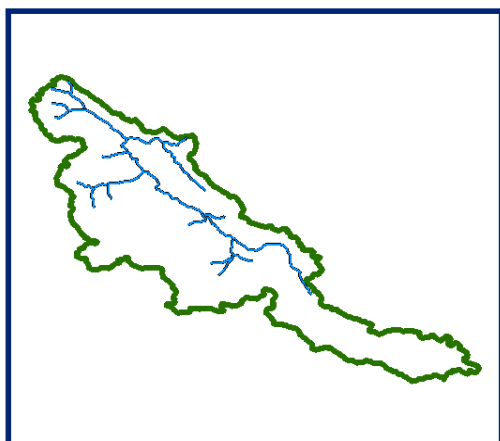
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
DATA NOT AVAILABLE



DATA USED
14 DECEMBER 2010
19 DECEMBER 2010



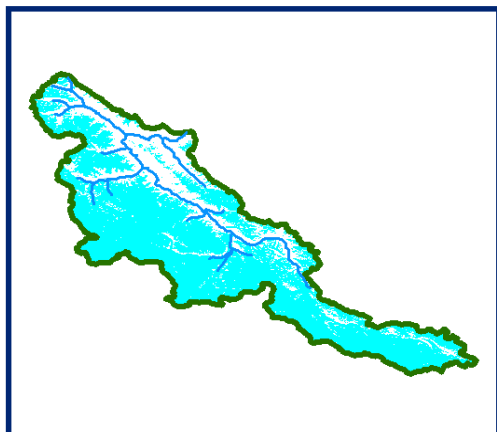
DATA USED
DATA NOT AVAILABLE



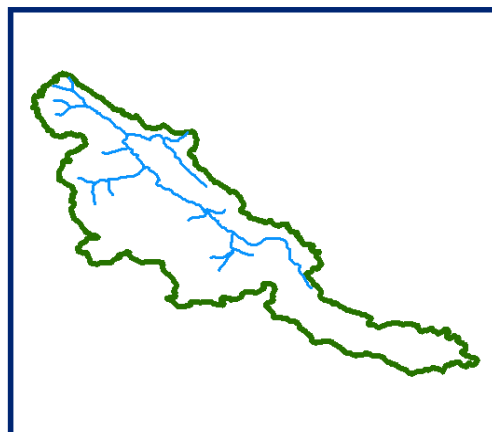
SNOW

0 1530 60 90 120

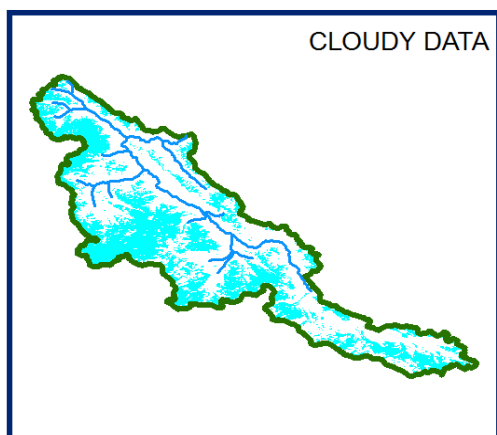
SNOW COVER MAP : SHASGAN BASIN



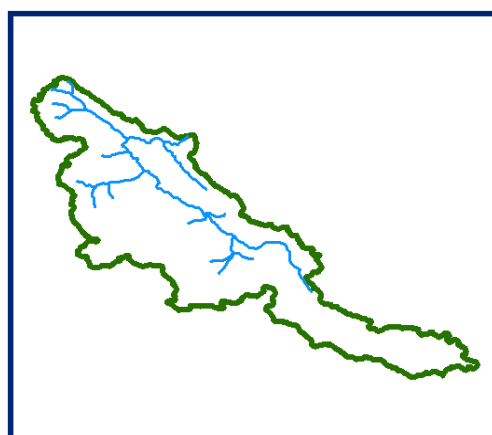
2 JANUARY 2011



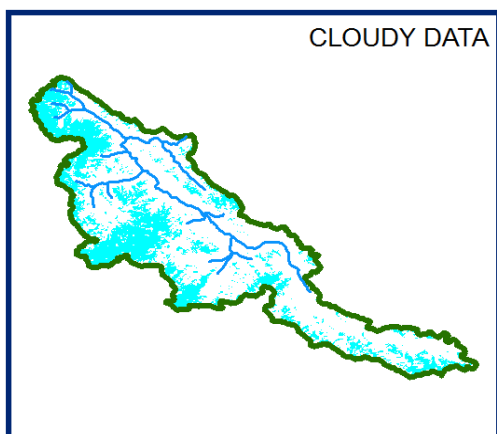
DATA NOT AVAILABLE



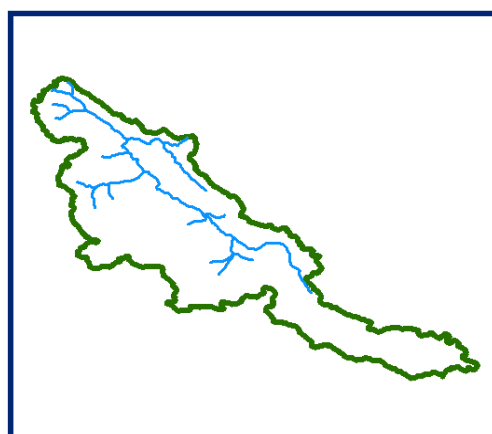
12 JANUARY 2011



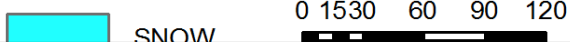
DATA NOT AVAILABLE



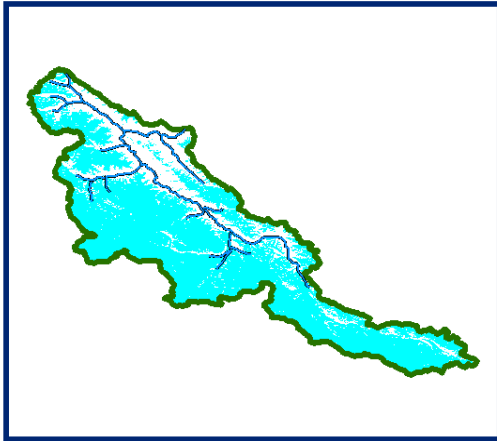
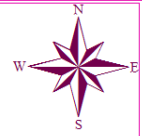
21 JANUARY 2011



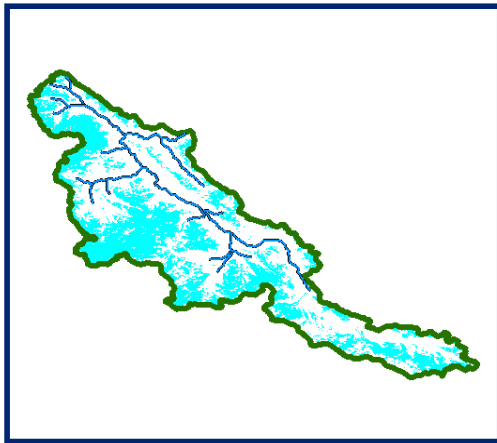
DATA NOT AVAILABLE



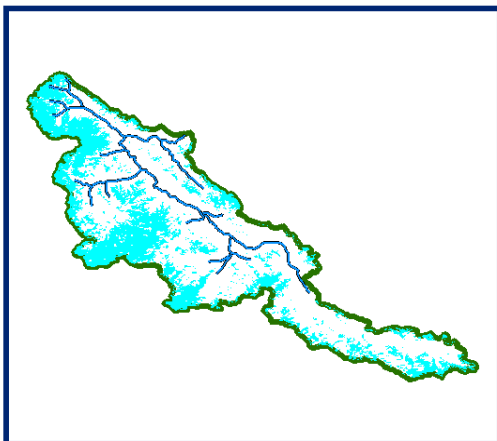
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
2 JANUARY 2011



DATA USED
12 JANUARY 2011



DATA USED
21 JANUARY 2011



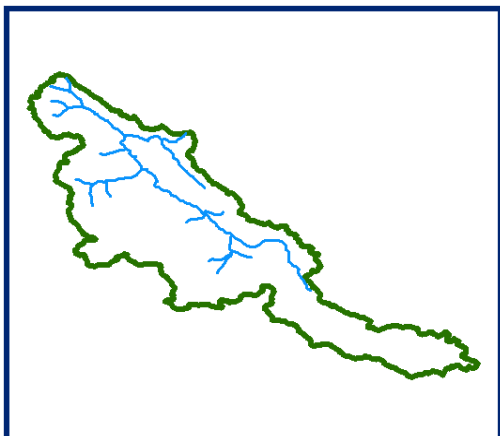
SNOW

0 15 30 60 90 120

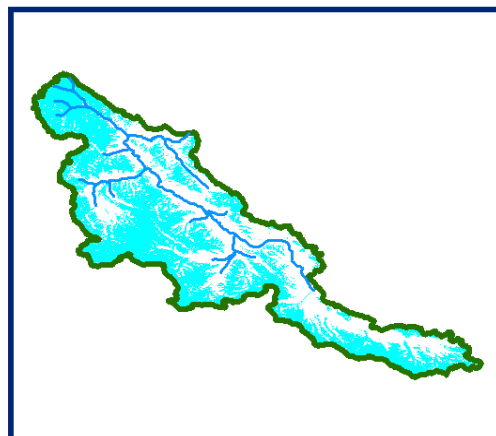
SNOW COVER MAP

:

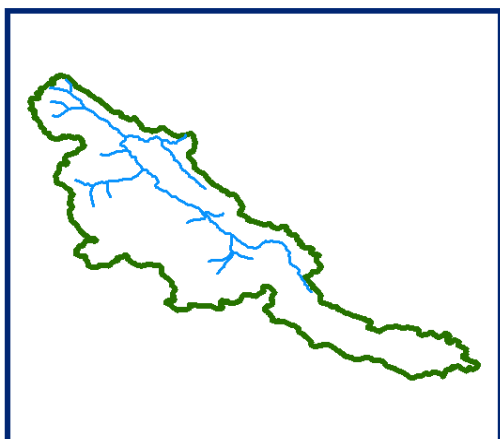
SHASGAN BASIN



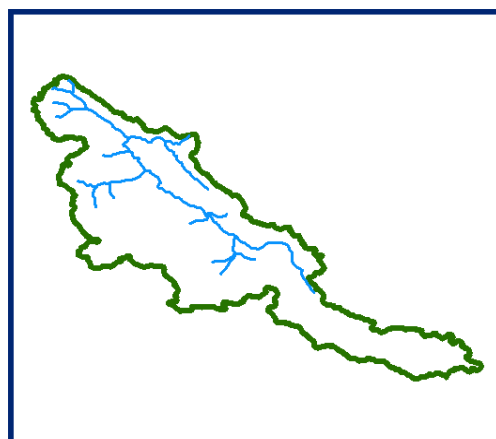
DATA NOT AVAILABLE



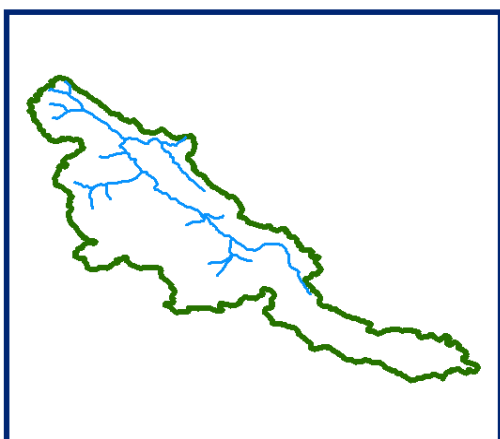
10 FEBRUARY 2011



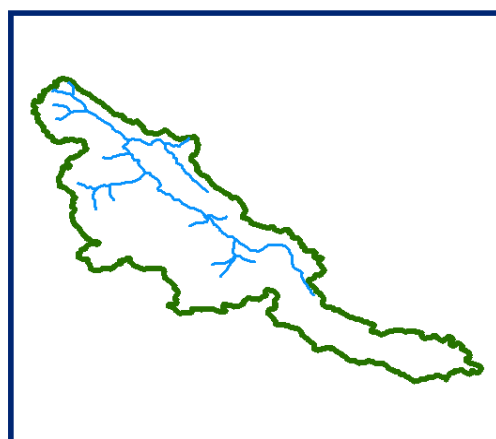
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DATA NOT AVAILABLE



DATA NOT AVAILABLE



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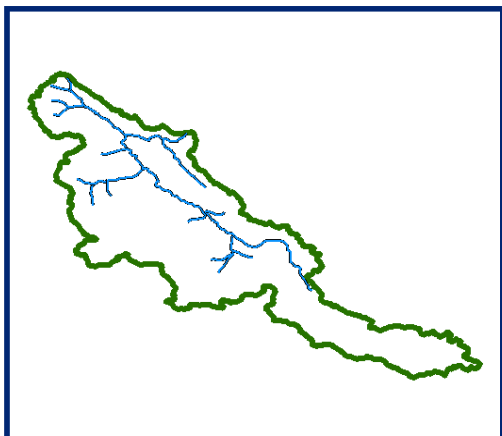


SNOW

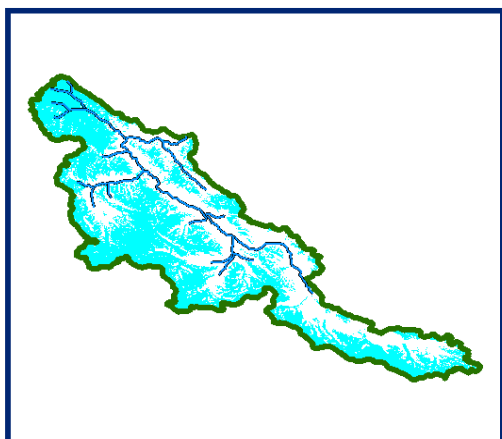
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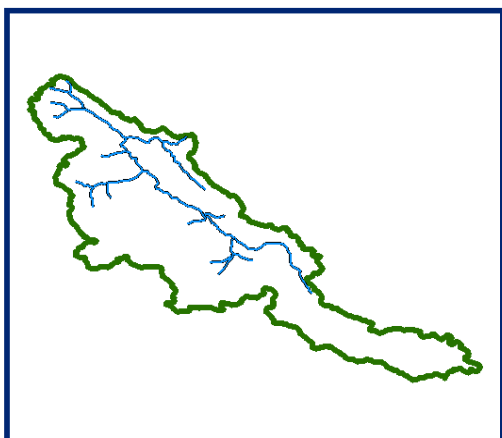
10 DAILY SNOW COVER MAP: SHASGAN BASIN



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DATA USED
10 FEBRUARY 2011



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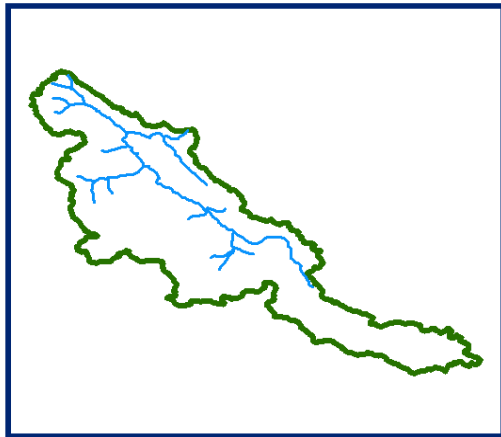
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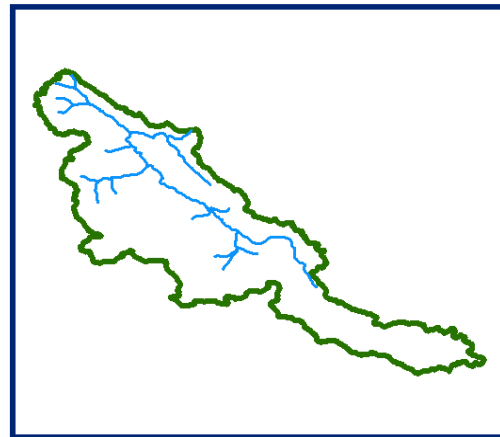
SNOW COVER MAP

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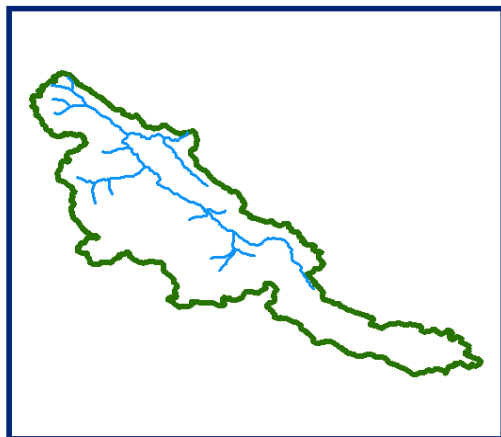
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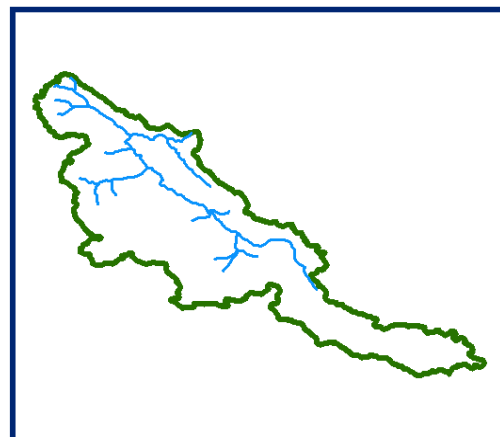
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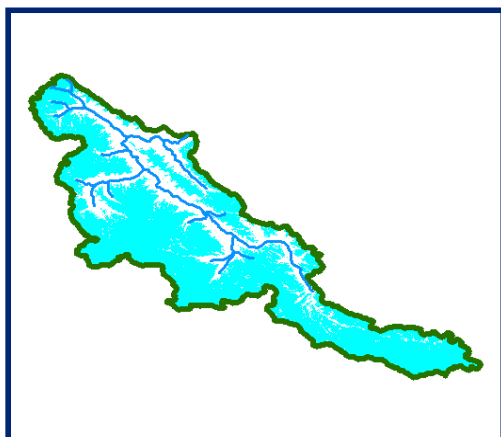
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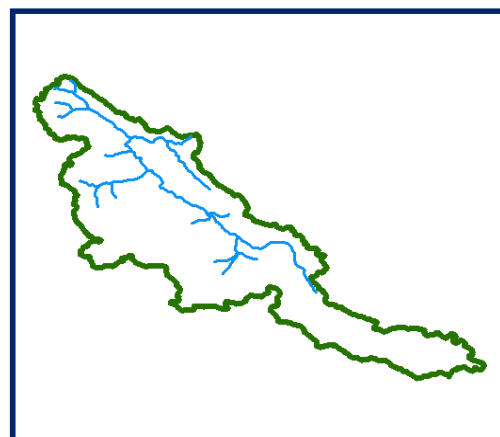
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25 MARCH 2011



DATA NOT AVAILABLE

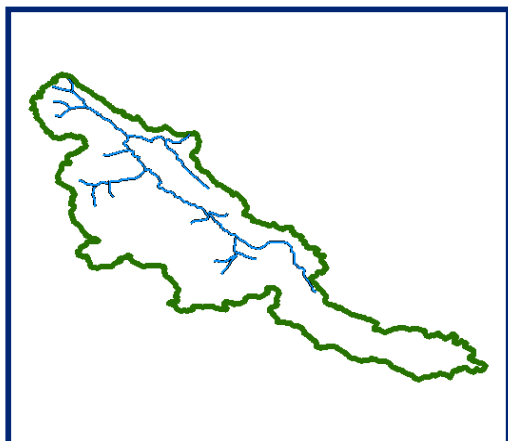


SNOW

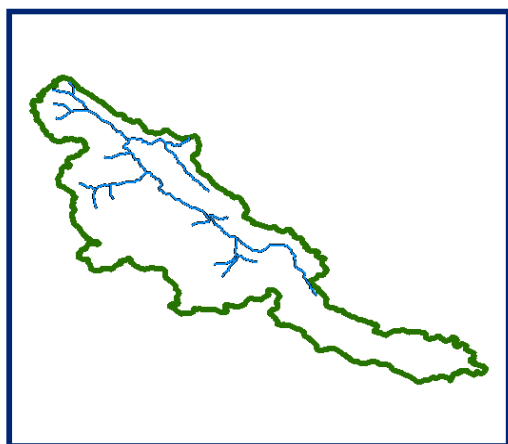
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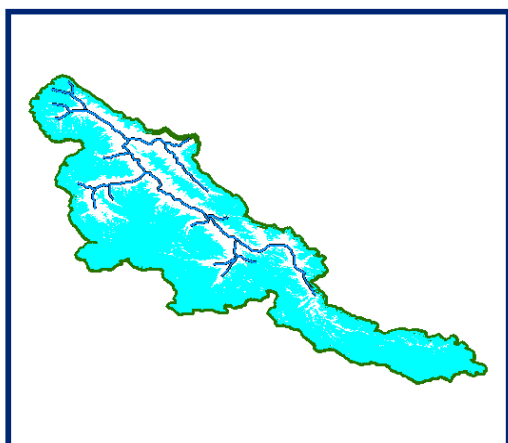
10 DAILY SNOW COVER MAP: SHASGAN BASIN



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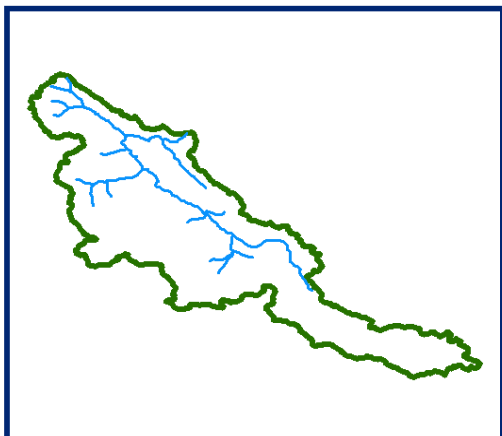
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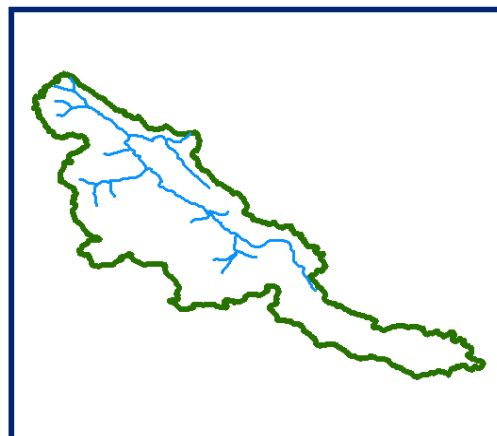
SNOW COVER MAP

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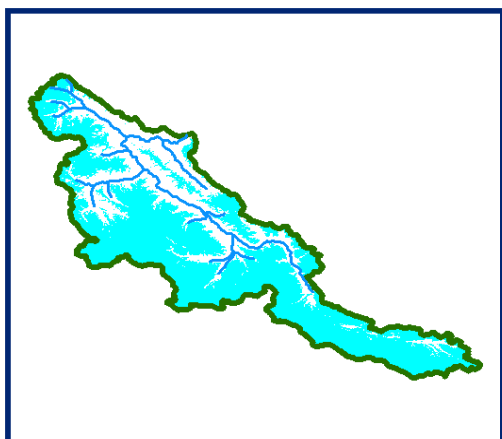
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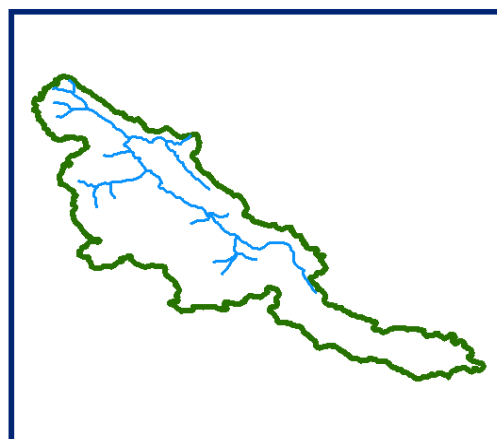
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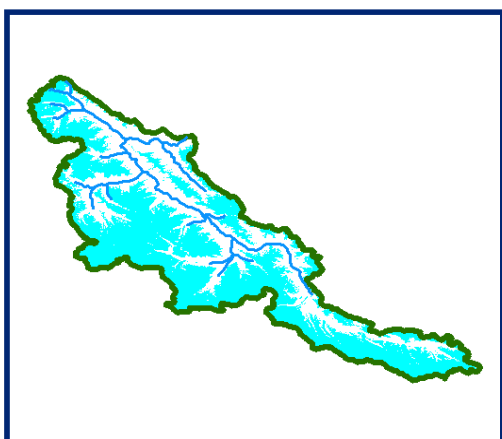
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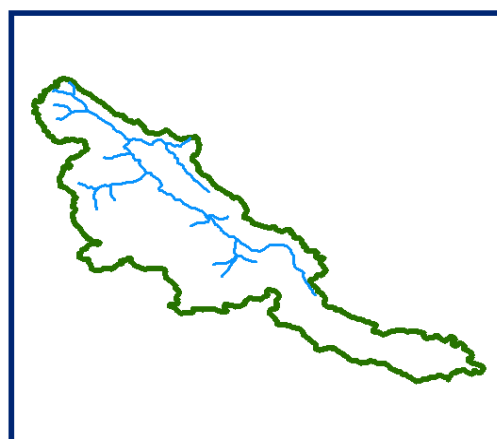
13 APRIL 2011



DATA NOT AVAILABLE



23 APRIL 2011



DATA NOT AVAILABLE

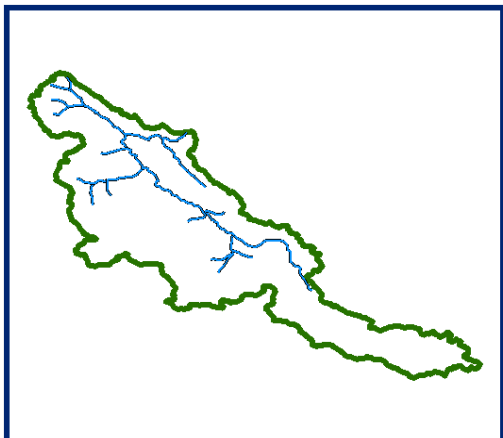


SNOW

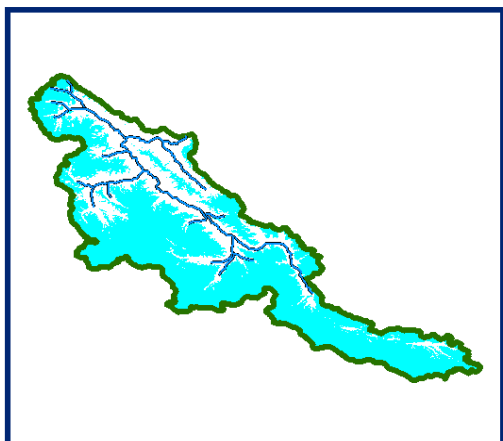
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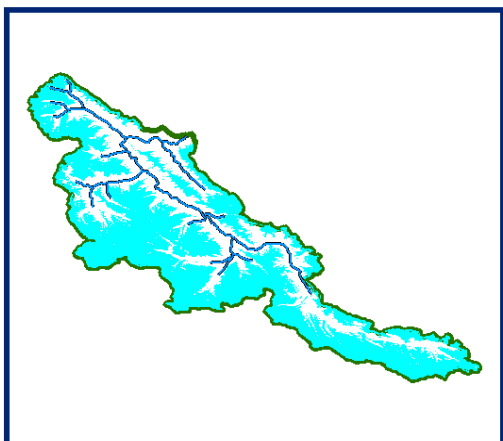
10 DAILY SNOW COVER MAP: SHASGAN BASIN



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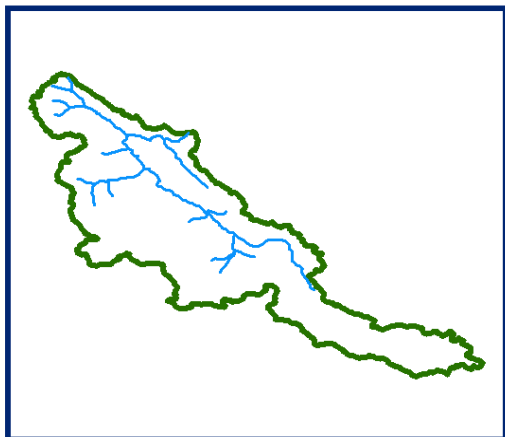
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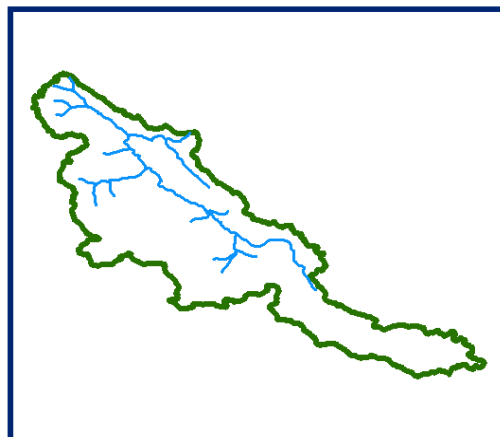
SNOW

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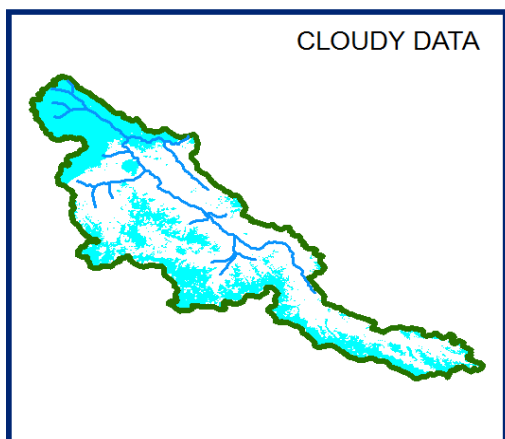
SNOW COVER MAP : SHASGAN BASIN



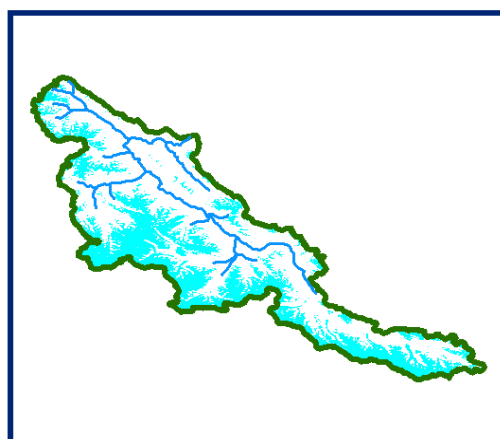
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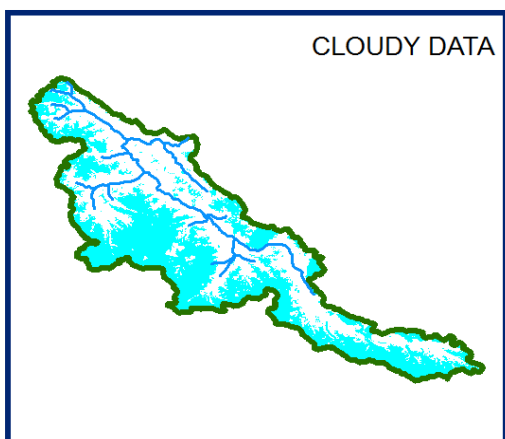
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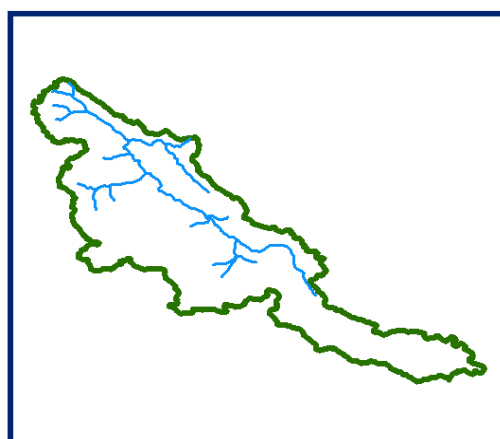
12 MAY 2011



17 MAY 2011



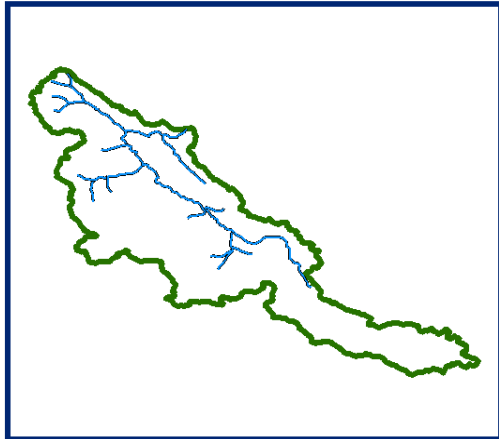
20 MAY 2011



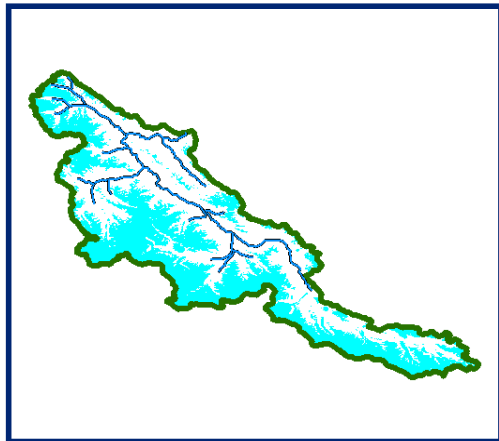
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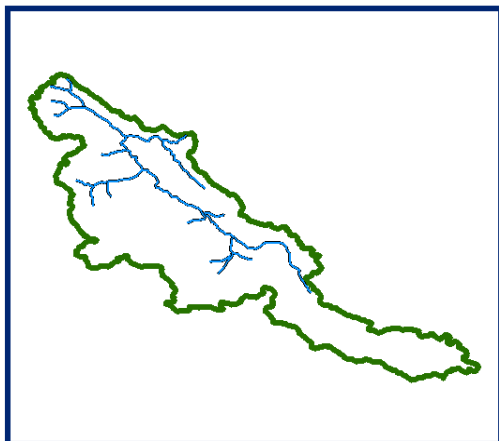
10 DAILY SNOW COVER MAP: SHASGAN BASIN



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DATA USED
12 MAY 2011
17 MAY 2011
20 MAY 2011



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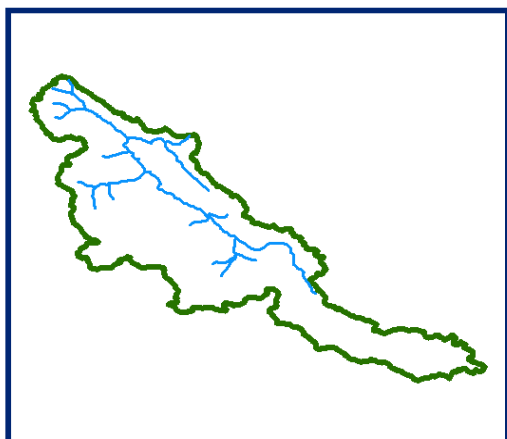
SNOW

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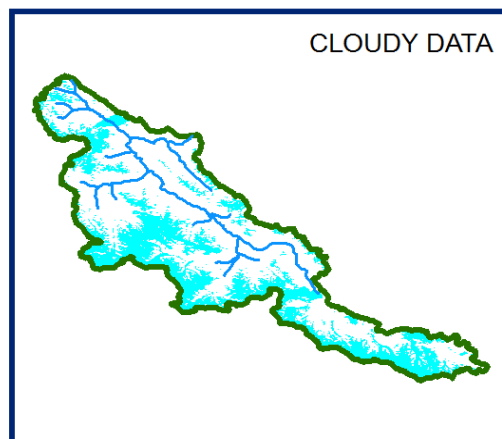
SNOW COVER MAP

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SHASGAN BASIN

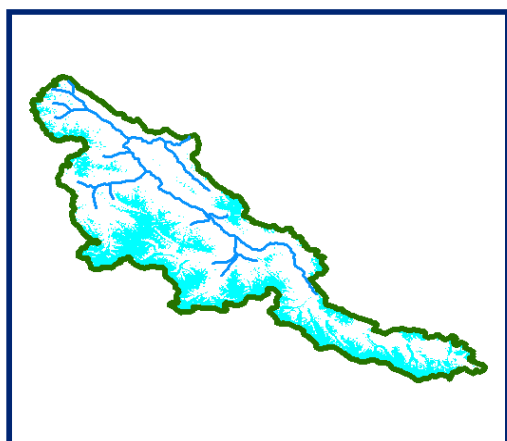


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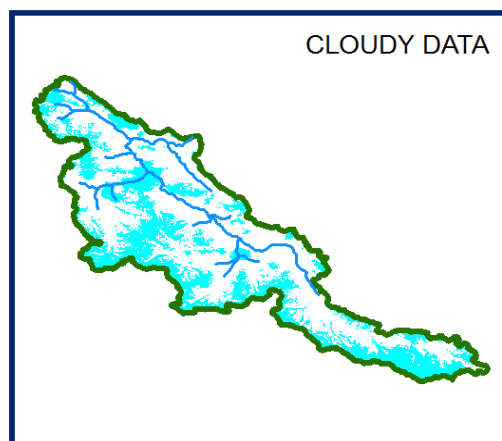


CLOUDY DATA

9 JUNE 2011

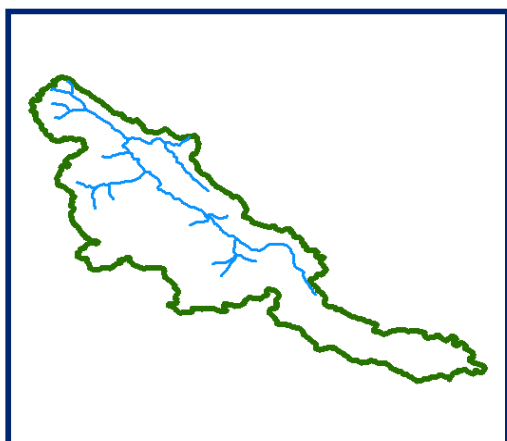


10 JUNE 2011

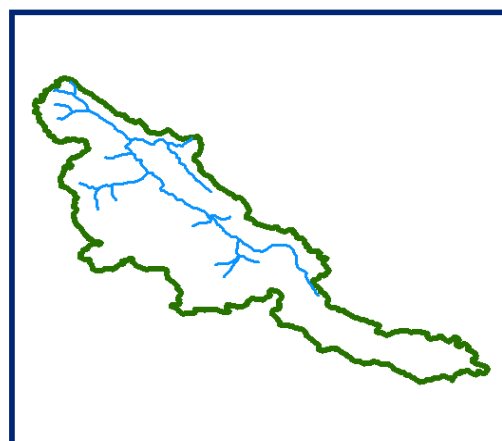


CLOUDY DATA

19 JUNE 2011



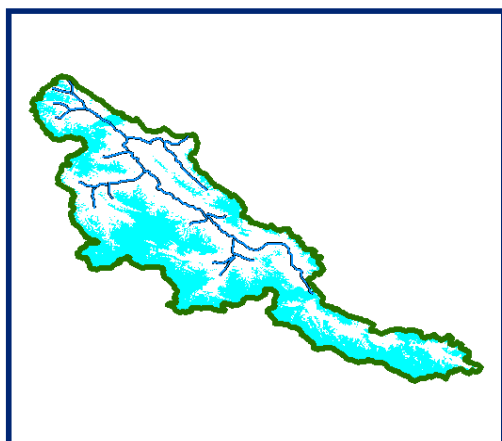
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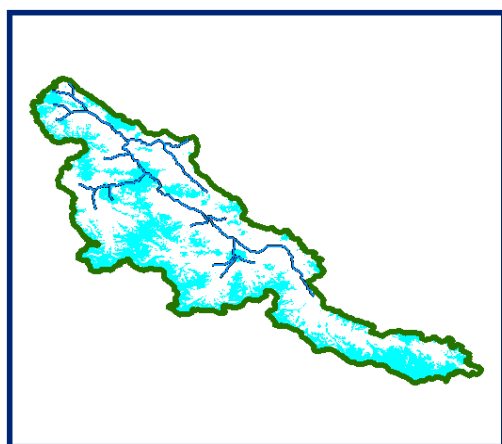
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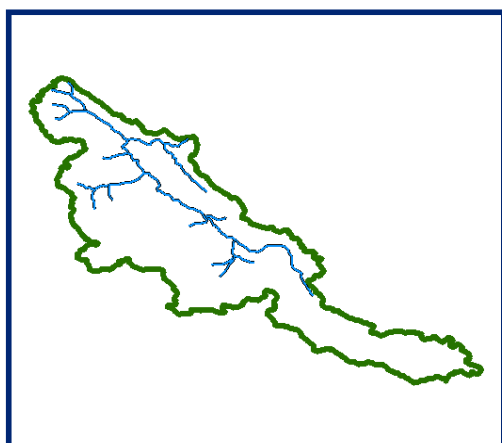
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
9 JUNE 2011
10 JUNE 2011



DATA USED
19 JUNE 2011



DATA USED
DATA NOT AVAILABLE



SNOW

0 15 30 60 90 120