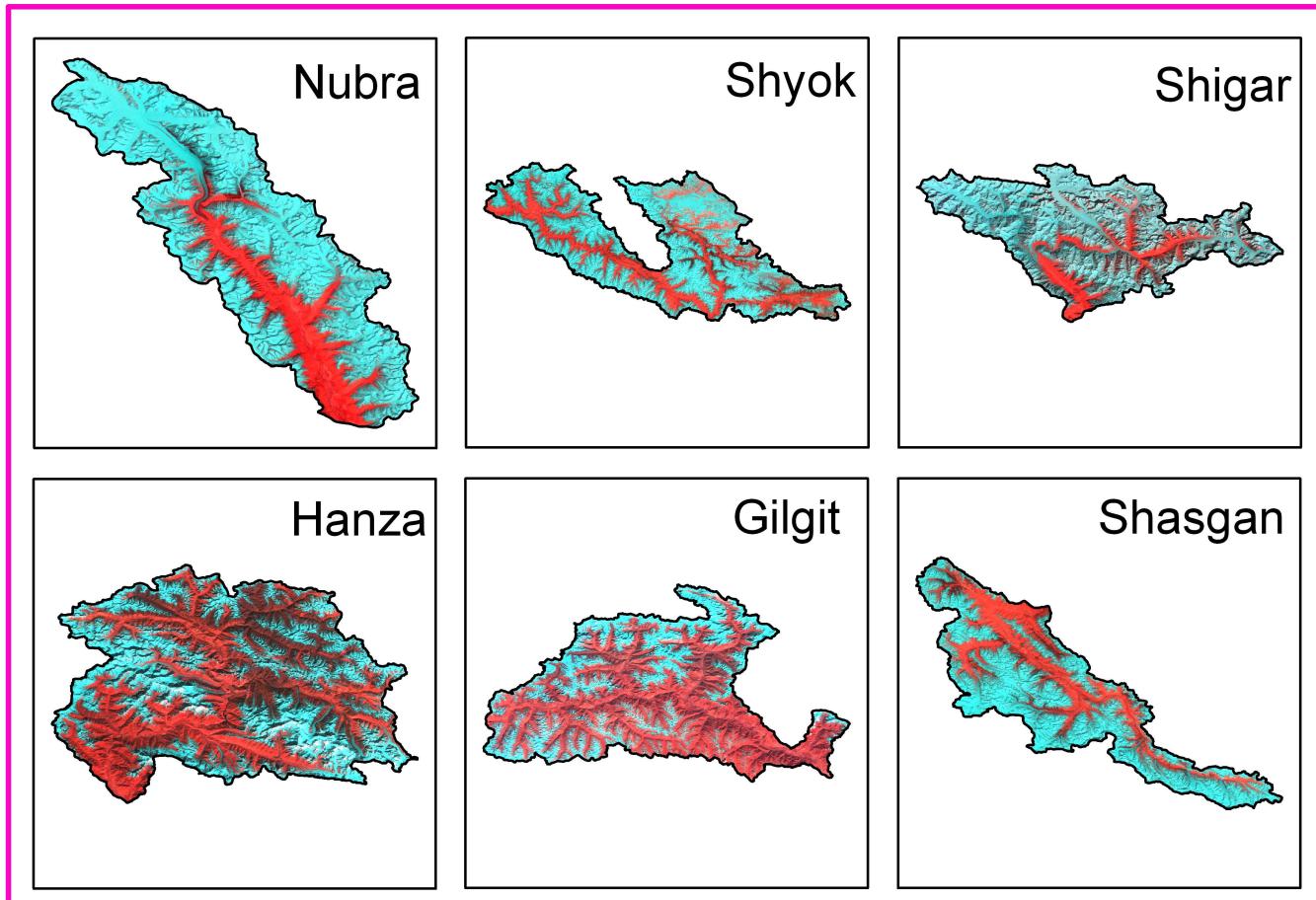


SNOW COVER ATLAS OF INDUS BASIN

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 : 2009-10



Volume II



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

Report Number	SAC/EPSA/MPSG/SGP/SN/ 80 /2013
Month and year of publication	January 2013
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	B. P. Rathore, S. K. Singh, I. Bahuguna, A. S. Rajawat and Ajai
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	This atlas gives subbasin-wise distribution of snow cover in the Indus basin from October 2009 to June 2010. 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.
Key words	Snow cover, NDSI, AWIFS, depletion curve, Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan basins.
Security Classification	Unrestricted
Distribution	Among concerned

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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 repetitivity. 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 2009 to June 2010 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:

$$\text{Normalized Difference Snow Index(NDSI)} = (\text{band 2} - \text{band 5}) / (\text{band 2} + \text{band 5}) \quad ..(1)$$

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 2009 to June 2010. 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

This investigation was carried out under Snow and Glacier Studies Project, a joint initiative of Ministry of Environment and Forest (MoEF) and Department of Space (DOS). The authors are grateful to Shri. A. S. Kirankumar, Director, Space Applications Centre, Ahmedabad for continuous guidance and encouragement during the investigation. Authors would like to thank Dr. J. S. Parihar, DD, EPSA for their suggestions and comments on the manuscript.

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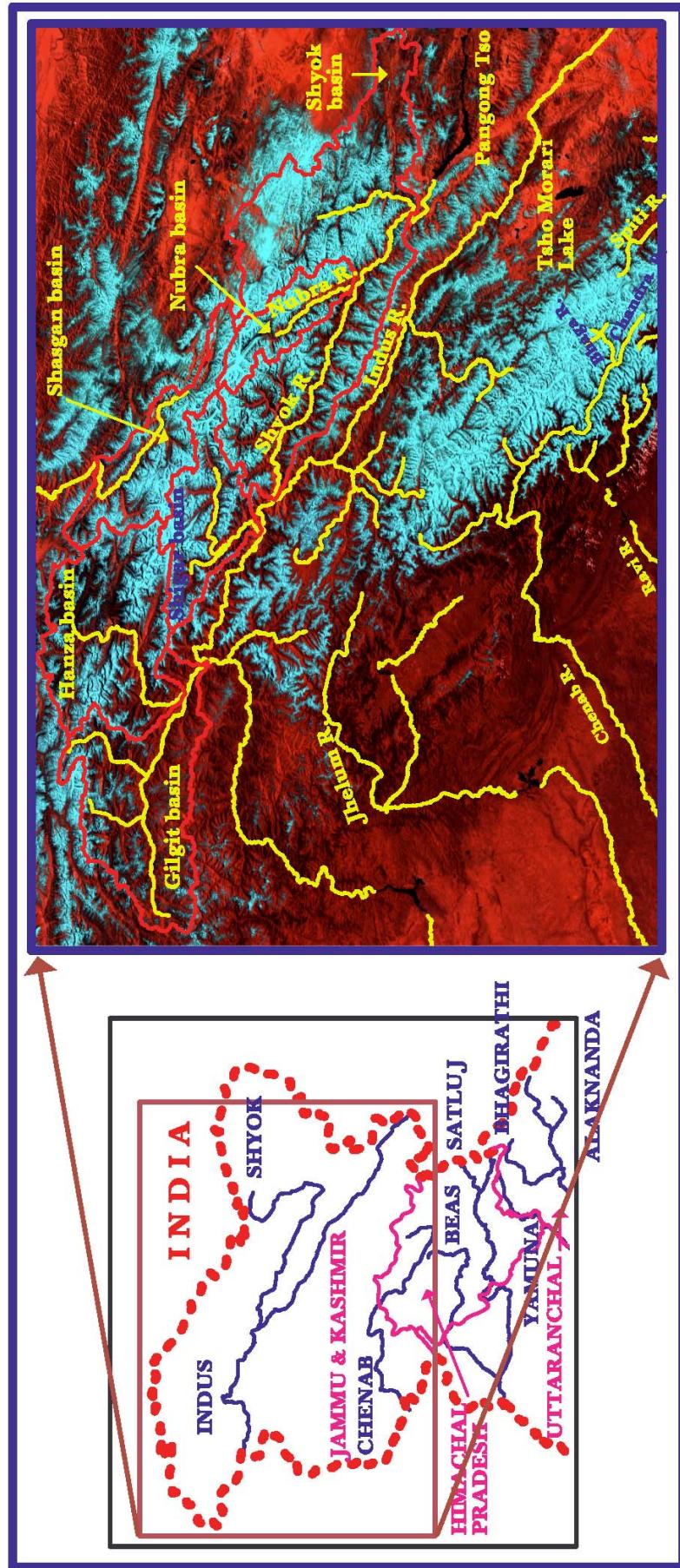


Figure 1: Location map of Nubra, Shyok, Shigar, Hanza, Gilgit and Shasgan sub-basins (Part of Indus basin)

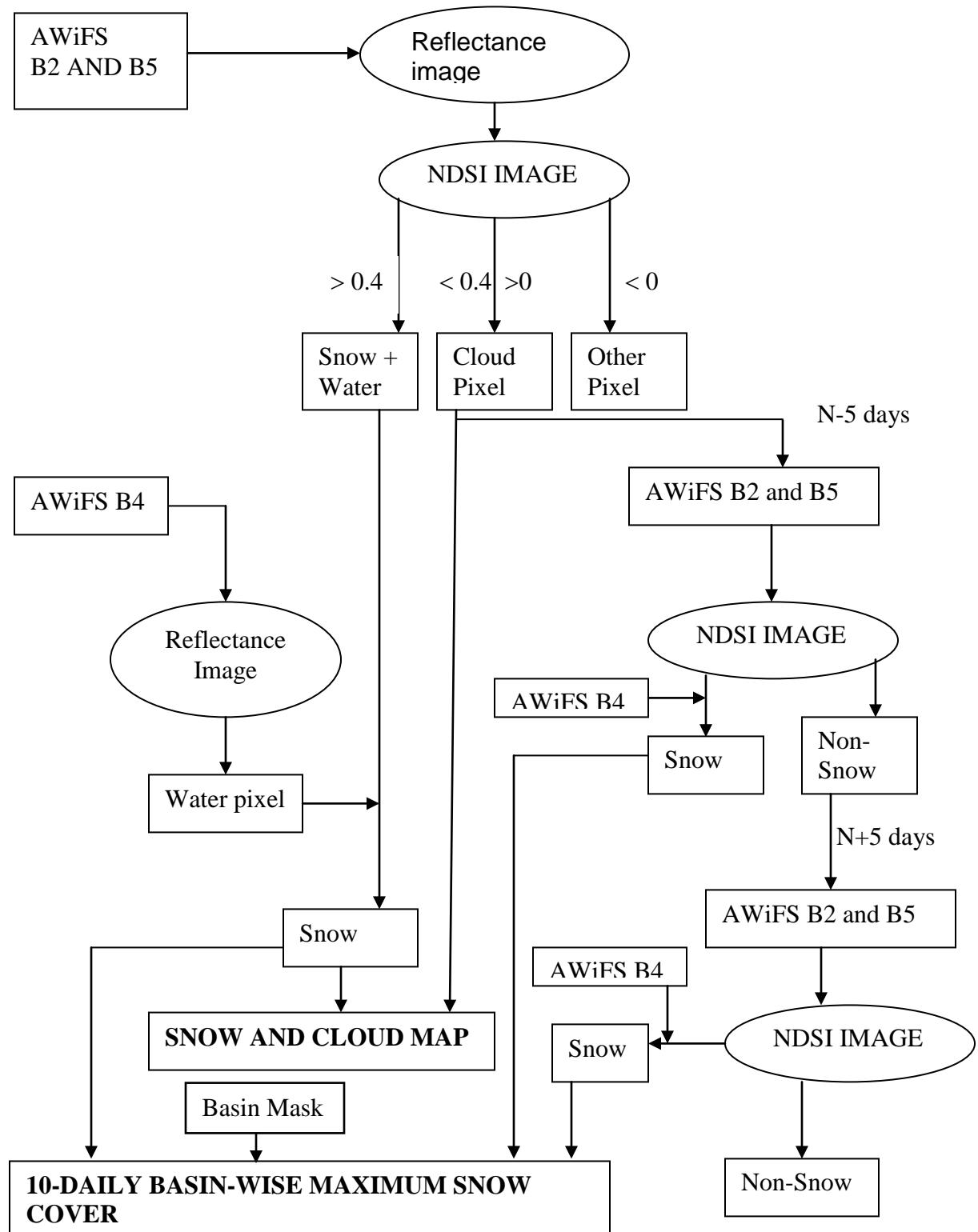


Figure 2: Algorithm for snow cover mapping using AWiFS data

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 2009							
1	03-Oct-09	2013	47	4	18-Oct-09	3528	83
2	08-Oct-09	2806	66	5	27-Oct-09	2448	57
3	17-Oct-09	2747	65				
November 2009							
1	01-Nov-09	2847	67	5	15-Nov-09	2234	52
2	06-Nov-09	2455	58	6	20-Nov-09	3519	83
3	10-Nov-09	2116	50	7	25-Nov-09	2453	58
4	11-Nov-09	3287	77				
December 2009							
1	04-Dec-09	1771	42	4	24-Dec-09	3850	90
2	14-Dec-09	3889	91	5	28-Dec-09	3215	76
3	19-Dec-09	3898	92	6	29-Dec-09	3466	81
January 2010							
1	02-Jan-10	3822	90	4	26-Jan-10	3844	90
2	07-Jan-10	3816	90	5	31-Jan-10	3889	91
3	21-Jan-10	3844	90				
February 2010							
1	05-Feb-10	4173	98	2	10-Feb-10	4039	95
MARCH 2010							
1	11-Mar-10	3735	88	3	20-Mar-10	3555	83
2	15-Mar-10	3684	87				
APRIL 2010							
1	08-Apr-10	3774	89	2	27-Apr-10	3586	84
MAY 2010							
1	02-May-10	3446	81	4	26-May-10	3496	82
2	21-May-10	3673	86	5	31-May-10	3519	83
3	22-May-10	3380	79				
JUNE 2010							
1	05-Jun-10	3599	85	3	29-Jun-10	2443	57
2	20-Jun-10	3200	75				

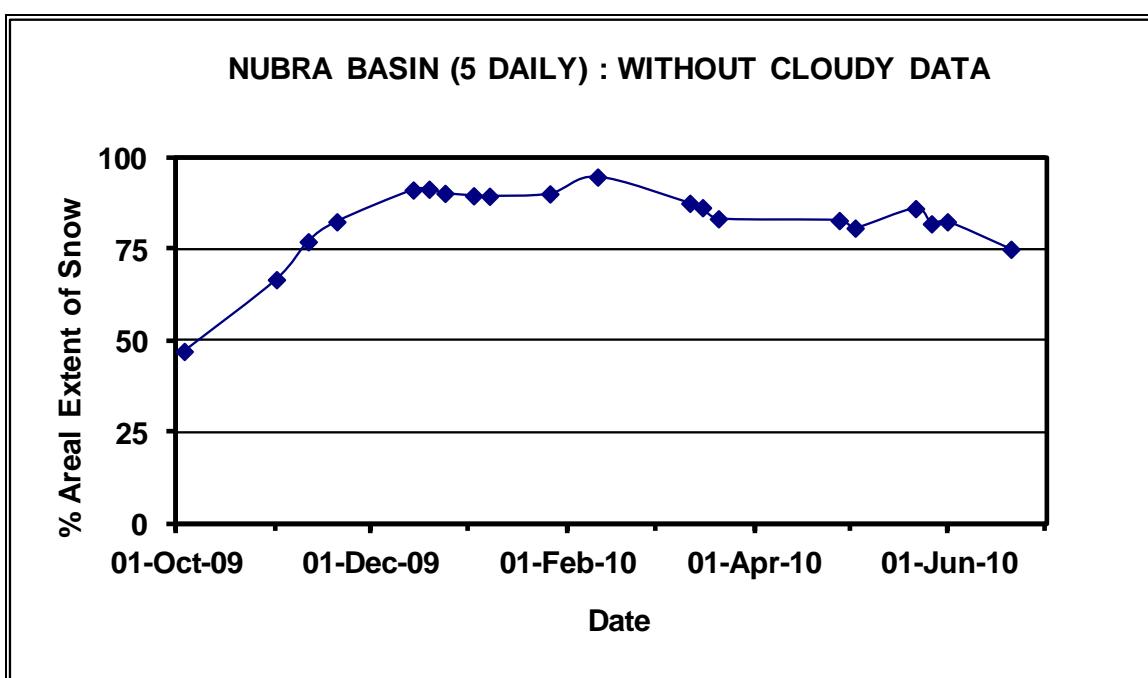
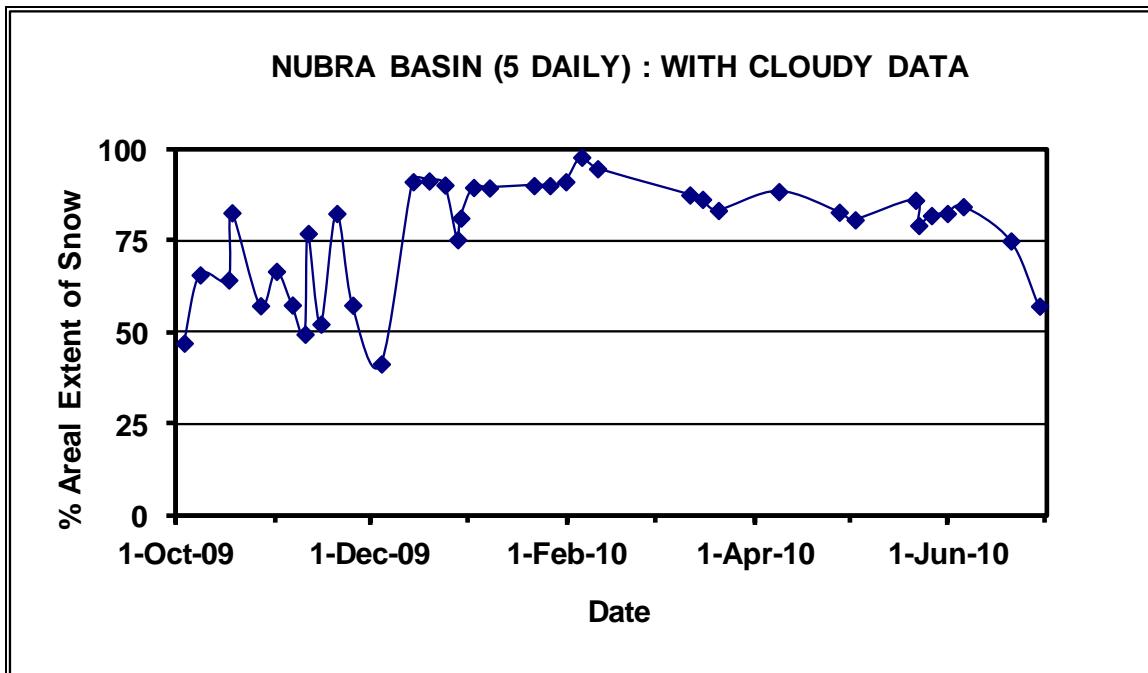
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: NUBRA

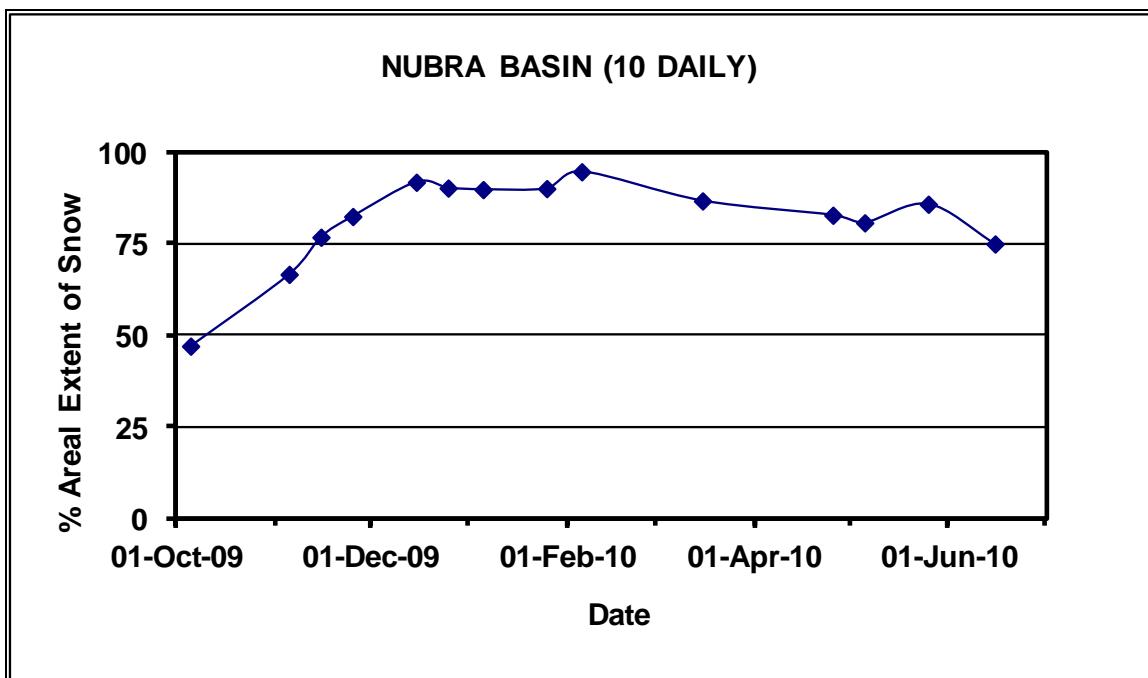
BASIN AREA: 4258 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	03-Oct-09	2013	47				
November 2009							
1	05-Nov-09	2847	67	2	25-Nov-09	3519	83
2	15-Nov-09	3279	77				
December 2009							
1	14-Dec-09	3917	92	2	24-Dec-09	3850	90
January 2010							
1	02-Jan-10	3832	90	2	26-Jan-10	3844	90
February 2010							
1	05-Feb-10	4039	95				
March 2010							
1	20-Mar-10	3700	87				
April 2010							
1	25-Apr-10	3534	83				
May 2010							
1	02-May-10	3446	81	2	26-May-10	3543	86
June 2010							
1	20-Jun-10	3200	75				

Snow cover depletion curve



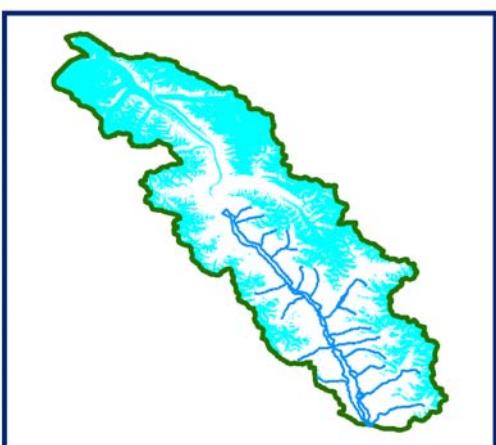
Snow cover depletion curve



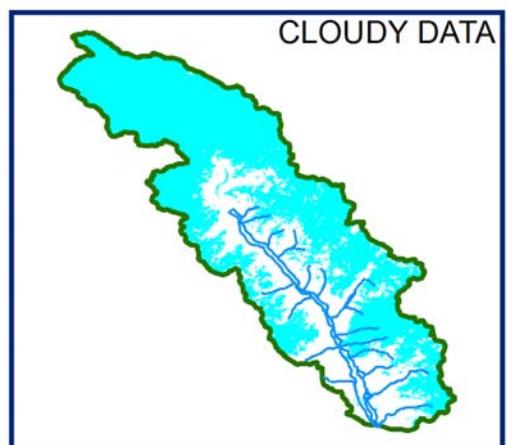
SNOW COVER MAP

SNOW COVER MAP:

NUBRA BASIN



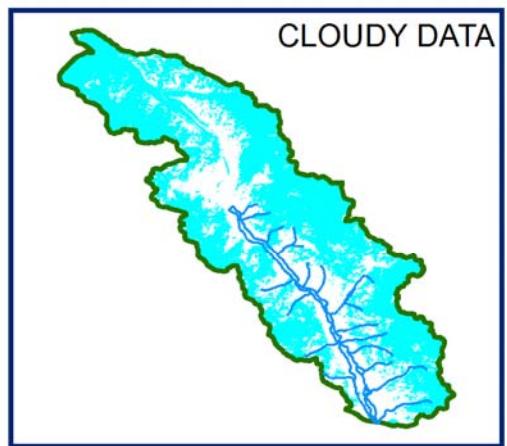
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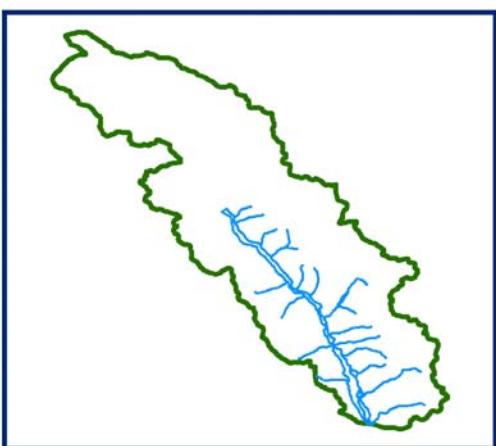
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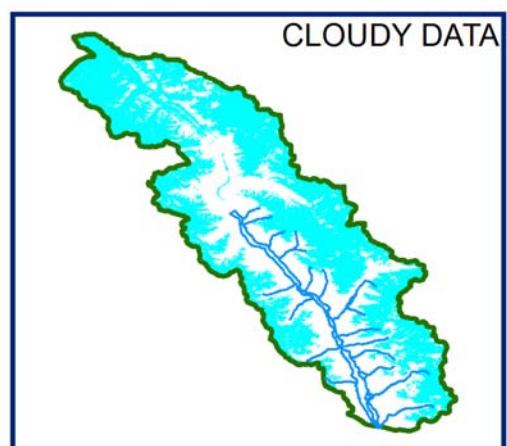
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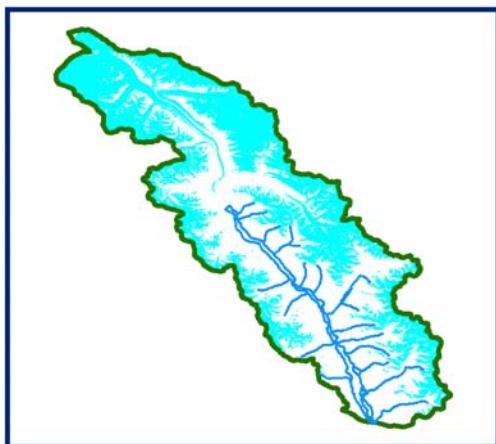
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SNOW

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 Kilometers

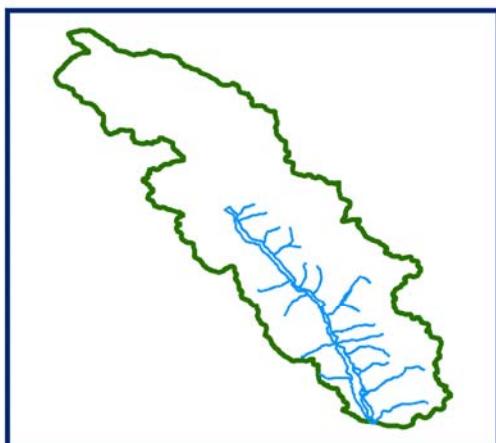
10 DAILY SNOW COVER MAP: NUBRA BASIN



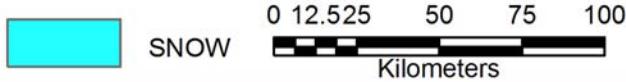
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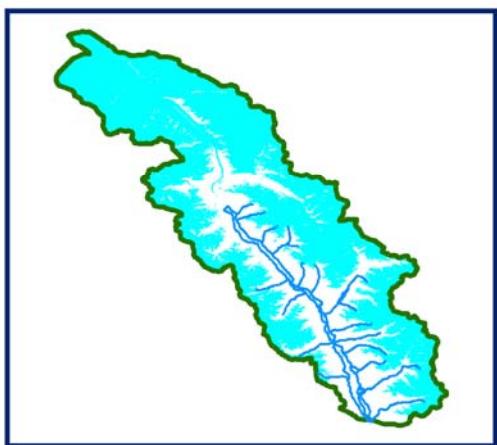


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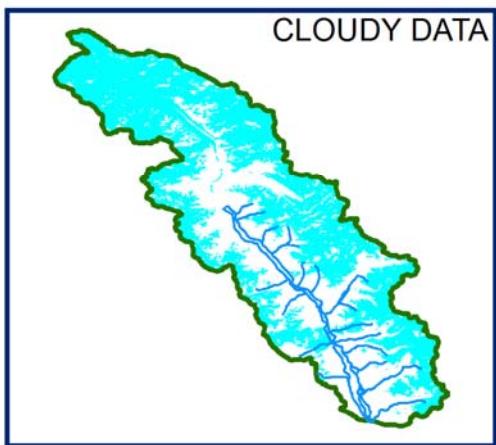


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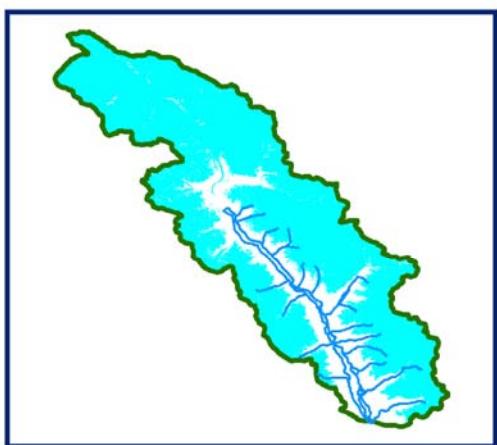
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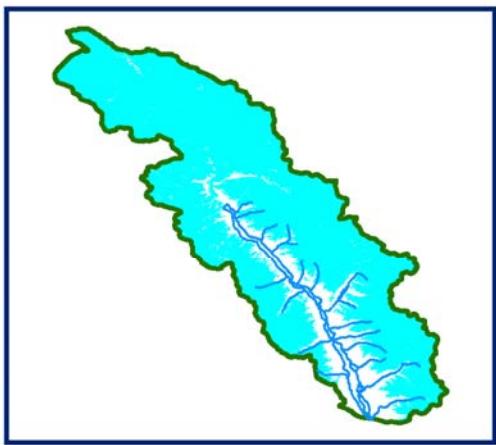
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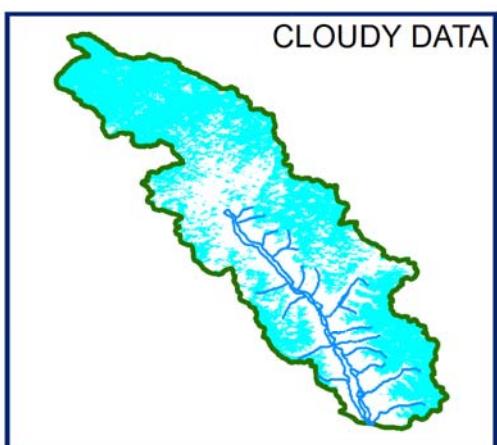
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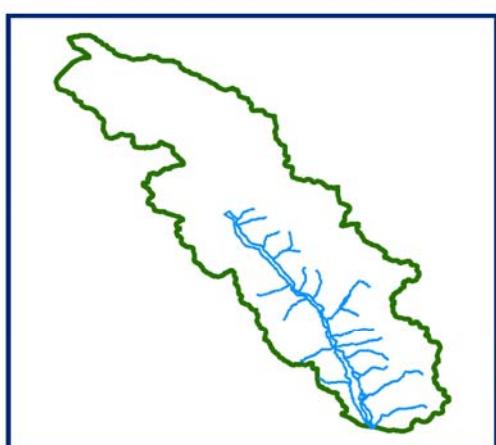
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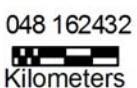
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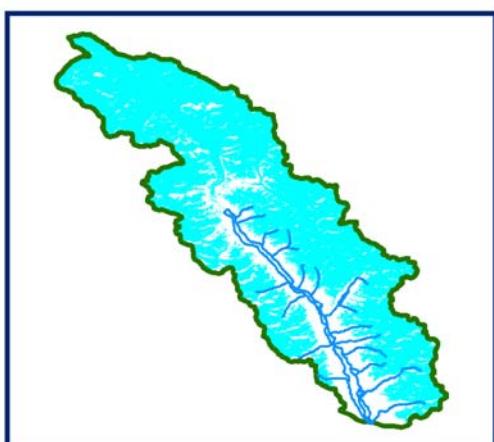
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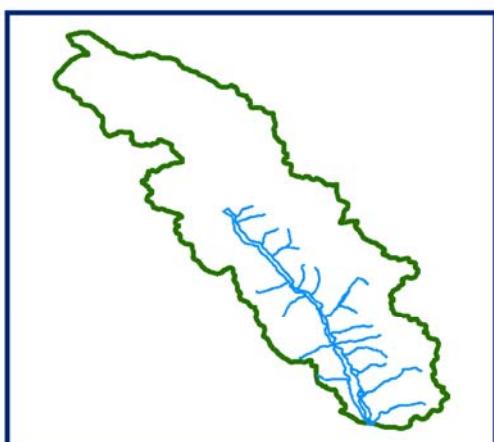
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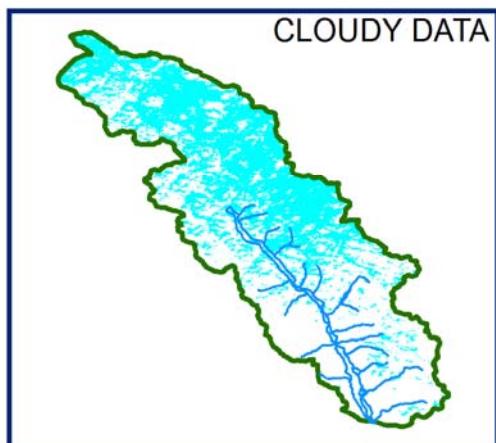


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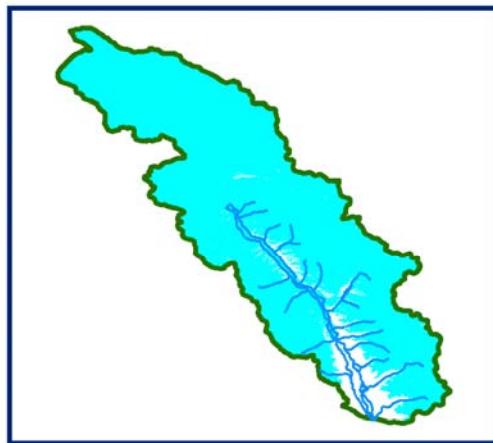
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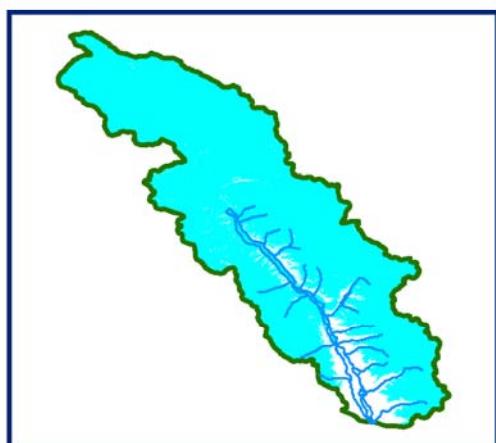
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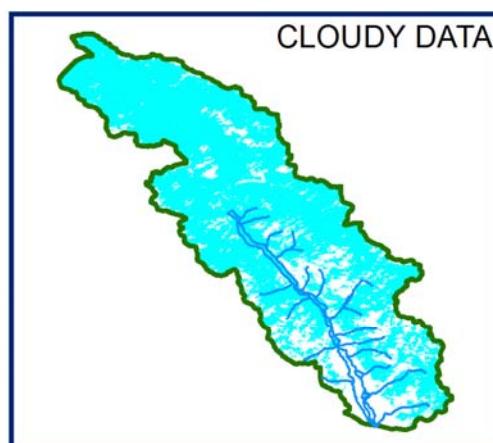
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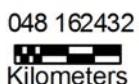
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SNOW



Kilometers

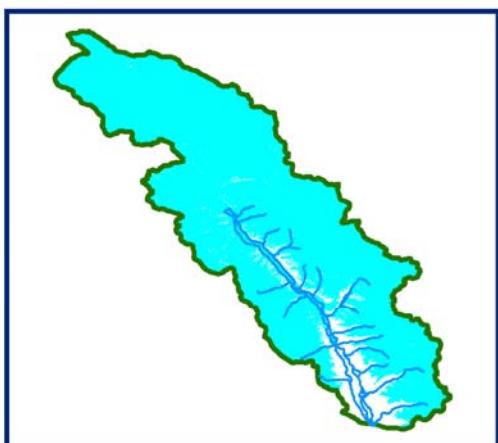
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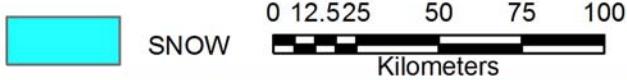
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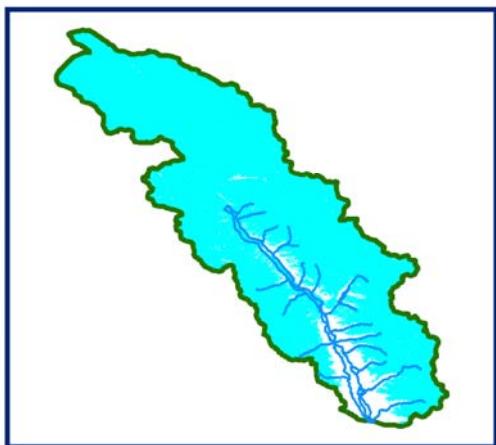


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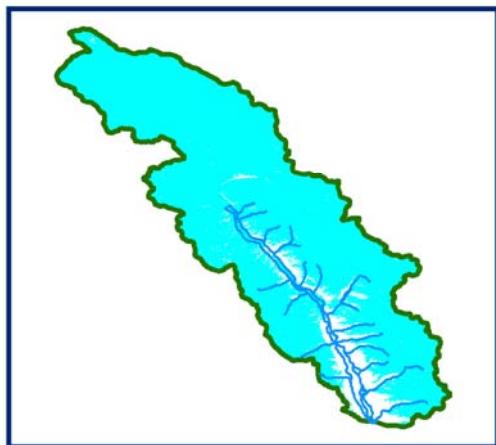


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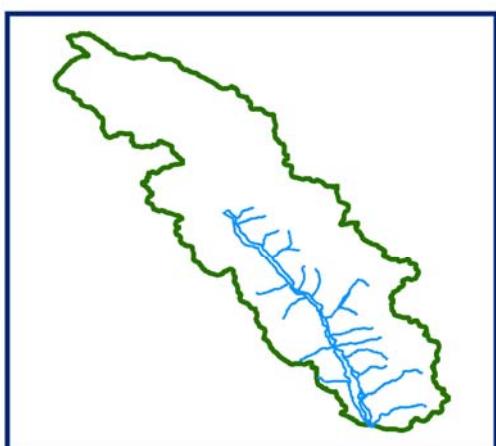
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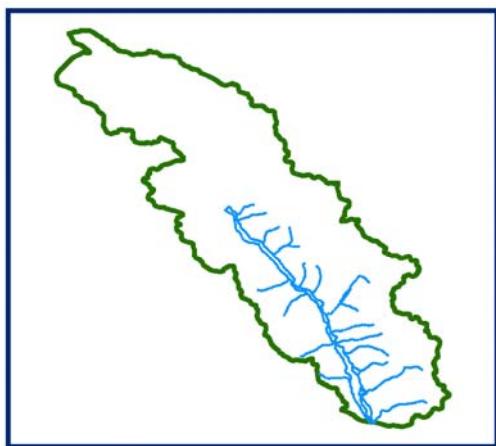
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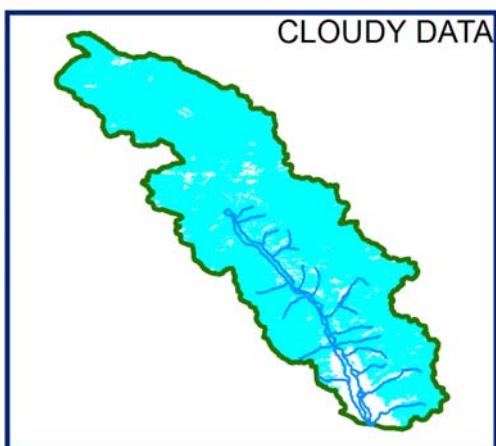
07 JANUARY 2010



CLOUDY DATA



CLOUDY DATA



21 JANUARY 2010



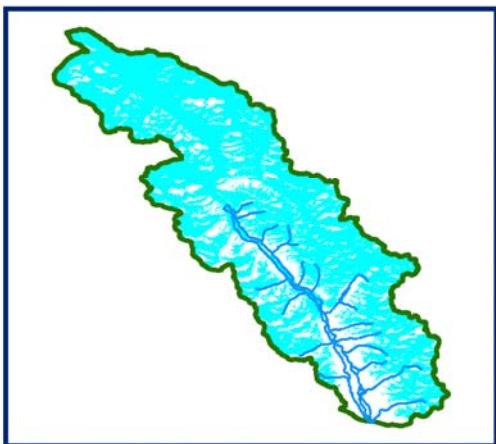
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SNOW

048 162432
 Kilometers

10 DAILY SNOW COVER MAP: NUBRA BASIN



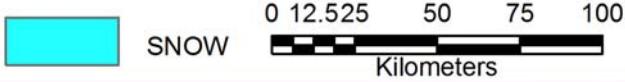
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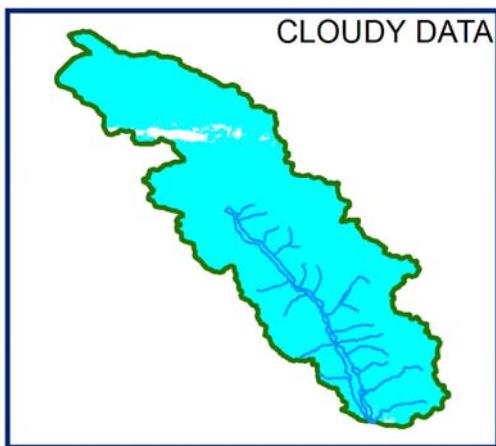


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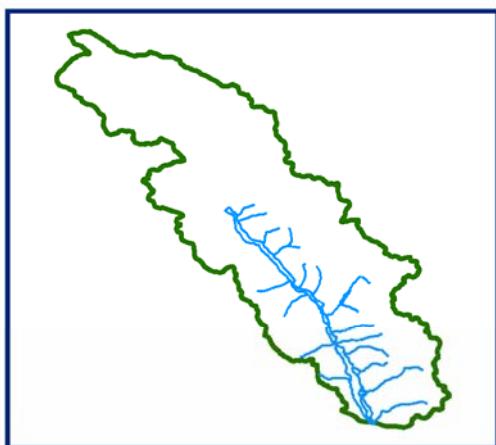
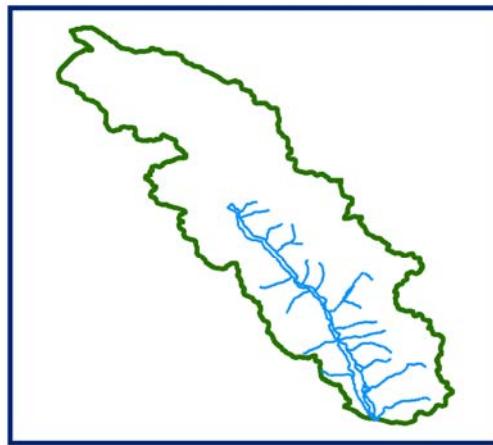
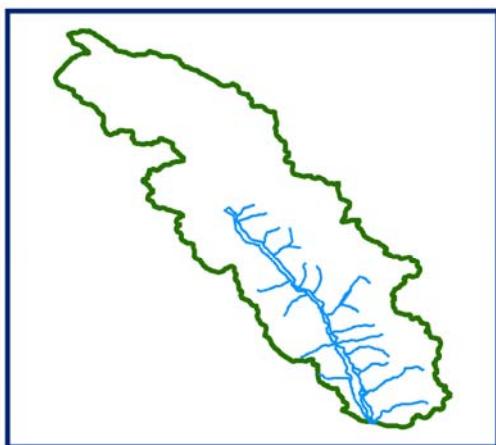


SNOW COVER MAP:

NUBRA BASIN



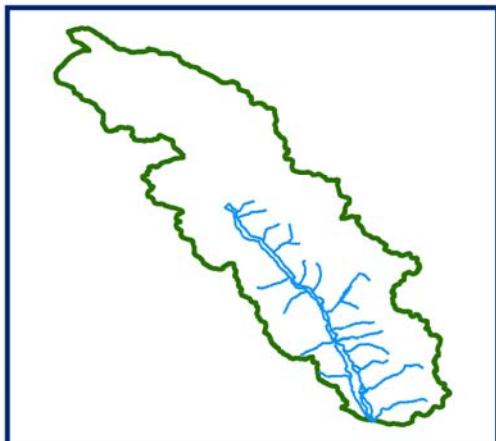
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SNOW

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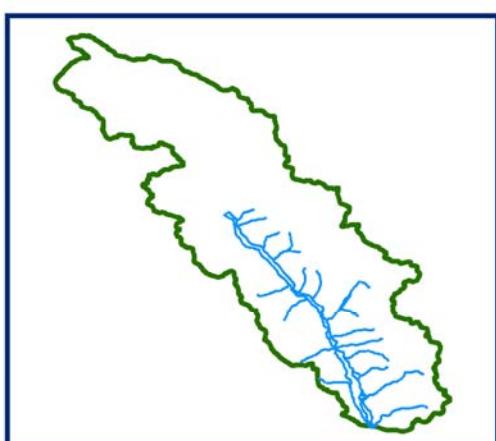
10 DAILY SNOW COVER MAP: NUBRA BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE

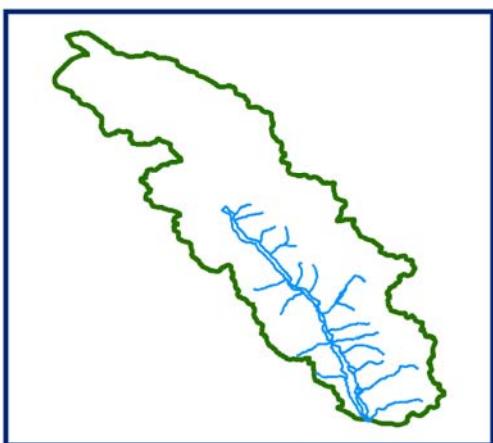


DATA NOT AVAILABLE

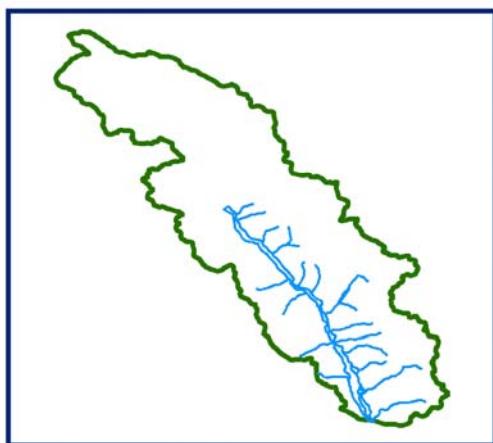


SNOW COVER MAP:

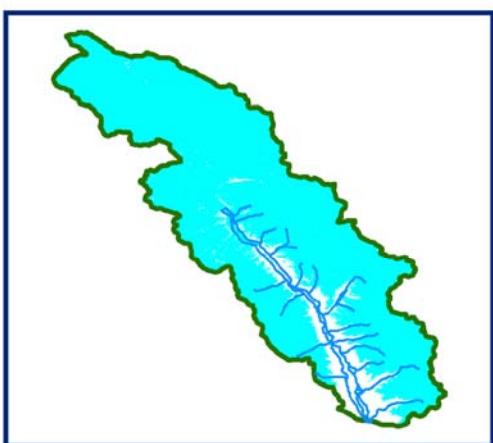
NUBRA BASIN



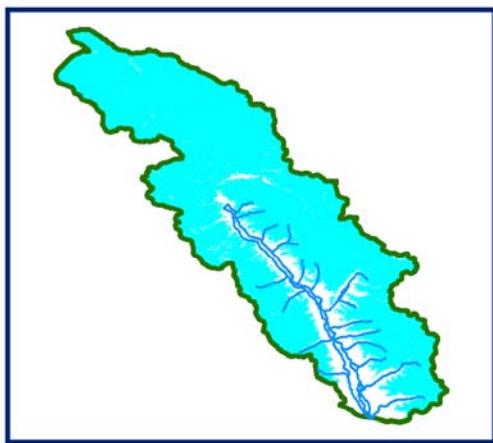
DATA NOT AVAILABLE



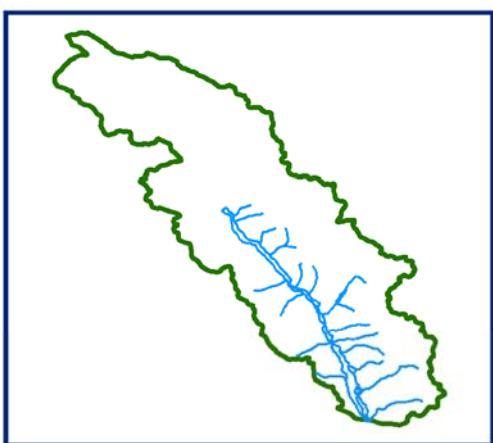
DATA NOT AVAILABLE



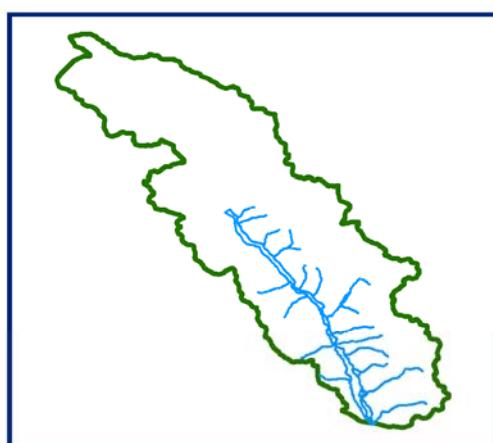
11 MARCH 2010



20 MARCH 2010



DATA NOT AVAILABLE



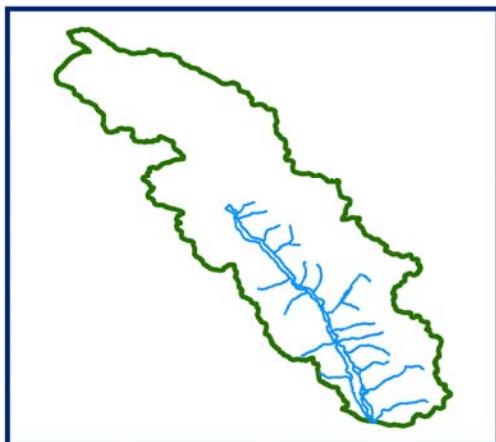
DATA NOT AVAILABLE



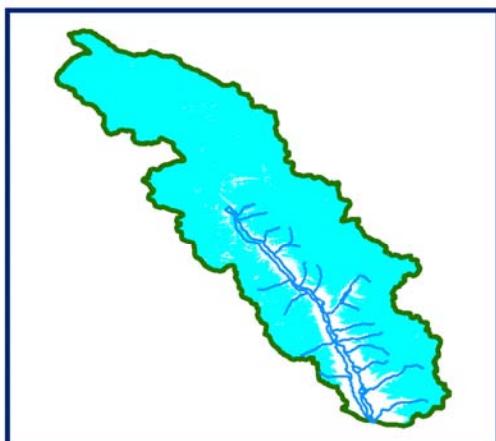
SNOW



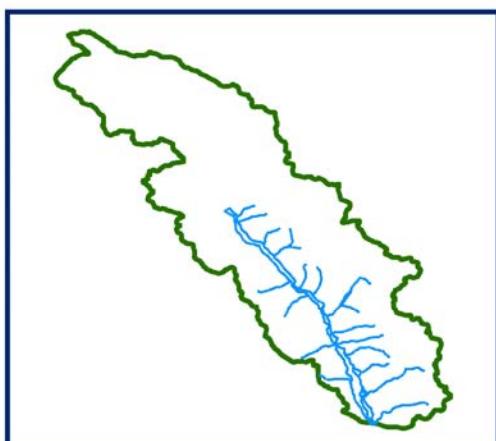
10 DAILY SNOW COVER MAP: NUBRA BASIN



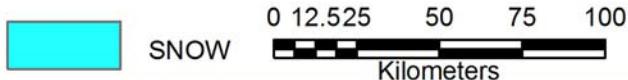
DATA NOT AVAILABLE



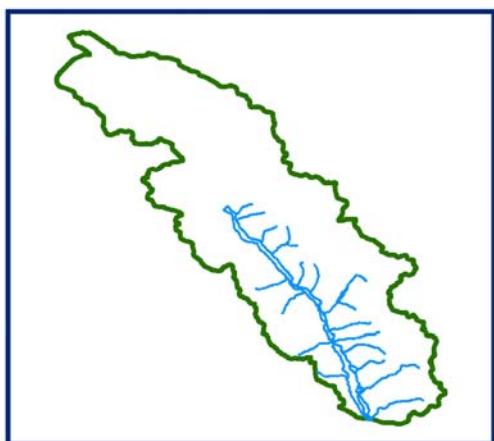
**DATA USED
11 MARCH 2010
20 MARCH 2010**



DATA NOT AVAILABLE

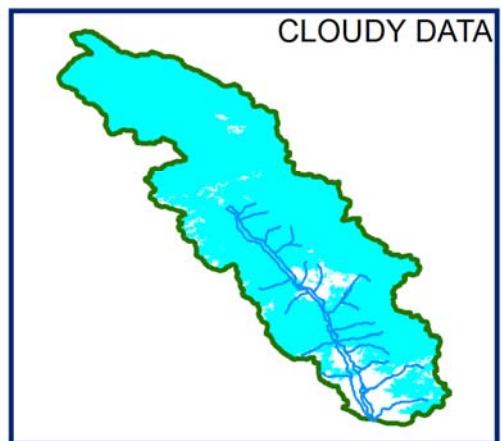
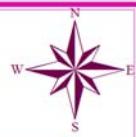


SNOW COVER MAP:

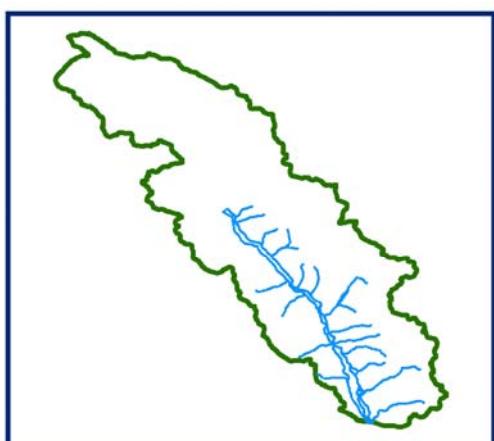


DATA NOT AVAILABLE

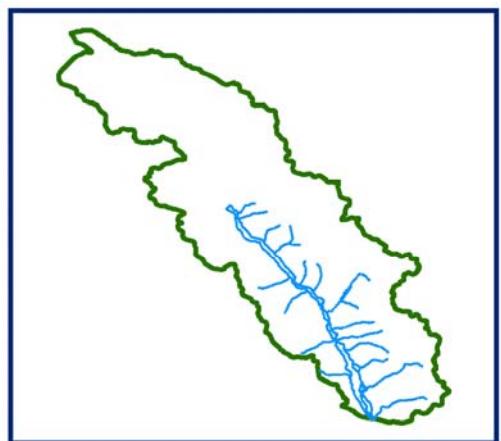
NUBRA BASIN



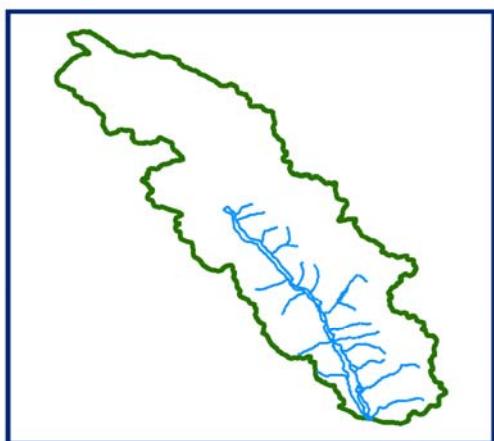
08 APRIL 2010



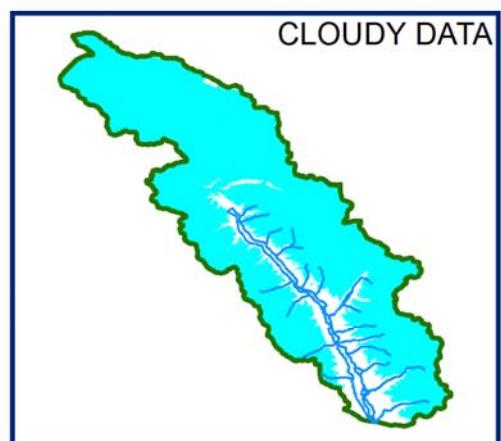
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



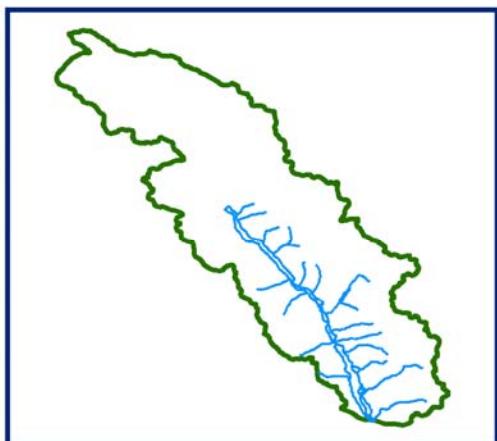
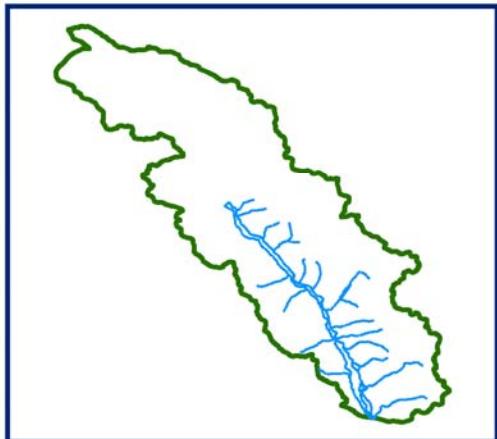
27 APRIL 2010



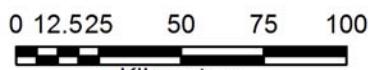
SNOW

048 162432
 Kilometers

10 DAILY SNOW COVER MAP: NUBRA BASIN



SNOW



Kilometers

SNOW COVER MAP:

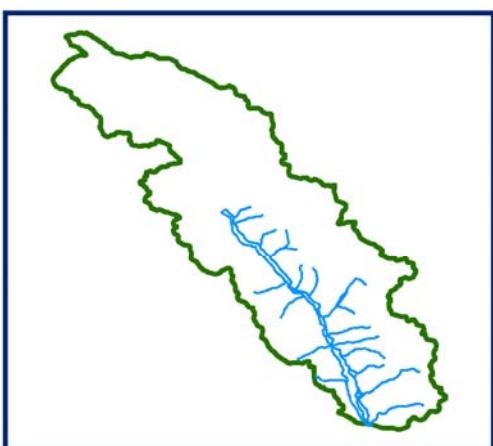
NUBRA BASIN



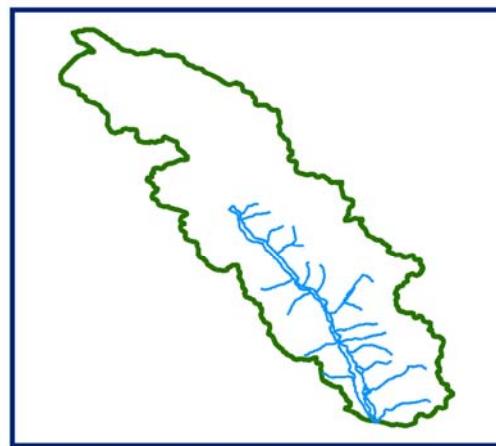
02 MAY 2010



DATA NOT AVAILABLE



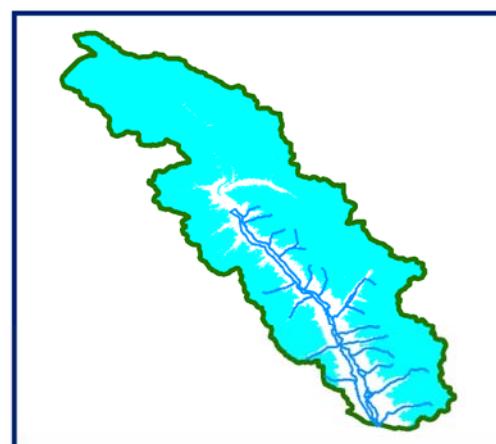
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 MAY 2010



31 MAY 2010



SNOW

048 162432
 Kilometers

10 DAILY SNOW COVER MAP: NUBRA BASIN



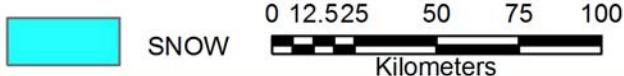
DATA USED
02 MAY 2010



DATA NOT AVAILABLE

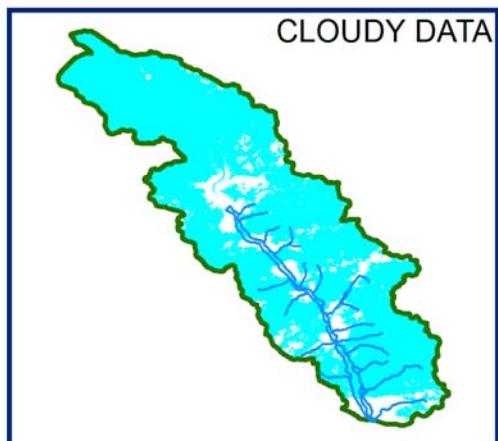


DATA USED
26 MAY 2010
31 MAY 2010

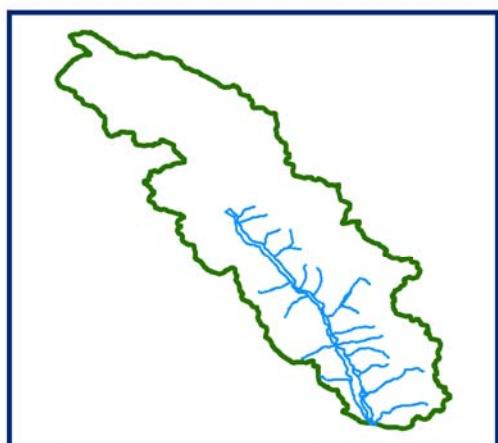
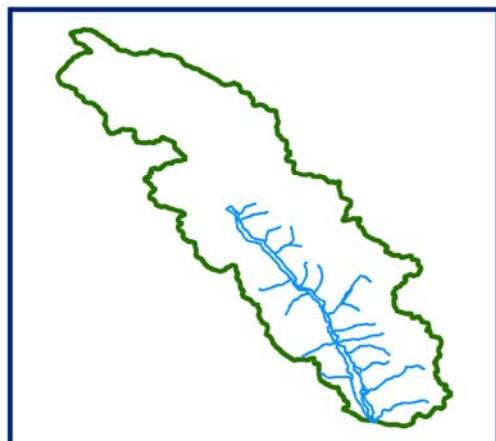


SNOW COVER MAP:

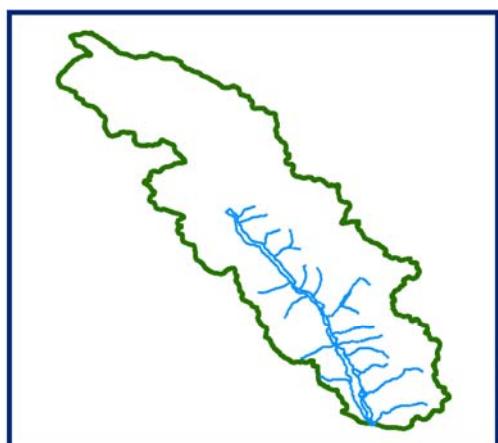
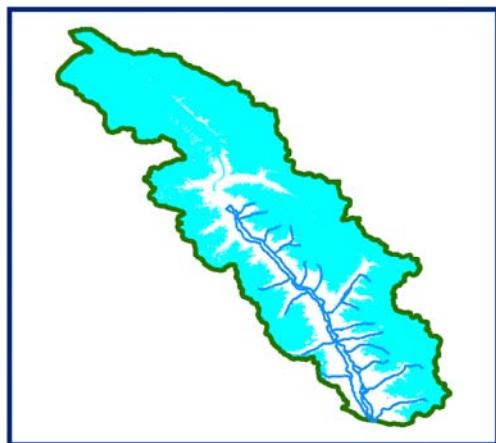
NUBRA BASIN



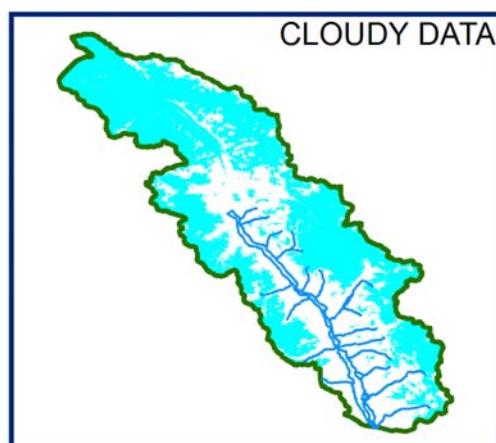
05 JUNE 2010



DATA NOT AVAILABLE



DATA NOT AVAILABLE



29 JUNE 2010



048 162432
Kilometers

A coordinate reference (048 162432) and a scale bar labeled "Kilometers".

10 DAILY SNOW COVER MAP: NUBRA BASIN



DATA NOT AVAILABLE



**DATA USED
20 JUNE 2010**



DATA NOT AVAILABLE



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 2009							
1	03-Oct-09	5327	20	4	18-Oct-09	16404	60
2	04-Oct-09	4446	16	5	27-Oct-09	8460	31
3	08-Oct-09	13322	49				
November 2009							
1	01-Nov-09	9875	36	4	20-Nov-09	20540	76
2	06-Nov-09	7662	28	5	21-Nov-09	19730	73
3	11-Nov-09	17222	64	6	25-Nov-09	14158	52
December 2009							
1	14-Dec-09	22479	83	3	24-Dec-09	21521	79
2	19-Dec-09	21662	80	4	29-Dec-09	17435	64
January 2010							
1	02-Jan-10	20625	76	3	26-Jan-10	19340	71
2	07-Jan-10	21557	79	4	31-Jan-10	19281	71
February 2010							
1	05-Feb-10	20539	76	2	10-Feb-10	24128	89
March 2010							
1	11-Mar-10	20635	76	3	20-Mar-10	17688	65
2	15-Mar-10	19677	73				
MAY 2010							
1	02-May-10	15675	58	4	26-May-10	16199	60
2	21-May-10	17835	66	5	31-May-10	16492	61
3	22-May-10	17998	66				
JUNE 2010							
1	05-Jun-10	18104	67	3	29-Jun-10	8887	33
2	20-Jun-10	12629	47				

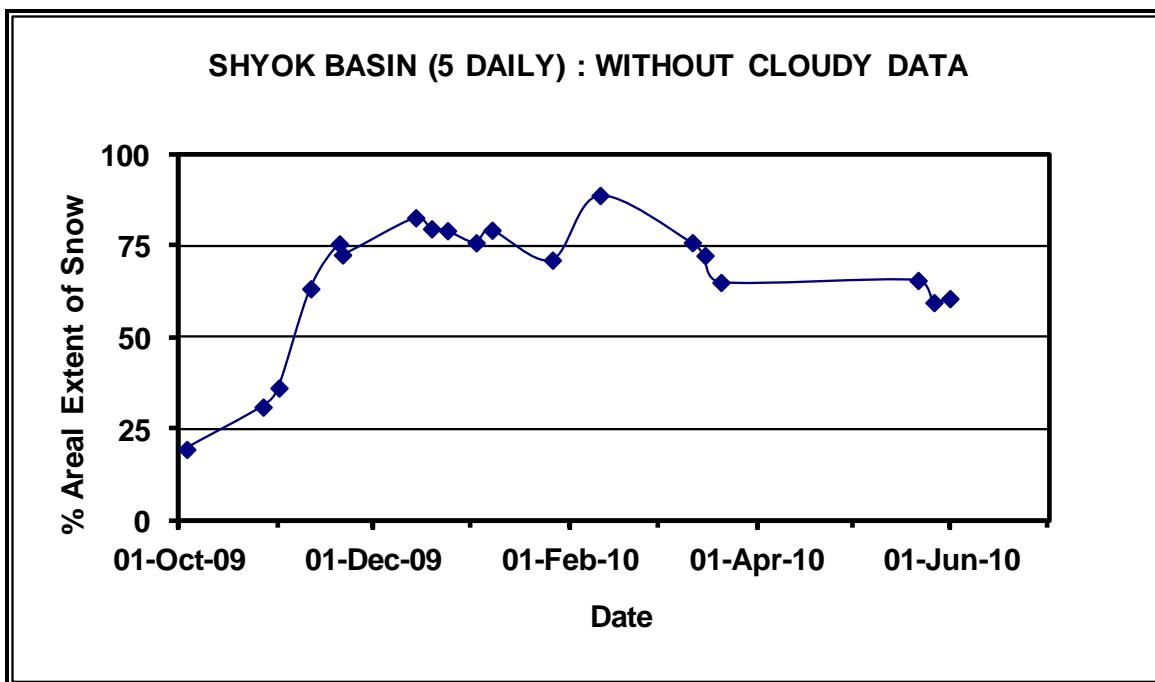
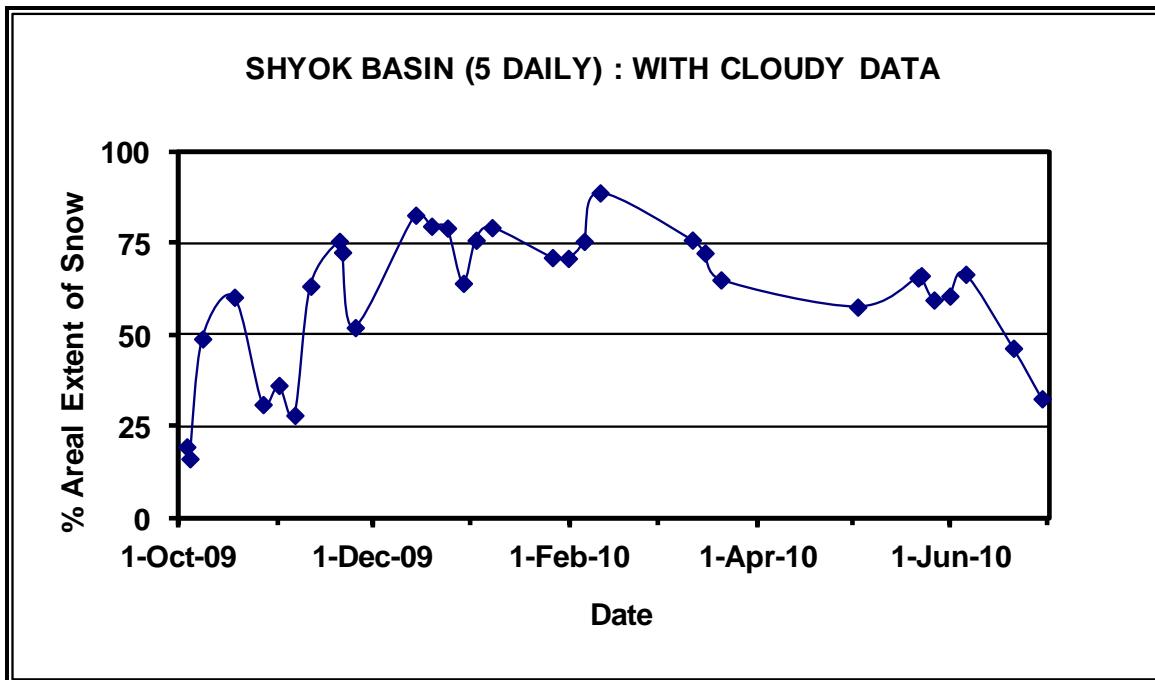
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHYOK

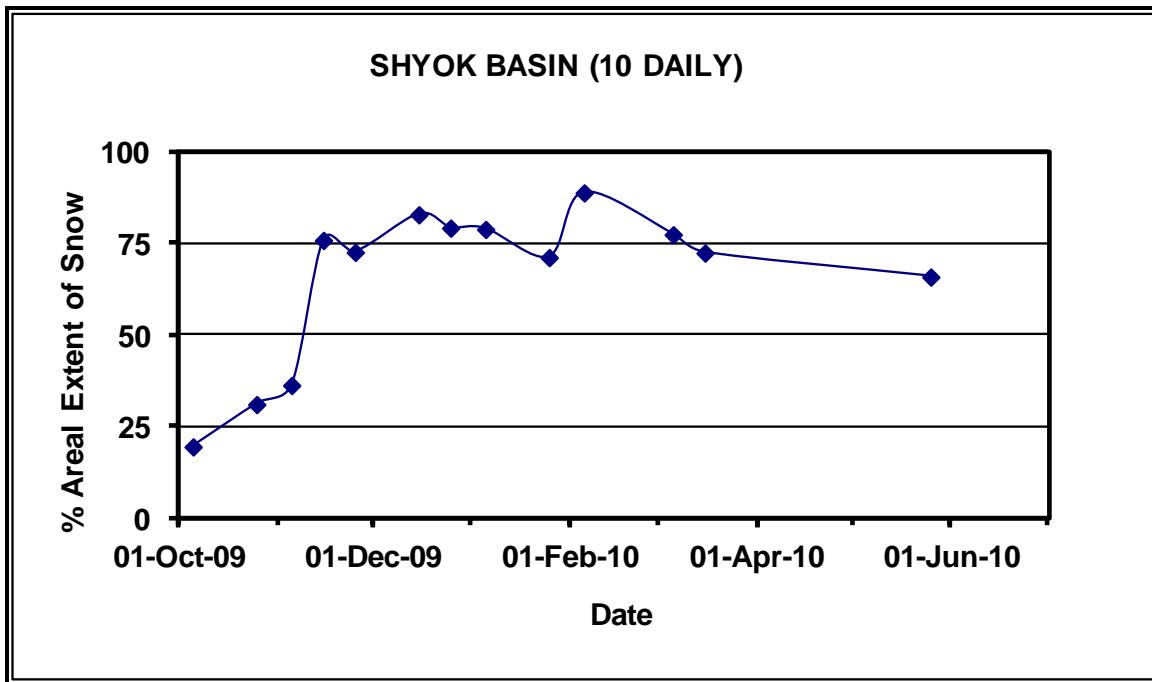
BASIN AREA: 27120 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	03-Oct-09	5327	20	2	25-Oct-09	8460	31
November 2009							
1	01-Nov-09	9875	36	3	25-Nov-09	19730	73
2	15-Nov-09	20611	76				
December 2009							
1	19-Dec-09	22510	83	2	24-Dec-09	21521	79
January 2010							
1	07-Jan-10	21425	79	2	25-Jan-10	19340	71
February 2010							
1	05-Feb-10	24128	89				
March 2010							
1	11-Mar-10	21033	78	2	11-Mar-10	19677	73
May 2010							
1	31-May-10	17899	66				

Snow cover depletion curve



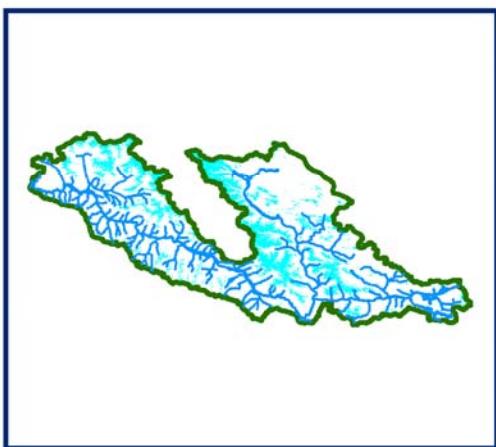
Snow cover depletion curve



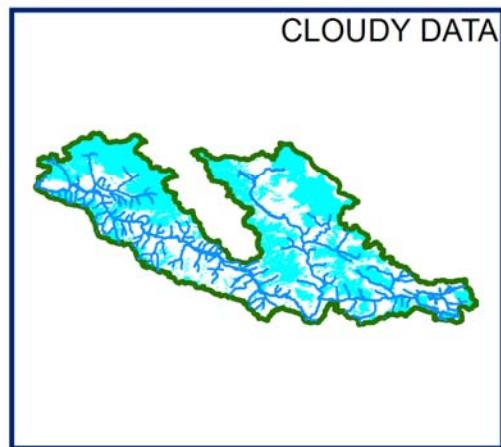
SNOW COVER MAP

SNOW COVER MAP:

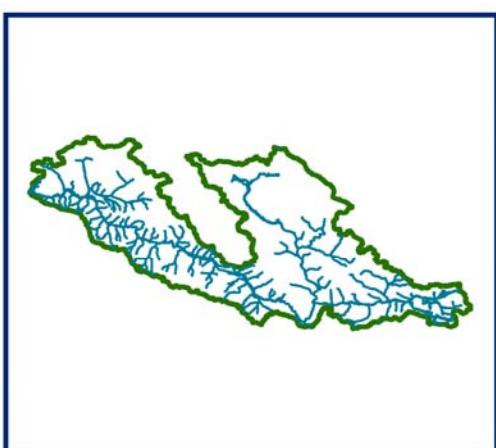
SHYOK BASIN



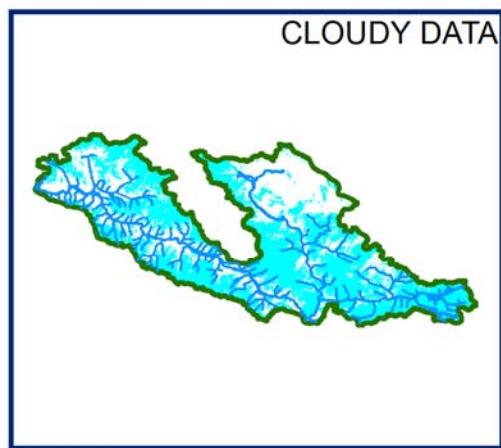
03 OCTOBER 2009



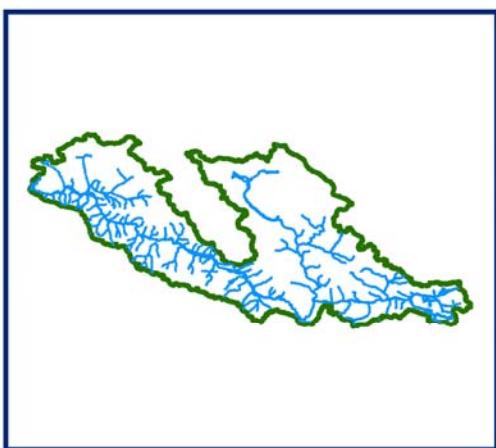
08 OCTOBER 2009



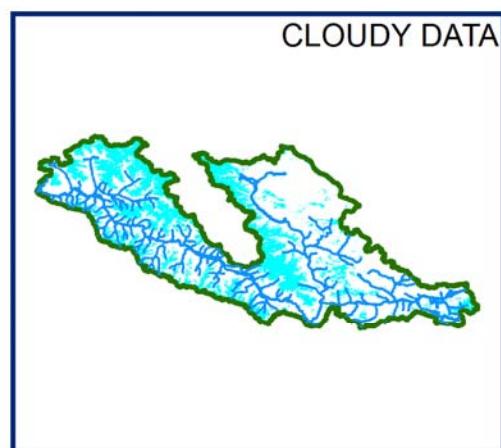
DATA NOT AVAILABLE



18 OCTOBER 2009



DATA NOT AVAILABLE



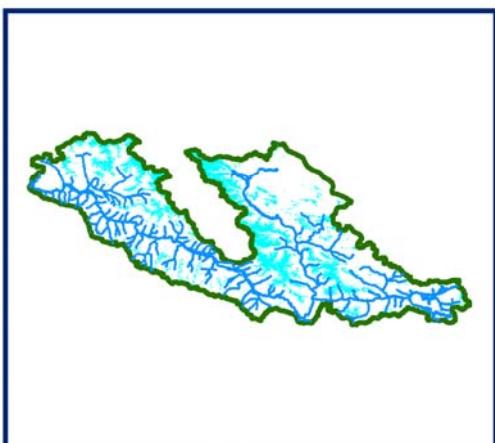
27 OCTOBER 2009



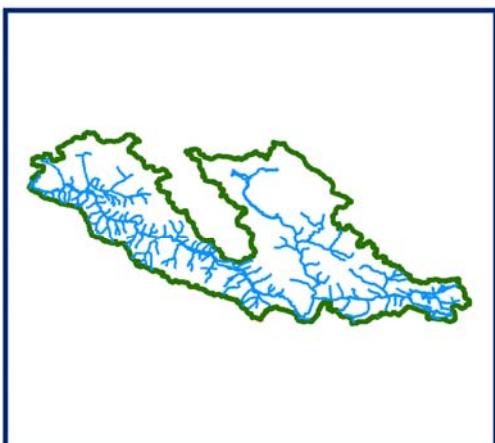
SNOW

0225507500
 Kilometers

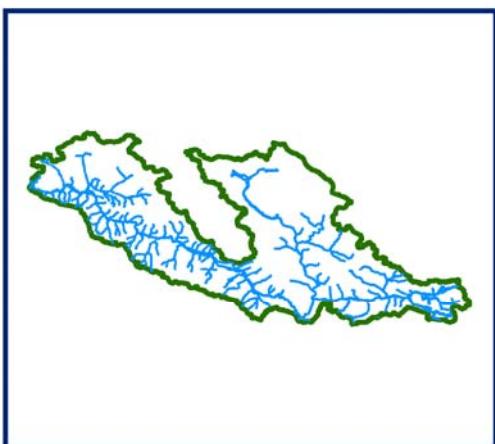
10 DAILY SNOW COVER MAP: SHYOK BASIN



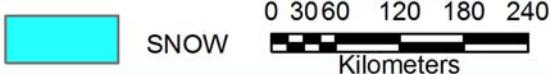
DATA USED
03 OCTOBER 2009



DATA NOT AVAILABLE

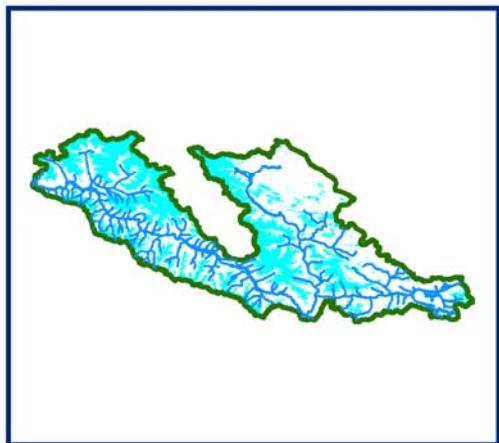


DATA NOT AVAILABLE

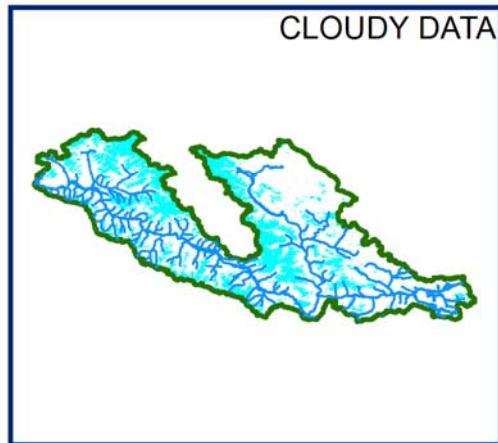


SNOW COVER MAP:

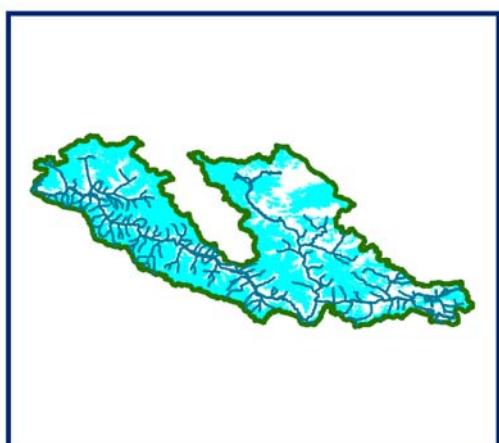
SHYOK BASIN



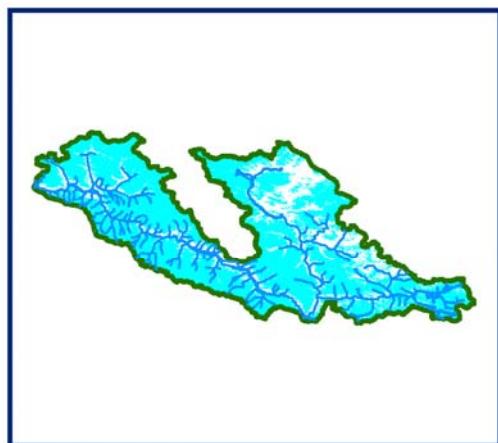
01 NOVEMBER 2009



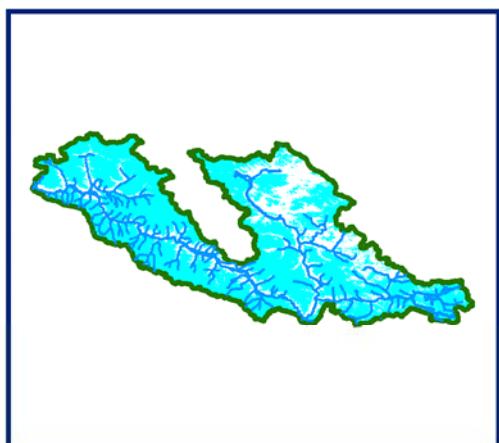
06 NOVEMBER 2009



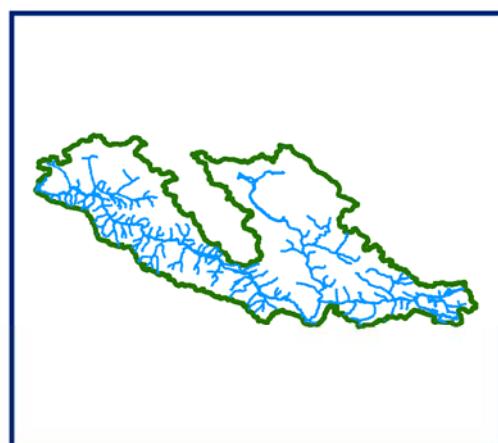
11 NOVEMBER 2009



20 NOVEMBER 2009



21 NOVEMBER 2009



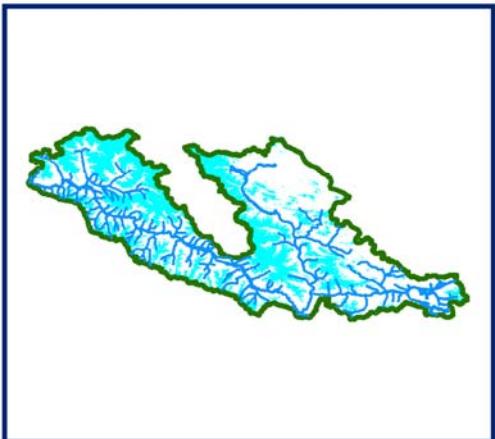
DATA NOT AVAILABLE



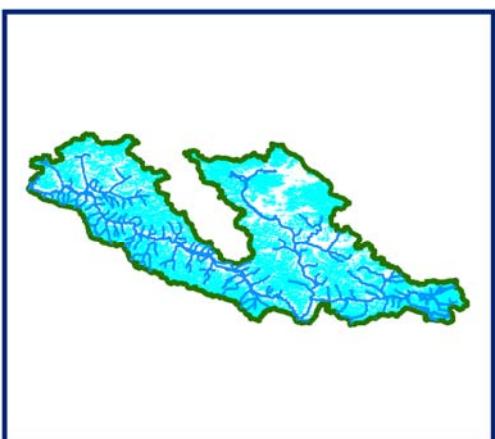
SNOW

02255075100
 Kilometers

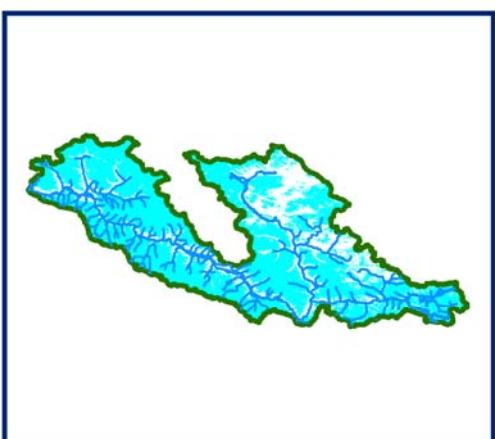
10 DAILY SNOW COVER MAP: SHYOK BASIN



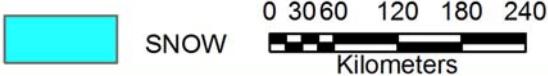
DATA USED
01 NOVEMBER 2009



DATA USED
11 NOVEMBER 2009
20 NOVEMBER 2009

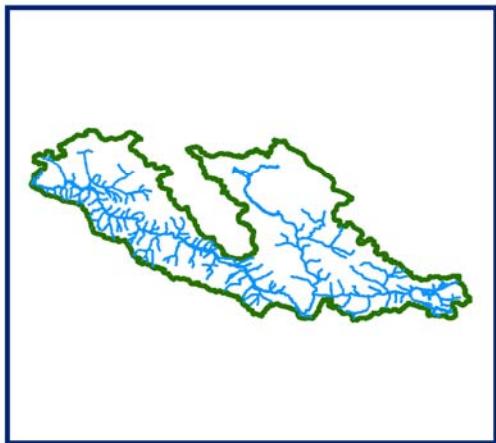


DATA USED
21 NOVEMBER 2009

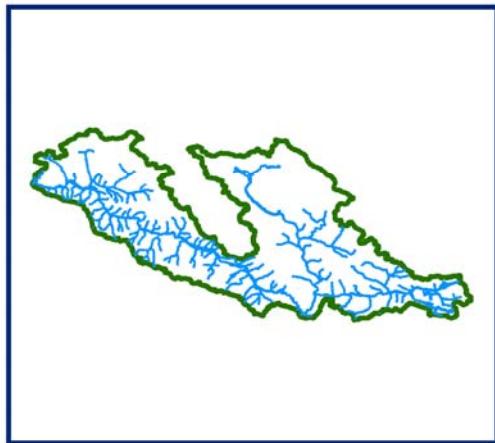


SNOW COVER MAP:

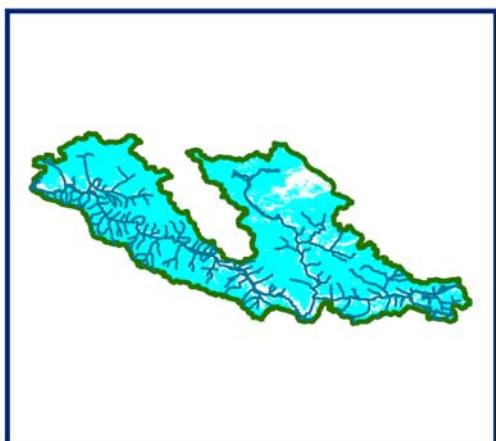
SHYOK BASIN



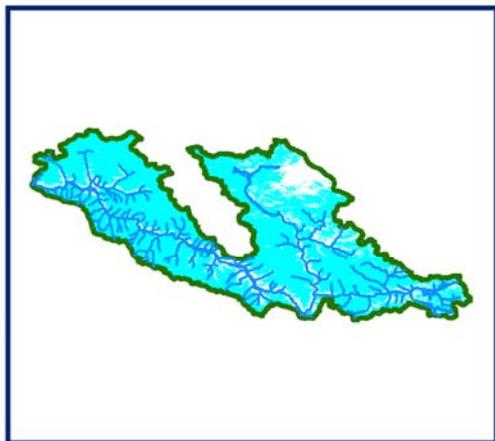
DATA NOT AVAILABLE



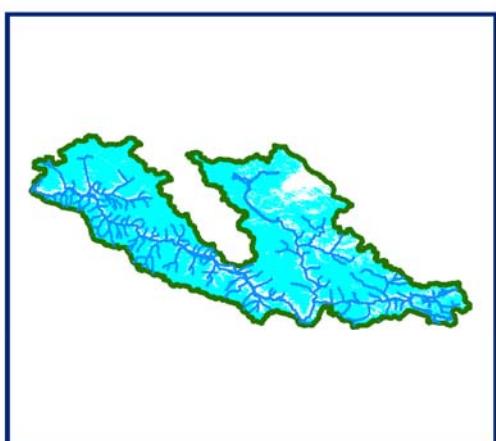
DATA NOT AVAILABLE



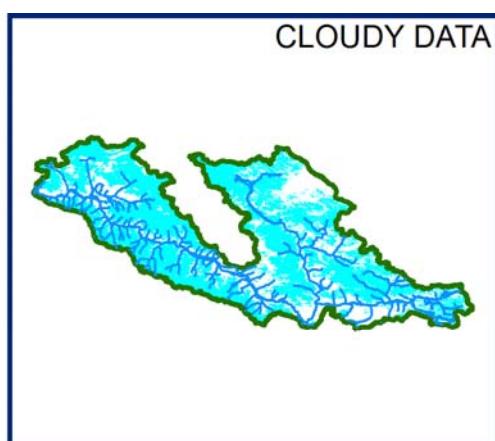
14 DECEMBER 2009



19 DECEMBER 2009



24 DECEMBER 2009



CLOUDY DATA

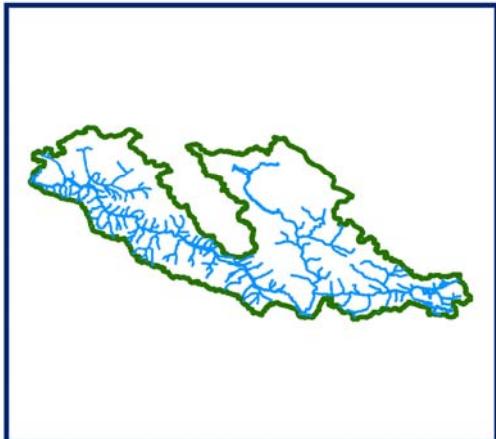
29 DECEMBER 2009



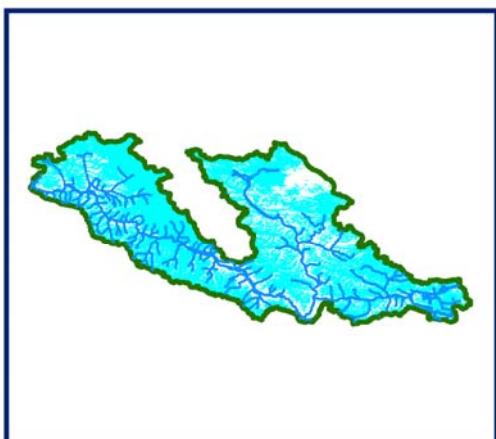
SNOW

02255075.00
 Kilometers

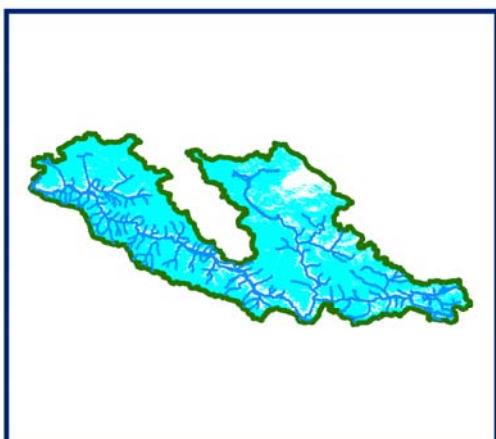
10 DAILY SNOW COVER MAP: SHYOK BASIN



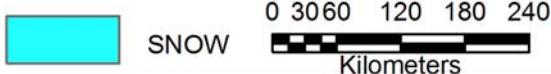
DATA NOT AVAILABLE



**DATA USED
14 DECEMBER 2009
19 DECEMBER 2009**

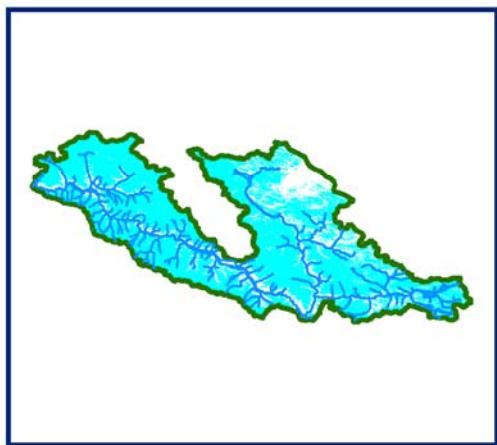


**DATA USED
24 DECEMBER 2009**

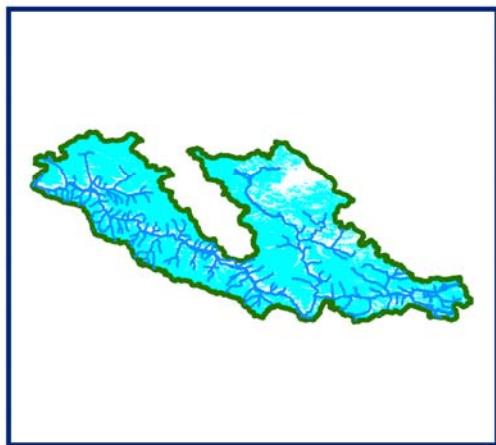


SNOW COVER MAP:

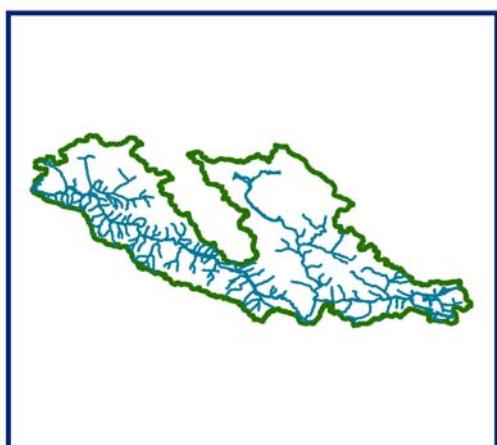
SHYOK BASIN



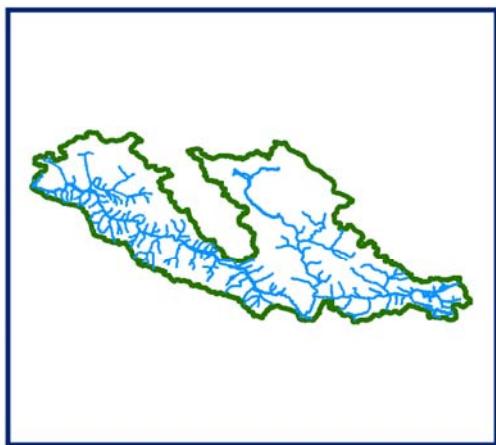
02 JANUARY 2010



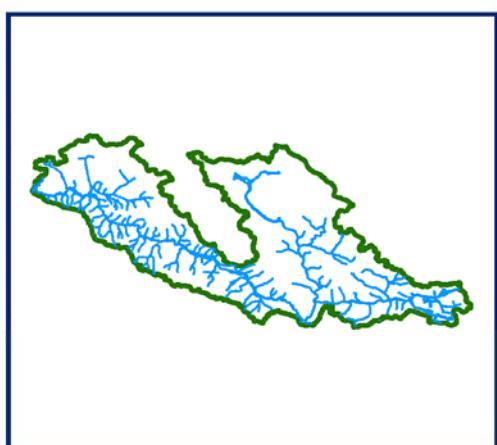
07 JANUARY 2010



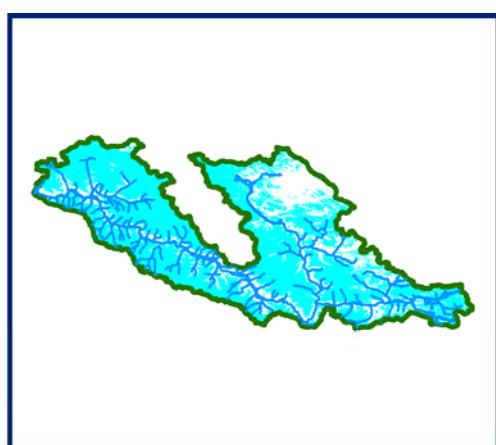
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



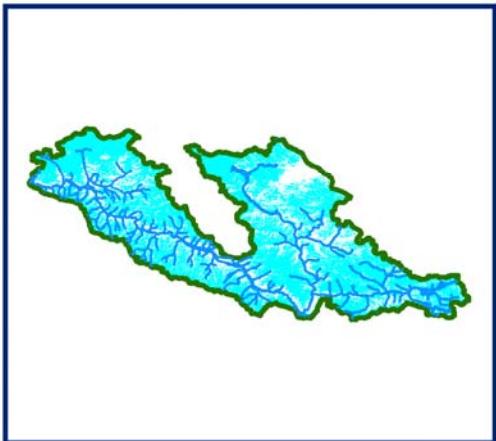
26 JANUARY 2010



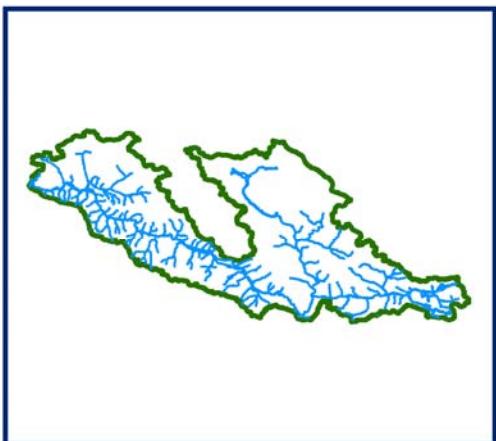
SNOW

02255075.00
 Kilometers

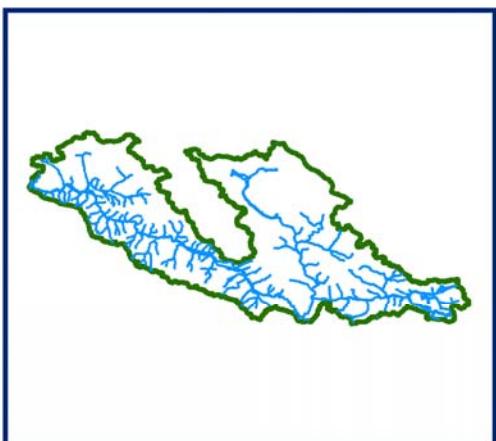
10 DAILY SNOW COVER MAP: SHYOK BASIN



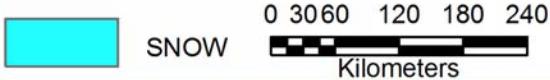
DATA USED
07 JANUARY 2010



DATA NOT AVAILABLE

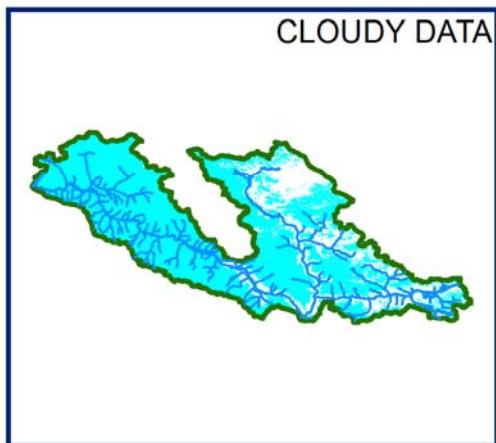


DATA NOT AVAILABLE

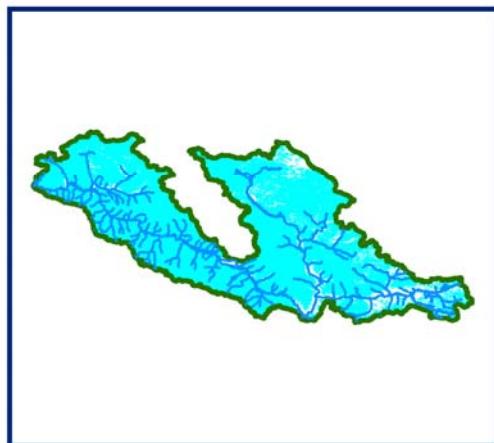


SNOW COVER MAP:

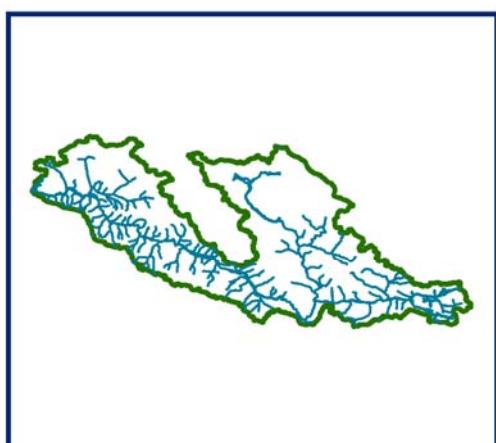
SHYOK BASIN



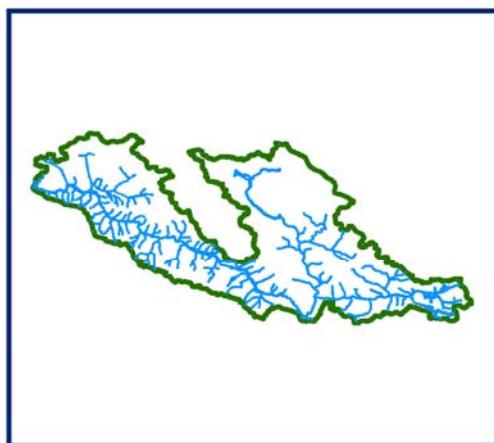
05 FEBRUARY 2010



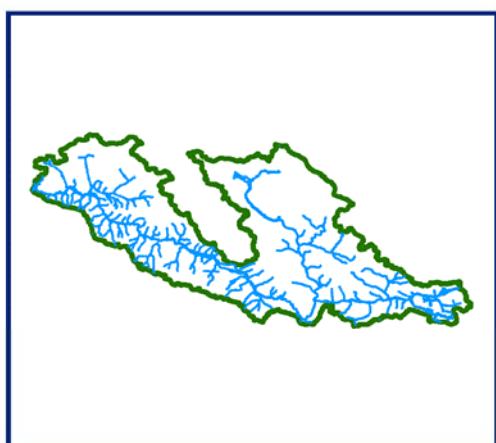
10 FEBRUARY 2010



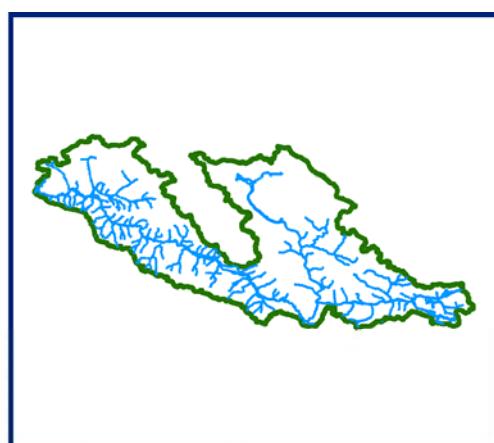
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



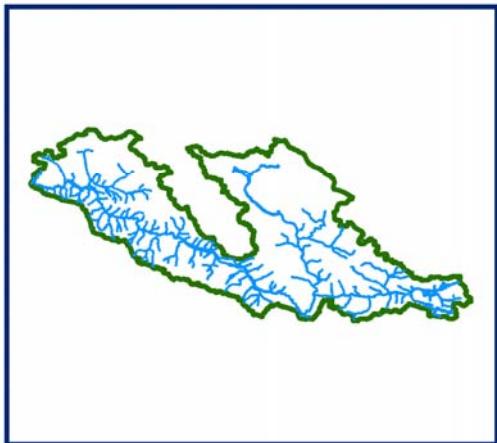
SNOW

02255075.00

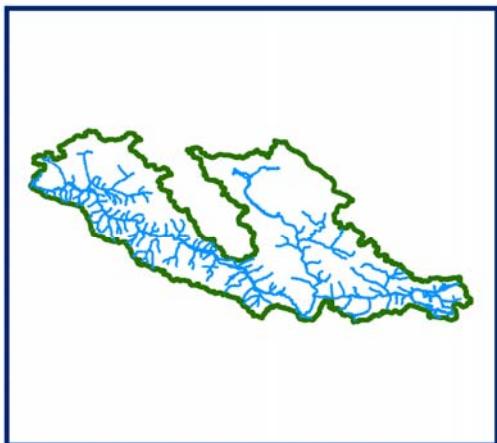


Kilometers

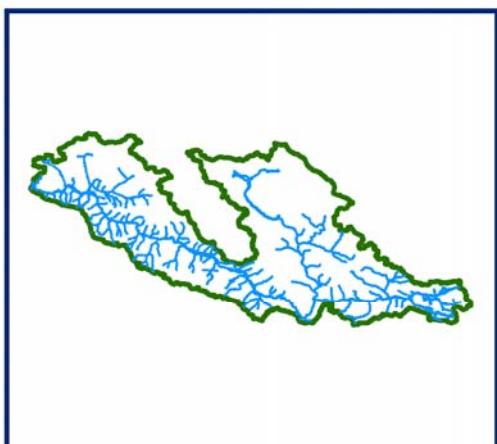
10 DAILY SNOW COVER MAP: SHYOK BASIN



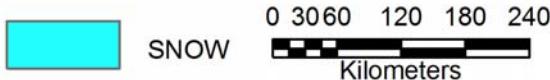
DATA NOT AVAILABLE



DATA NOT AVAILABLE

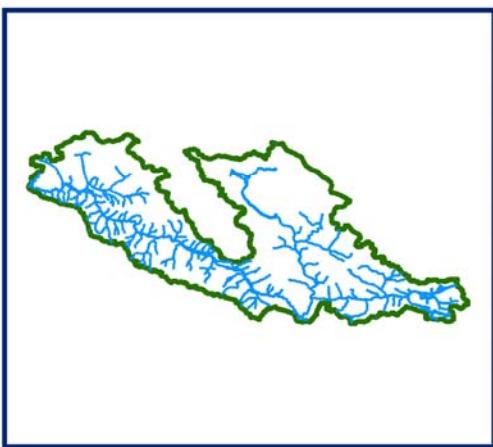


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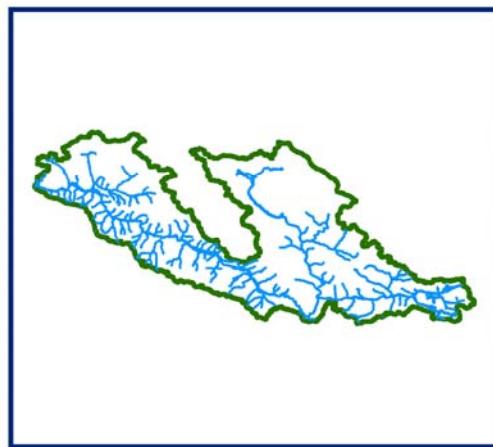


SNOW COVER MAP:

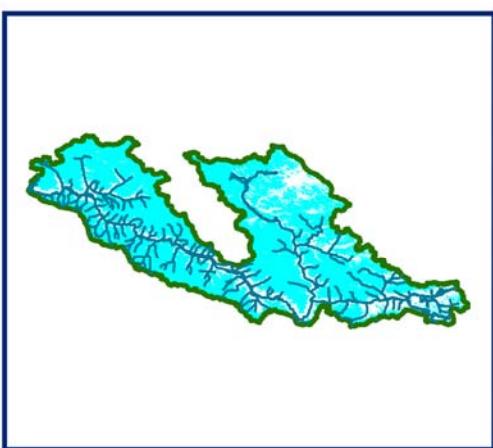
SHYOK BASIN



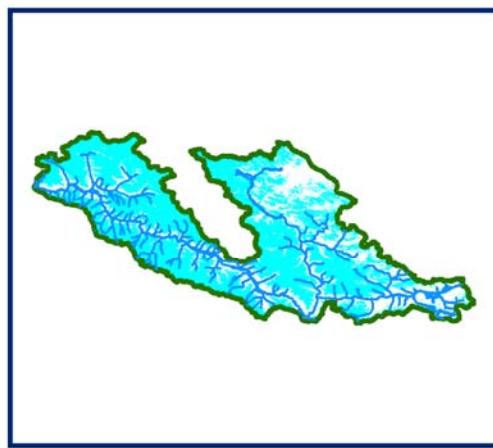
DATA NOT AVAILABLE



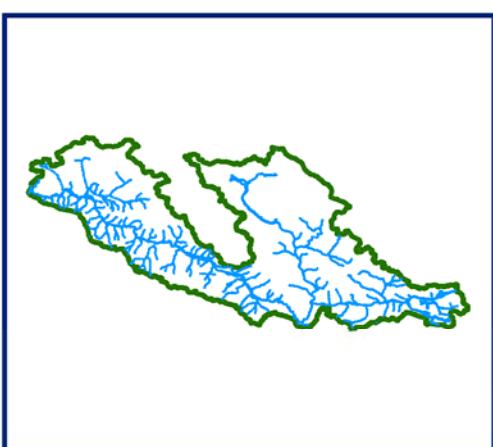
DATA NOT AVAILABLE



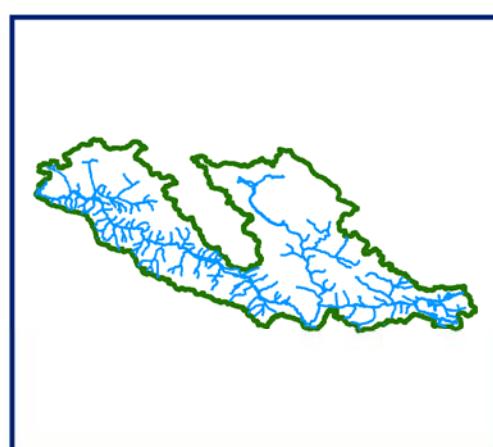
11 MARCH 2010



20 MARCH 2010



DATA NOT AVAILABLE



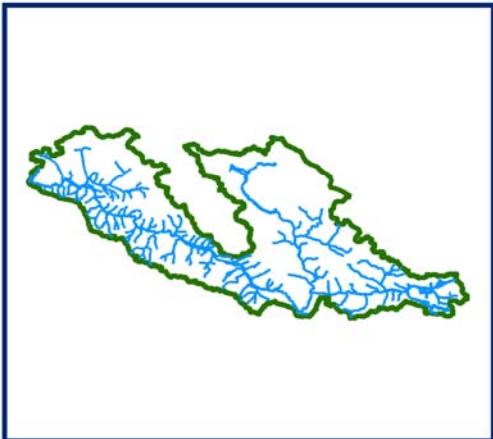
DATA NOT AVAILABLE



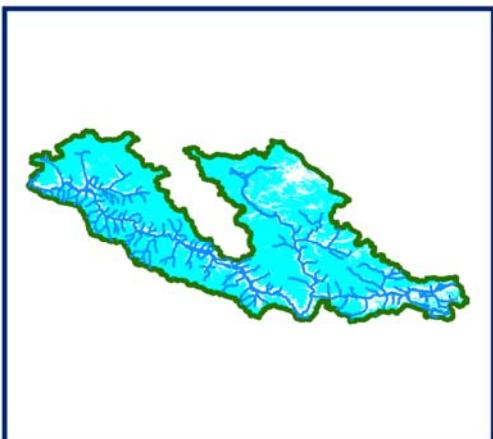
SNOW

0255075.00
 Kilometers

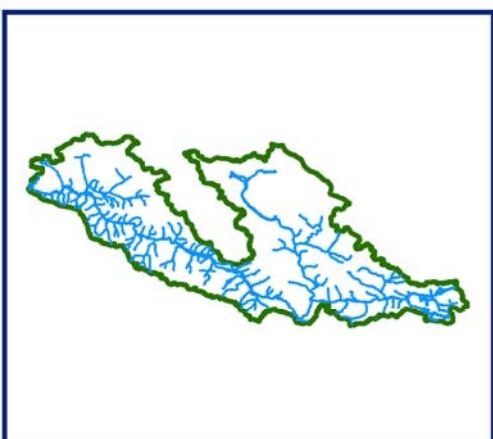
10 DAILY SNOW COVER MAP: SHYOK BASIN



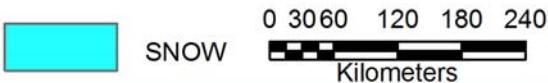
DATA NOT AVAILABLE



**DATA USED
11 MARCH 2010
20 MARCH 2010**

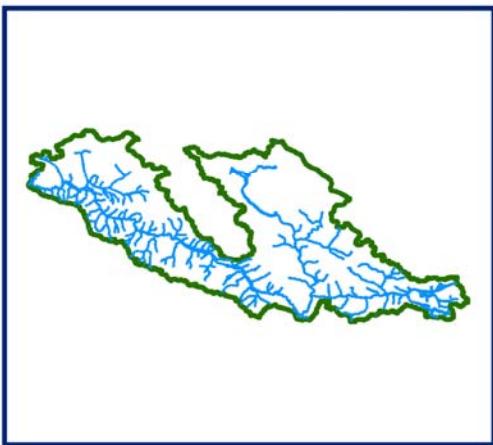


DATA NOT AVAILABLE

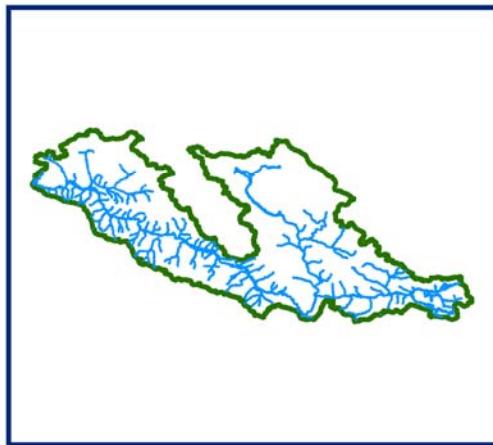


SNOW COVER MAP:

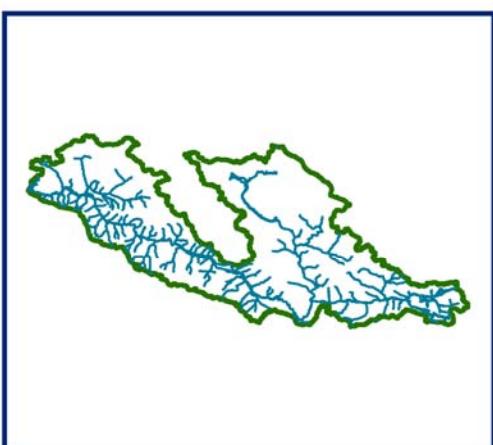
SHYOK BASIN



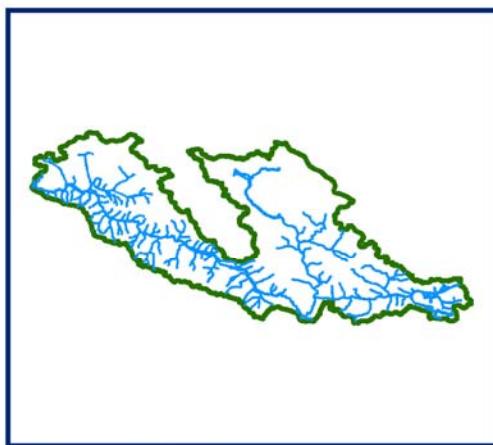
DATA NOT AVAILABLE



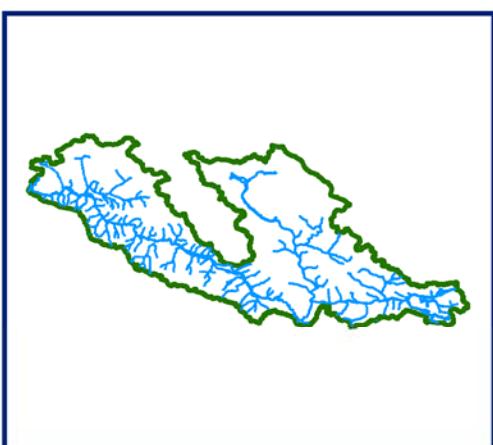
DATA NOT AVAILABLE



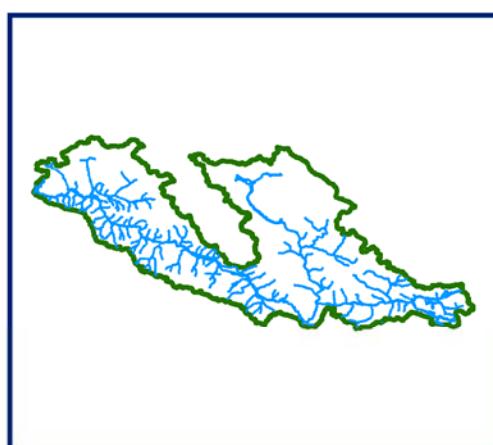
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DATA NOT AVAILABLE



DATA NOT AVAILABLE



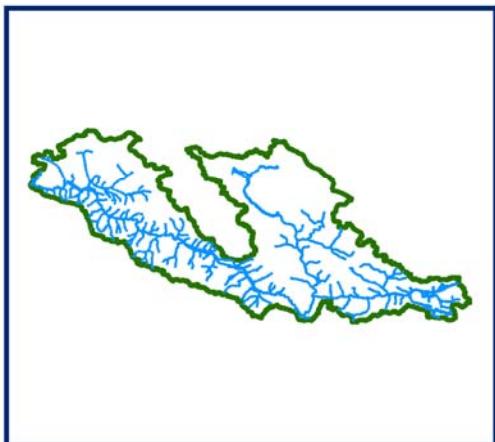
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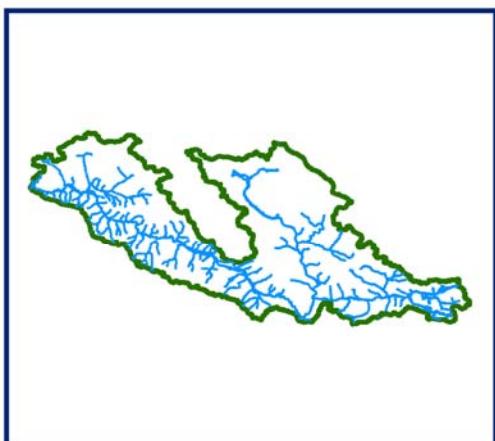
SNOW

02255075.00
 Kilometers

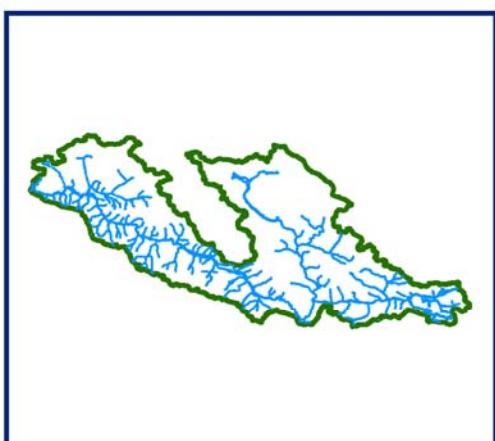
10 DAILY SNOW COVER MAP: SHYOK BASIN



DATA NOT AVAILABLE



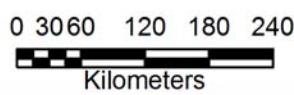
DATA NOT AVAILABLE



DATA NOT AVAILABLE

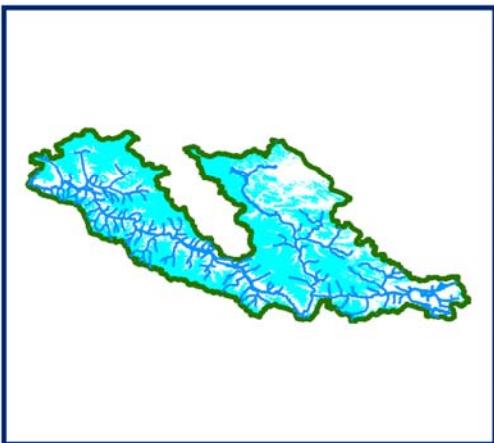


SNOW

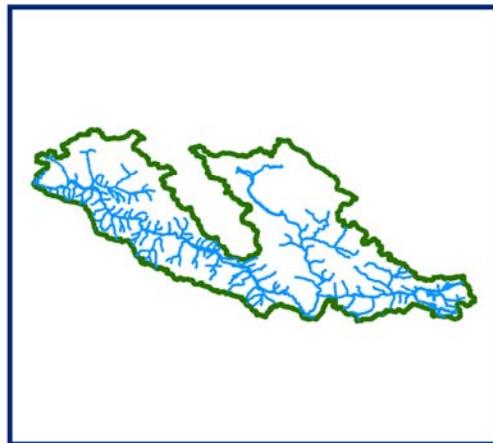


SNOW COVER MAP:

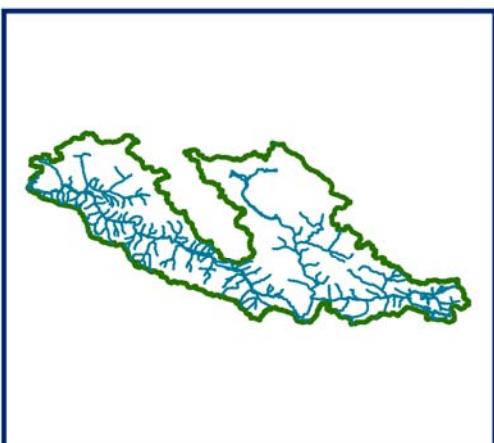
SHYOK BASIN



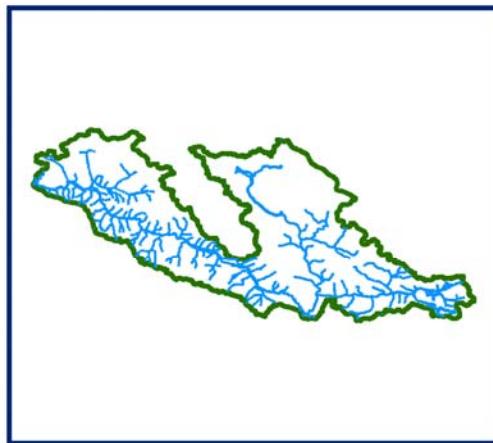
02 MAY 2010



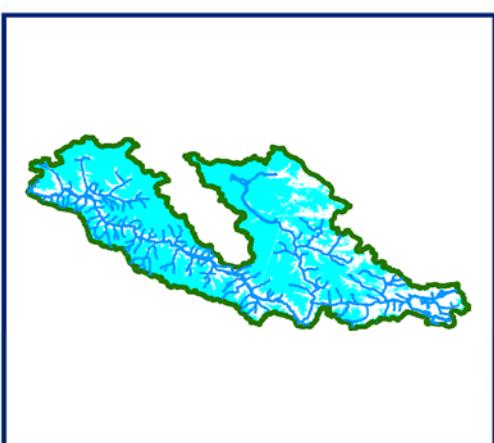
DATA NOT AVAILABLE



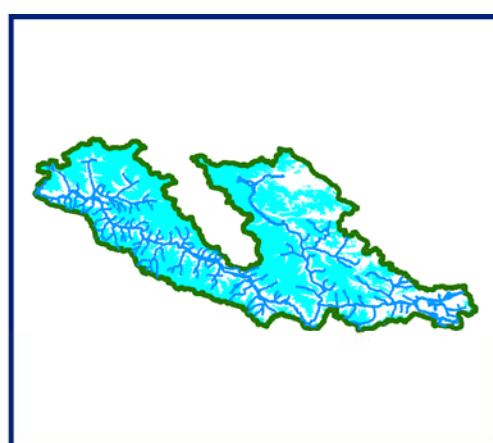
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 MAY 2010



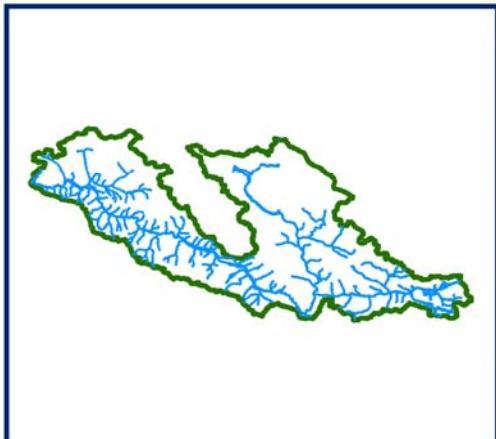
31 MAY 2010



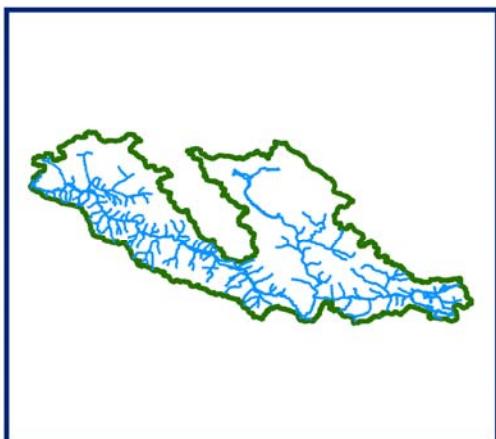
SNOW

025507500
 Kilometers

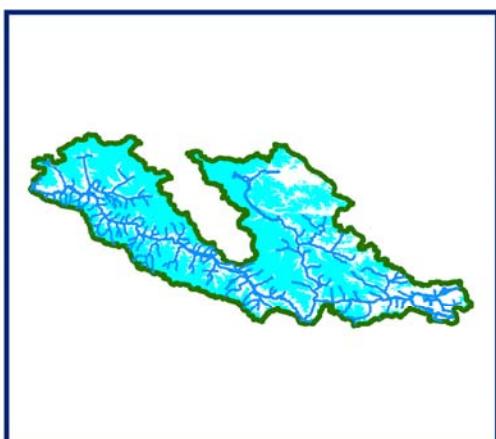
10 DAILY SNOW COVER MAP: SHYOK BASIN



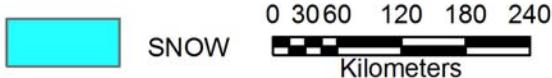
DATA NOT AVAILABLE



DATA NOT AVAILABLE



**DATA USED
26 MAY 2010
31 MAY 2010**



SNOW COVER MAP:

SHYOK BASIN



CLOUDY DATA



05 JUNE 2010

DATA NOT AVAILABLE



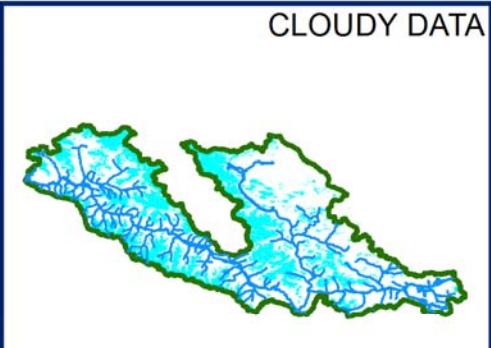
DATA NOT AVAILABLE



20 JUNE 2010



DATA NOT AVAILABLE



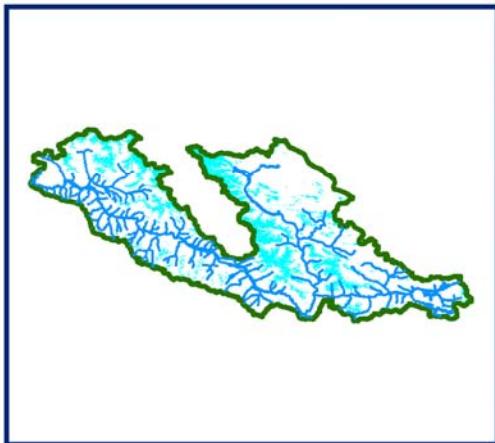
29 JUNE 2010



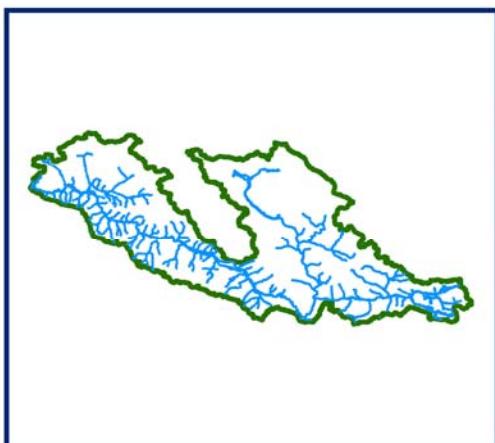
SNOW

10255075.00
 Kilometers

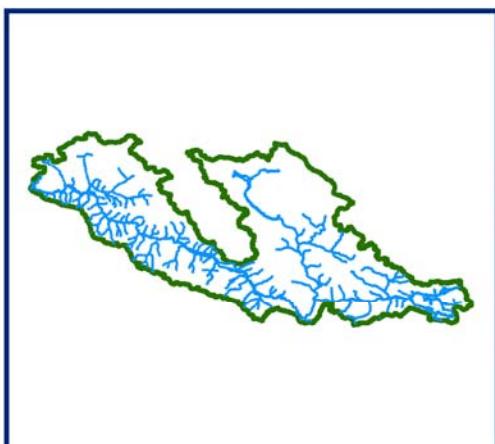
10 DAILY SNOW COVER MAP: SHYOK BASIN



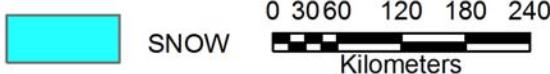
DATA USED
03 OCTOBER 2009



DATA NOT AVAILABLE



DATA NOT AVAILABLE



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 2009							
1	03-Oct-09	2186	31	4	12-Oct-09	4202	60
2	07-Oct-09	3288	47	5	17-Oct-09	3812	54
3	08-Oct-09	6200	88	6	27-Oct-09	4274	61
November 2009							
1	01-Nov-09	4692	67	5	15-Nov-09	3223	46
2	06-Nov-09	3478	49	6	20-Nov-09	5424	77
3	10-Nov-09	4162	59	7	25-Nov-09	4758	67
December 2009							
1	04-Dec-09	2343	33	5	23-Dec-09	6368	90
2	14-Dec-09	6416	91	6	24-Dec-09	6343	90
3	19-Dec-09	6369	90	7	28-Dec-09	4570	65
January 2010							
1	02-Jan-10	6282	89	4	26-Jan-10	5846	83
2	07-Jan-10	6146	87	5	31-Jan-10	6733	95
3	21-Jan-10	5387	76				
February 2010							
1	05-Feb-10	6912	98				
MARCH 2010							
1	05-Mar-10	5765	82	3	15-Mar-10	6122	87
2	11-Mar-10	6218	88	4	20-Mar-10	5998	85
APRIL 2010							
1	08-Apr-10	6223	88	2	27-Apr-10	6848	97
MAY 2010							
1	02-May-10	5230	74	3	26-May-10	5438	77
2	21-May-10	5664	80	4	31-May-10	5480	78
JUNE 2010							
1	05-Jun-10	5414	77	2	29-Jun-10	3347	47

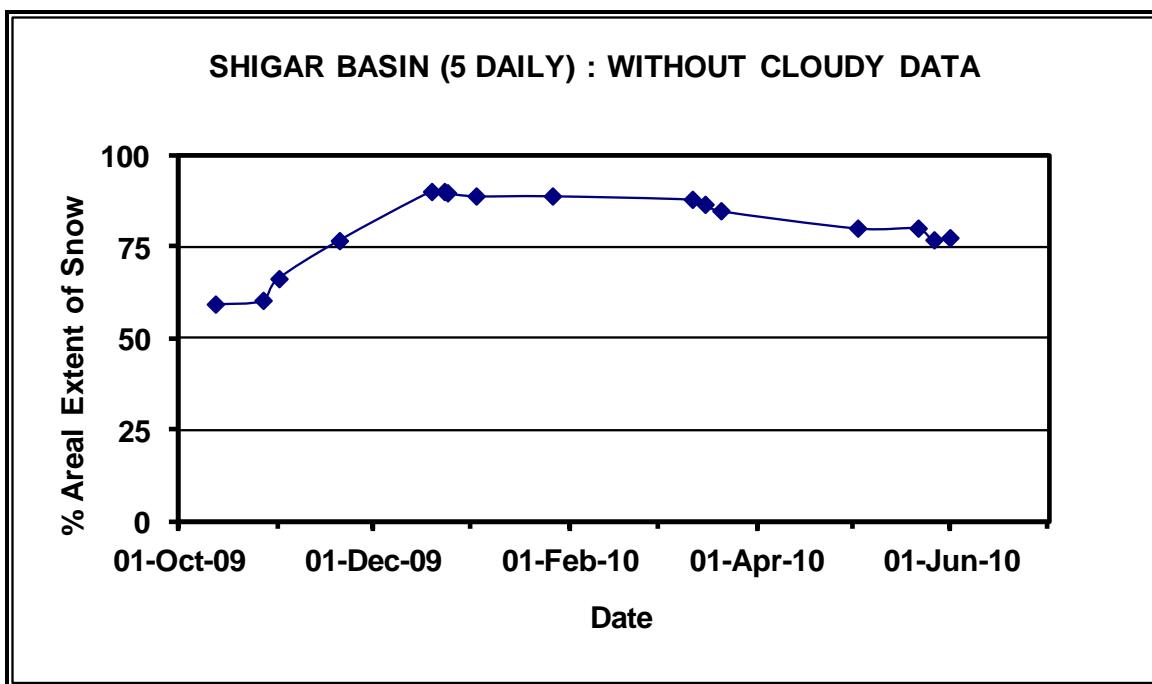
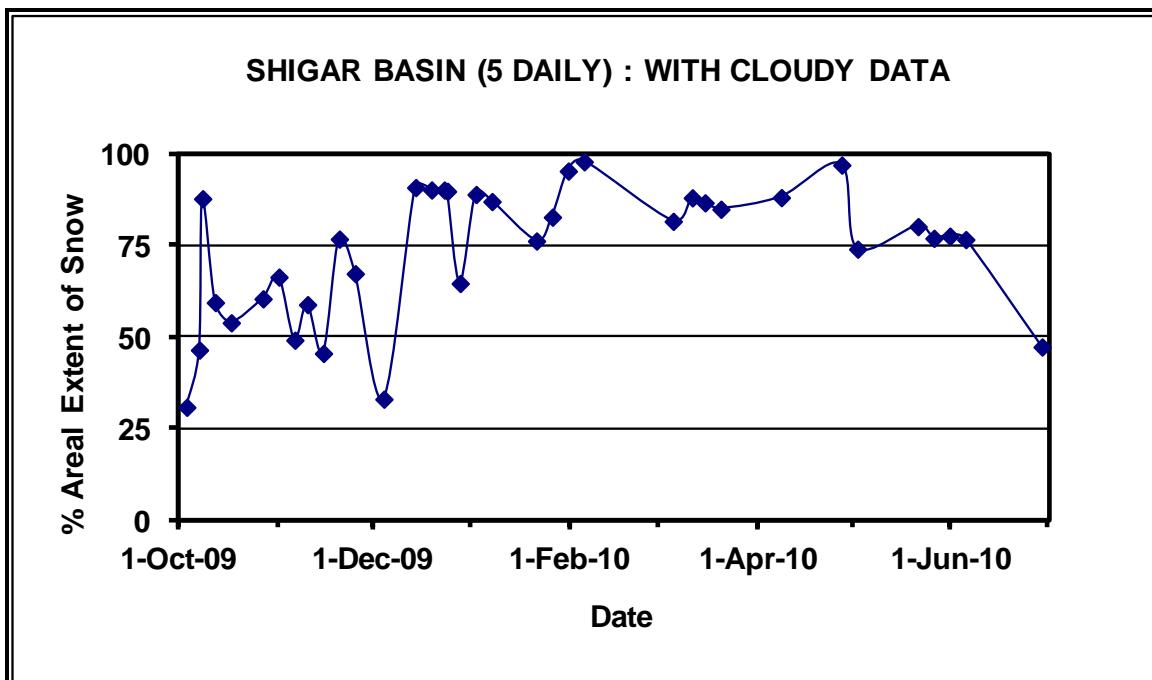
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHIGAR

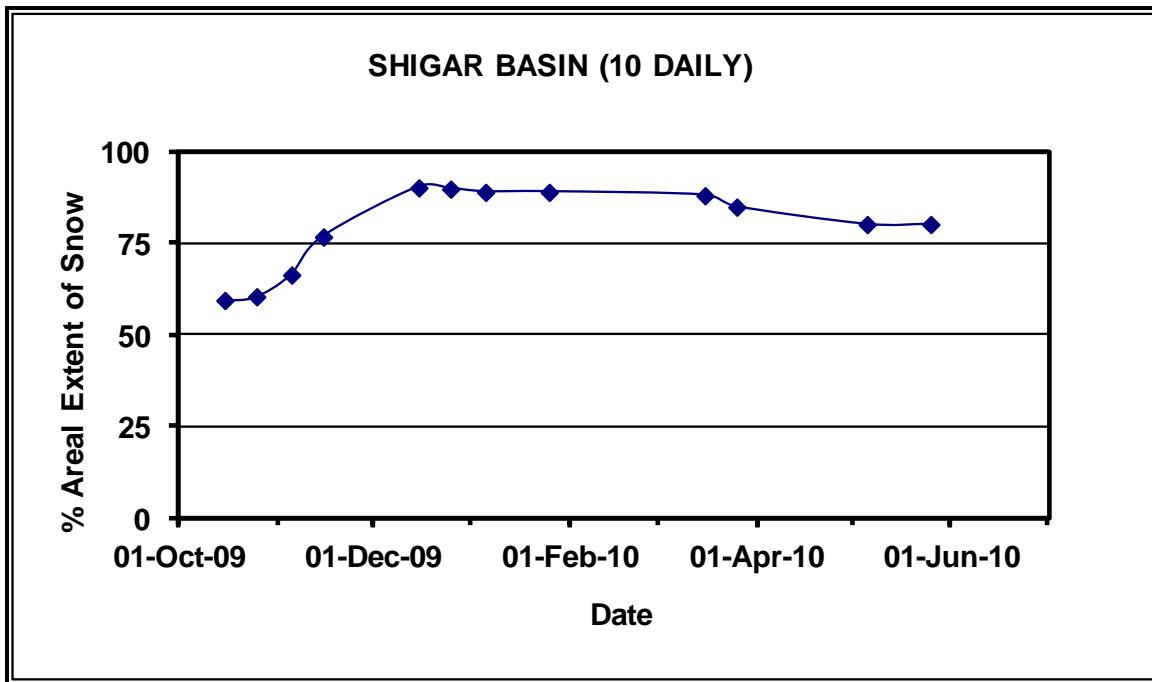
BASIN AREA: 7050 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	15-Oct-09	4202	60	2	27-Oct-09	4274	61
November 2009							
1	01-Nov-09	4692	67	2	20-Nov-09	5424	77
December 2009							
1	19-Dec-09	6369	90	2	24-Dec-09	6345	90
January 2010							
1	02-Jan-10	6282	89	2	25-Jan-10	6282	89
March 2010							
1	15-Mar-10	6218	88	2	25-Mar-10	5998	85
May 2010							
1	05-May-10	5664	80	2	25-May-10	5656	80

Snow cover depletion curve



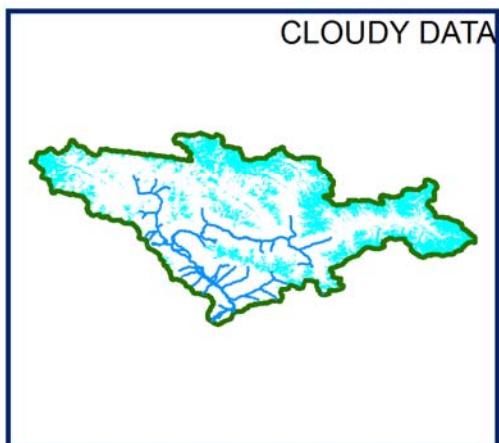
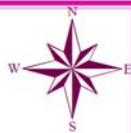
Snow cover depletion curve



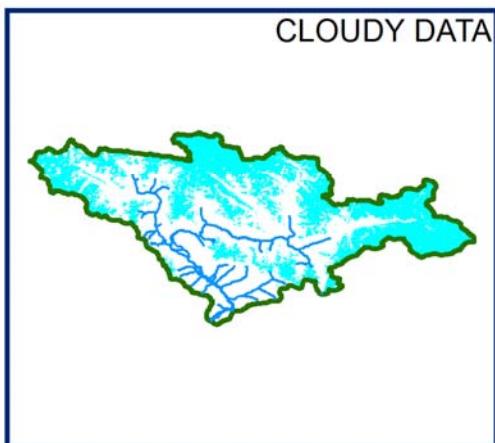
SNOW COVER MAP

SNOW COVER MAP:

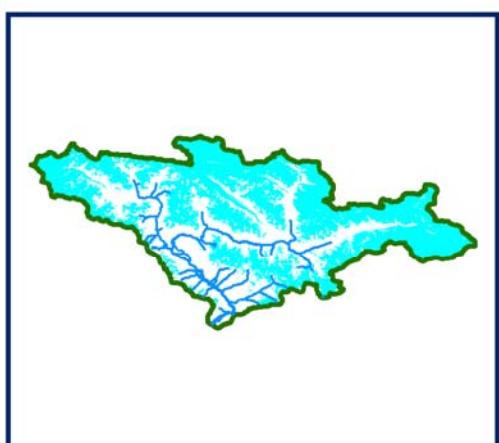
SHIGAR BASIN



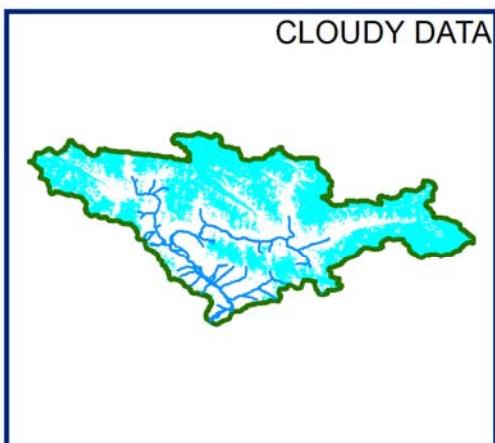
03 OCTOBER 2009



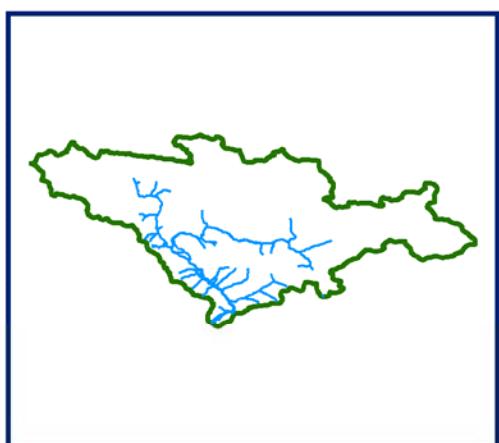
07 OCTOBER 2009



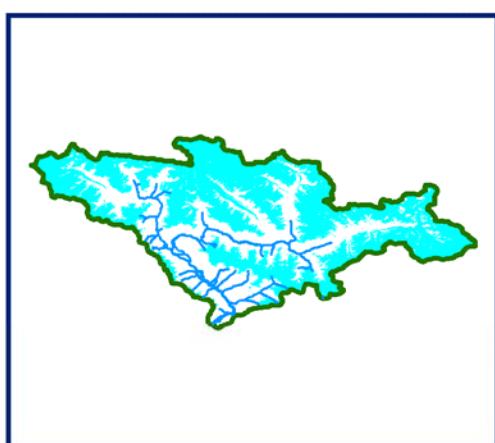
12 OCTOBER 2009



17 OCTOBER 2009



DATA NOT AVAILABLE



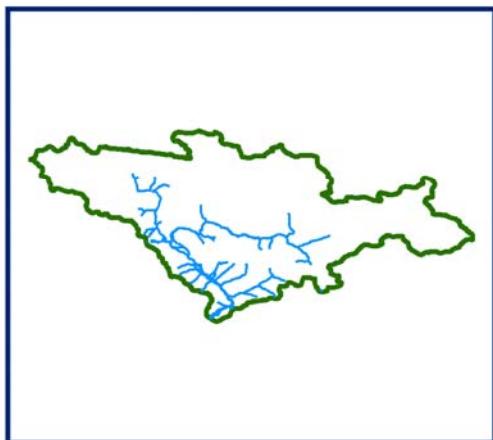
27 OCTOBER 2009



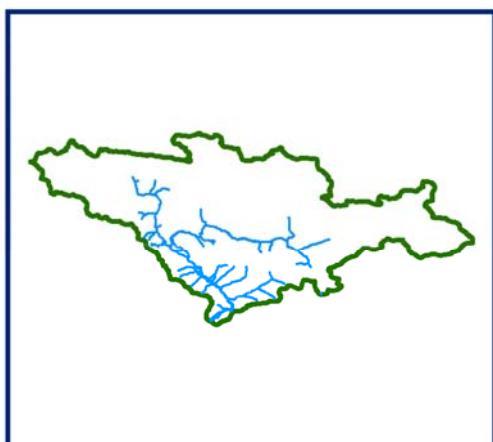
SNOW

00 02 03 04
Kilometers

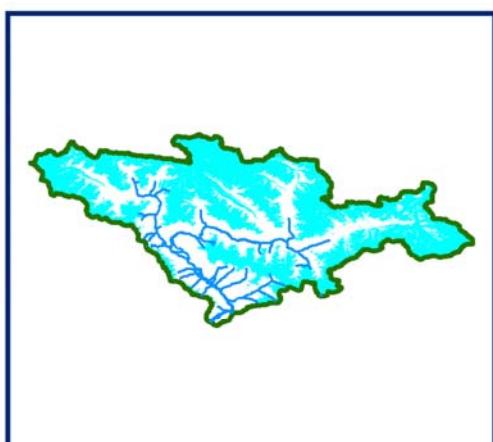
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA USED
27 OCTOBER 2009

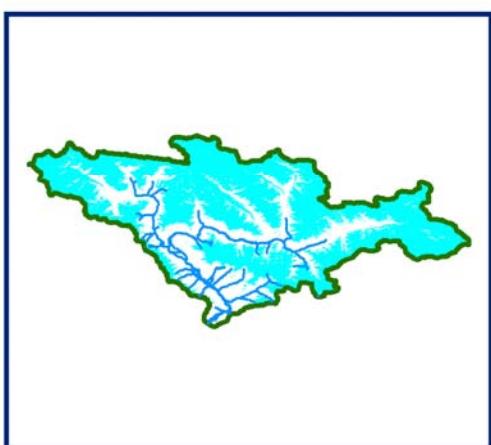


SNOW

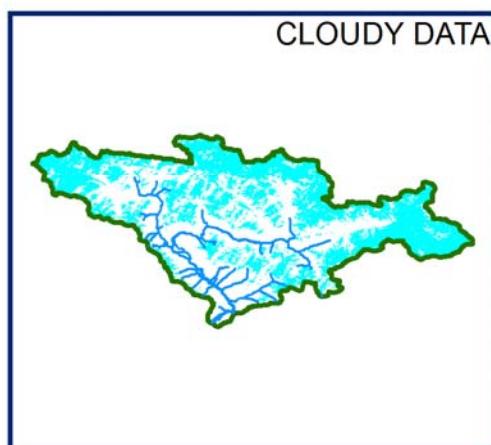


SNOW COVER MAP:

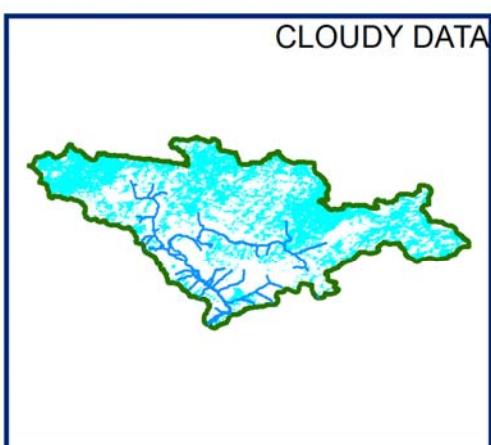
SHIGAR BASIN



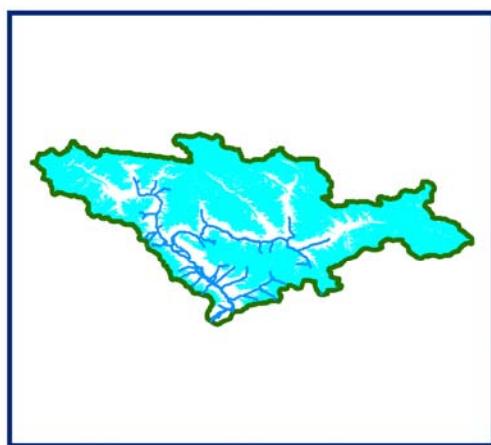
01 NOVEMBER 2009



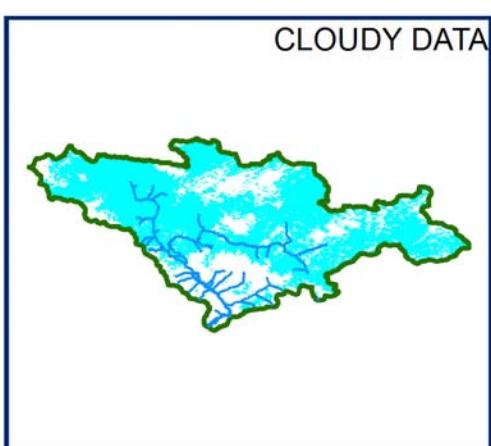
06 NOVEMBER 2009



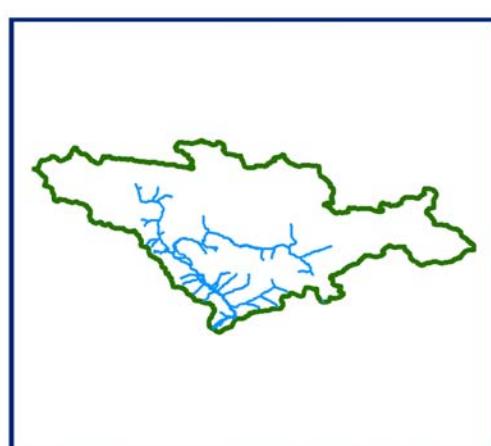
15 NOVEMBER 2009



20 NOVEMBER 2009



25 NOVEMBER 2009



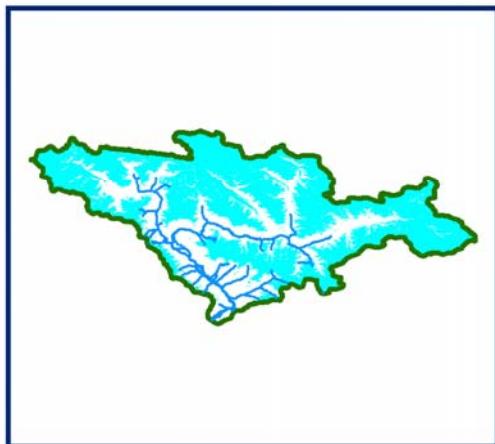
DATA NOT AVAILABLE



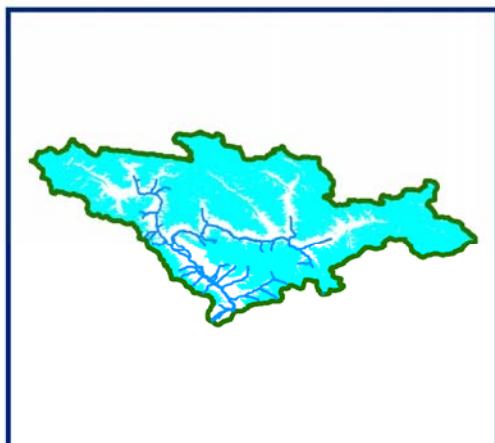
SNOW

01 02 03 04
Kilometers

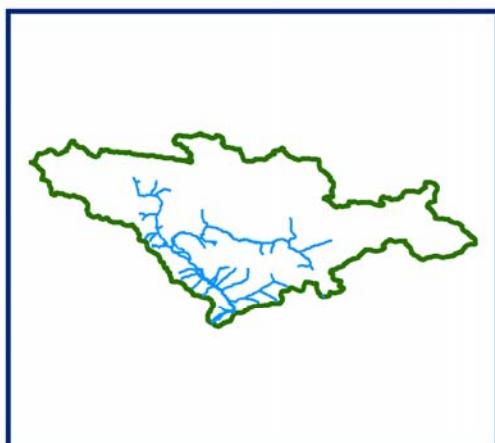
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA USED
01 NOVEMBER 2009



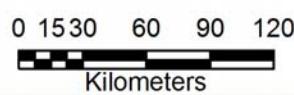
DATA USED
20 NOVEMBER 2009



DATA NOT AVAILABLE



SNOW



SNOW COVER MAP:

SHIGAR BASIN



CLOUDY DATA



04 DECEMBER 2009

DATA NOT AVAILABLE

CLOUDY DATA



14 DECEMBER 2009

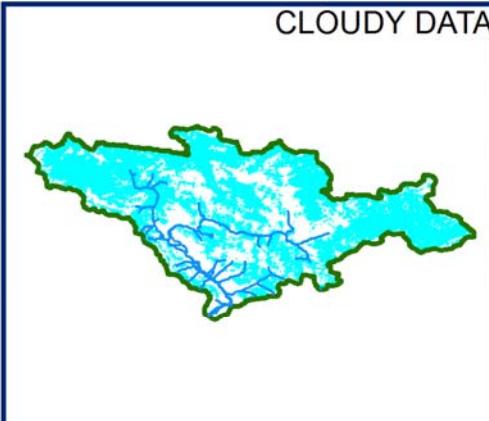


19 DECEMBER 2009

CLOUDY DATA



23 DECEMBER 2009



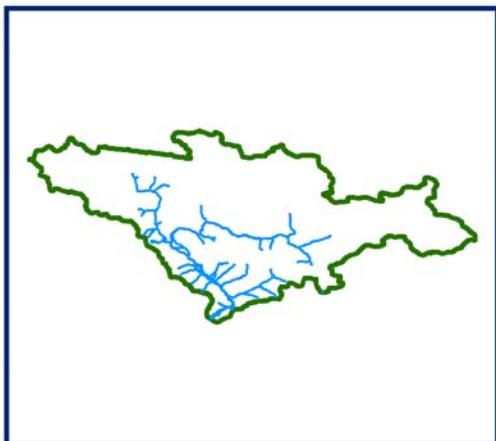
28 DECEMBER 2009



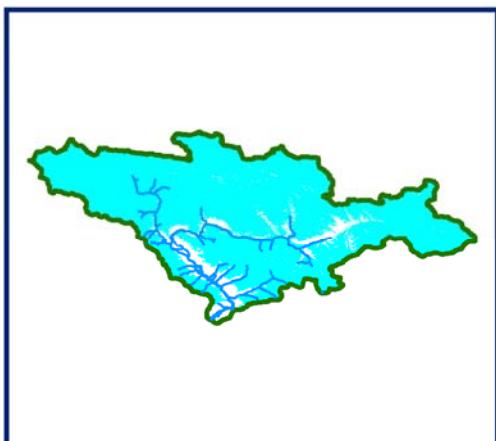
SNOW

01 02 03 04
 Kilometers

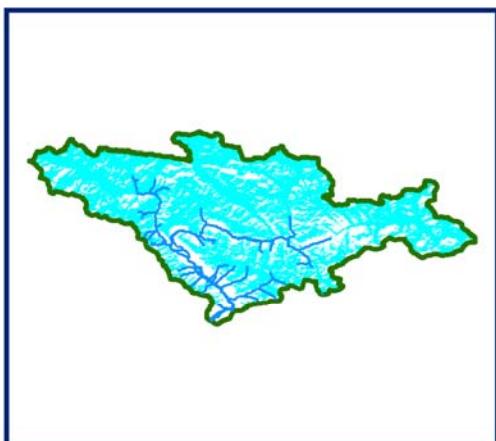
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA NOT AVAILABLE



**DATA USED
19 DECEMBER 2009**



**DATA USED
23 DECEMBER 2009
24 DECEMBER 2009**

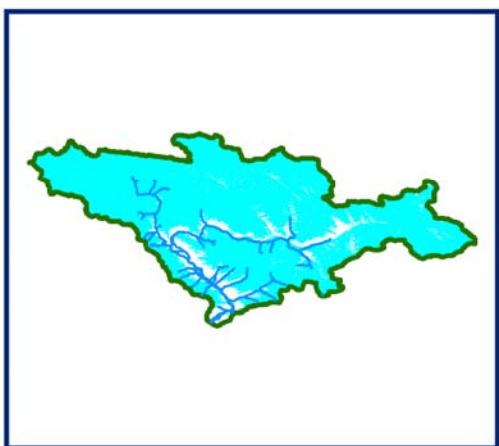


SNOW

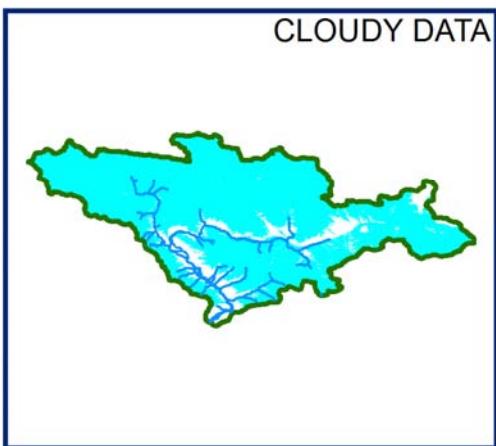


SNOW COVER MAP:

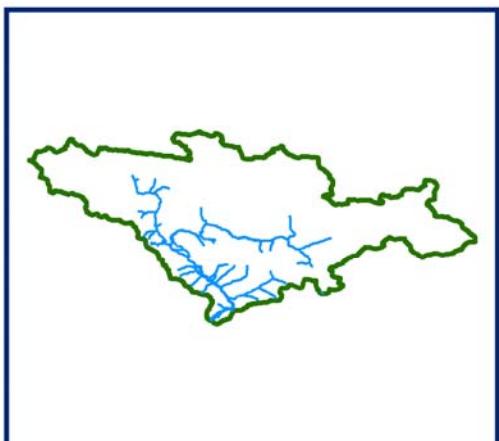
SHIGAR BASIN



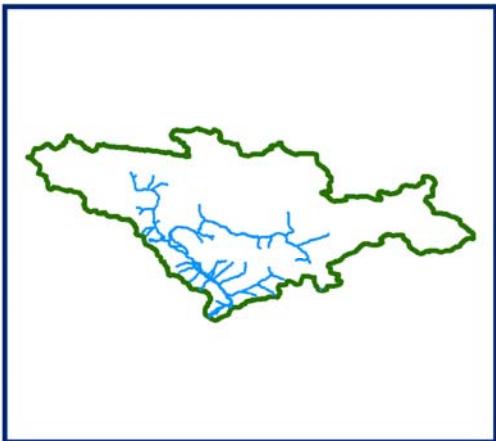
02 JANUARY 2010



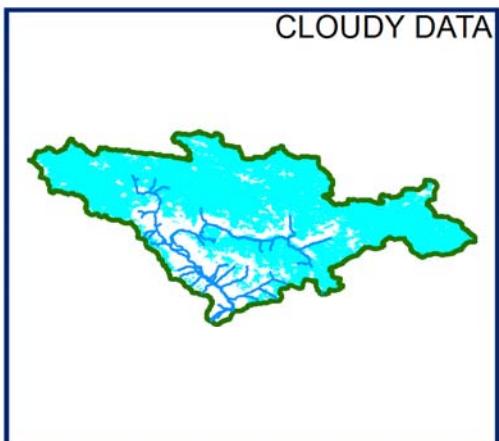
07 JANUARY 2010



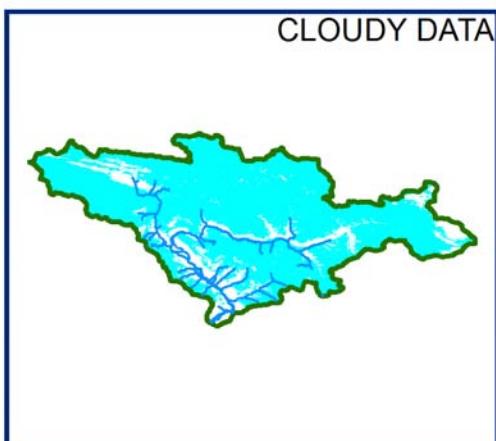
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 JANUARY 2010



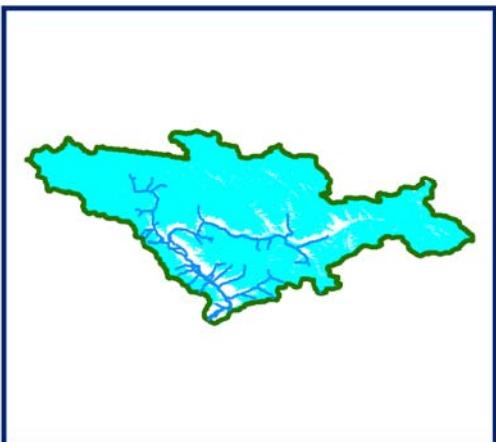
26 JANUARY 2010



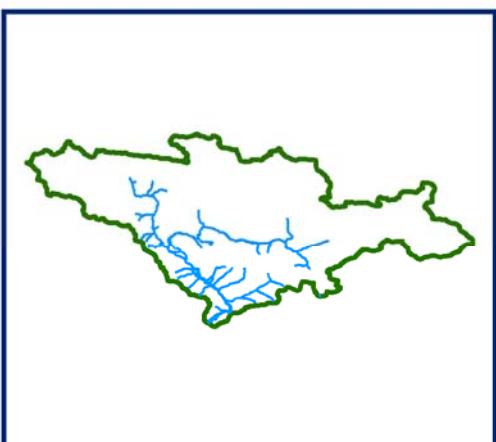
SNOW



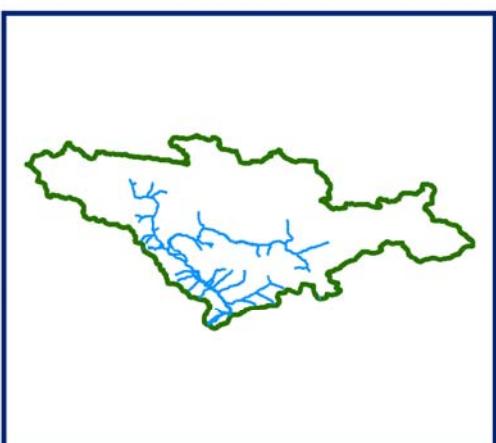
10 DAILY SNOW COVER MAP: SHIGAR BASIN



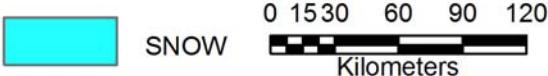
DATA USED
02 JANUARY 2010



DATA NOT AVAILABLE

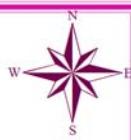


DATA NOT AVAILABLE



SNOW COVER MAP:

SHIGAR BASIN

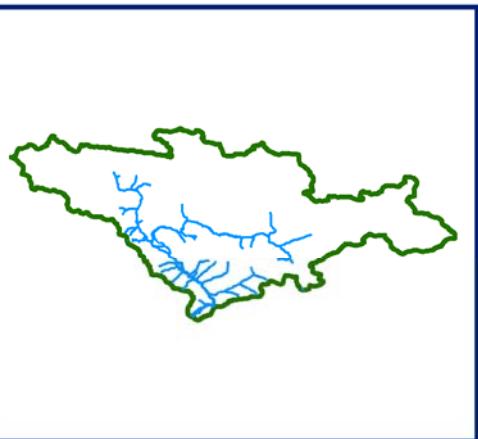


CLOUDY DATA

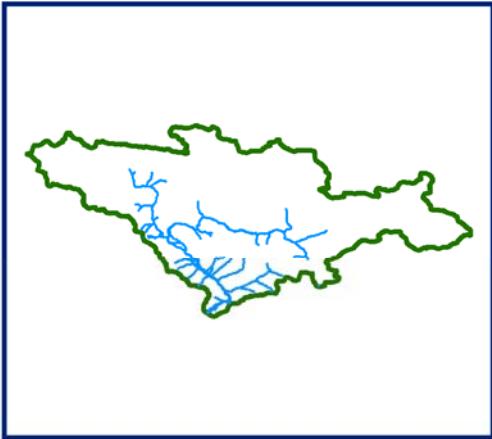


05 FEBRUARY 2010

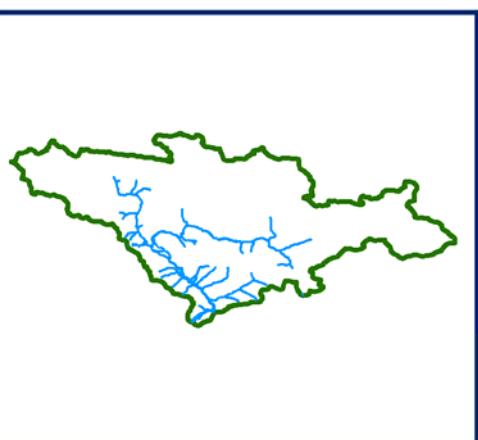
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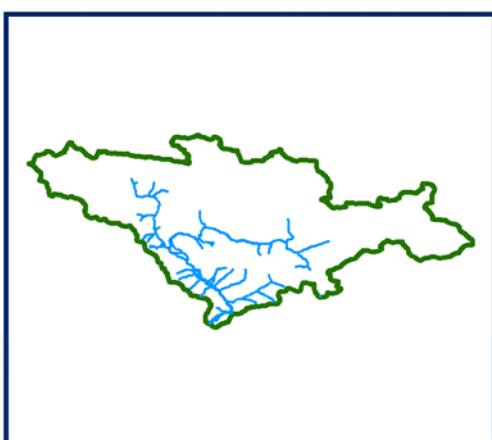
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DATA NOT AVAILABLE



DATA NOT AVAILABLE



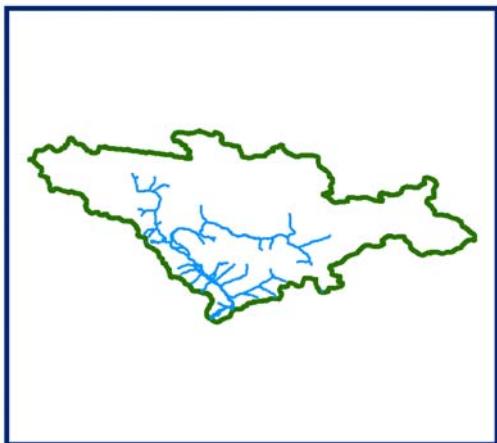
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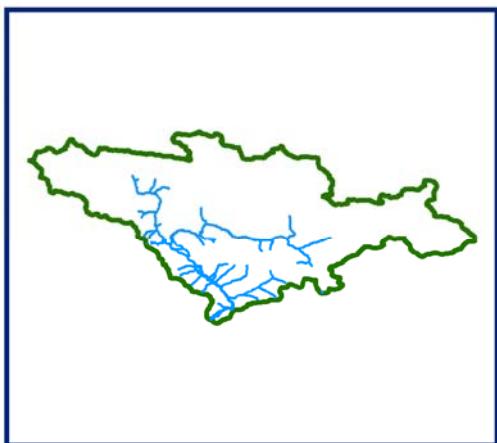
SNOW

03 02 01 00
Kilometers

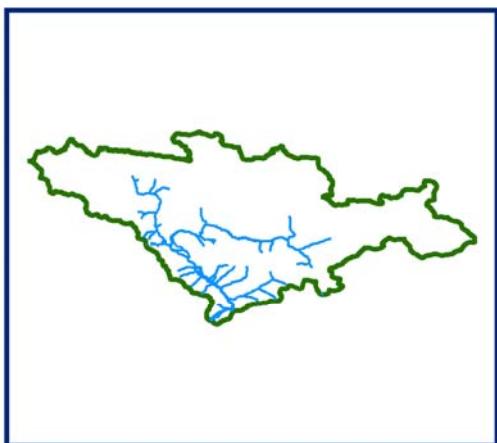
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA NOT AVAILABLE



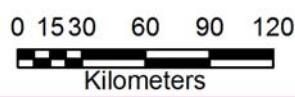
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DATA NOT AVAILABLE

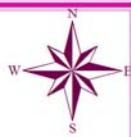


SNOW



SNOW COVER MAP:

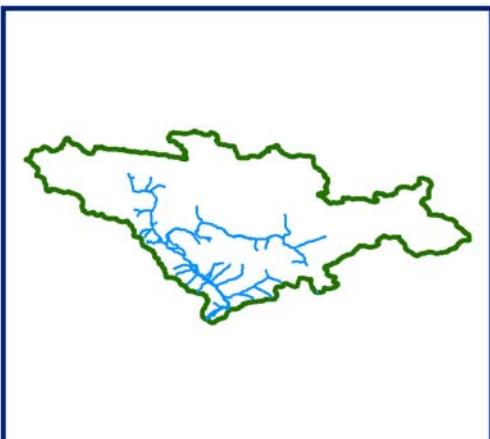
SHIGAR BASIN



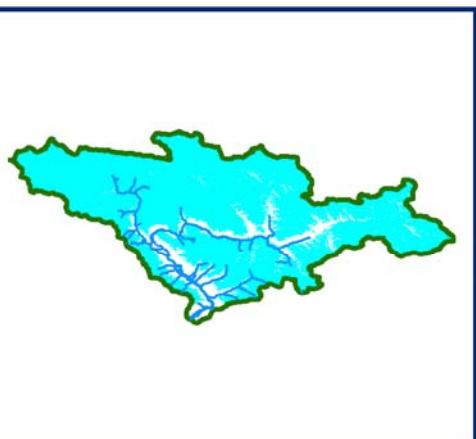
CLOUDY DATA



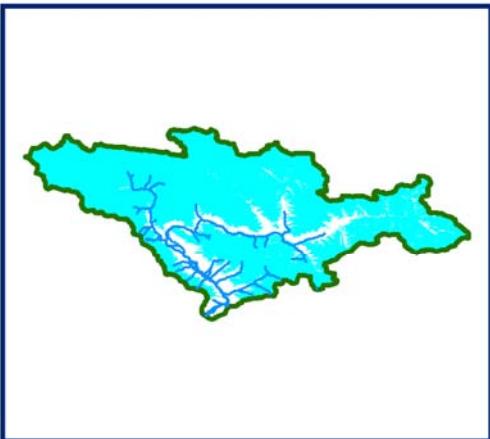
05 MARCH 2010



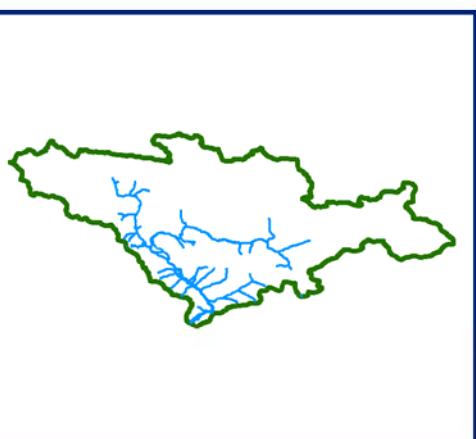
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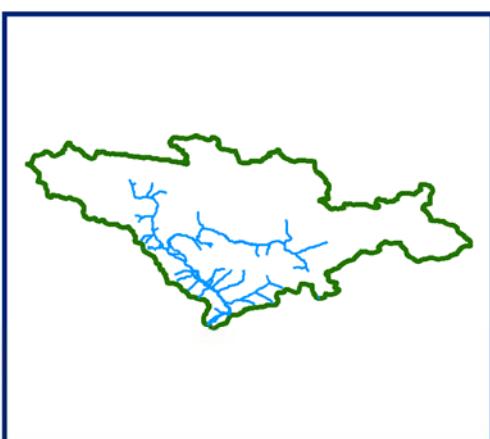
15 MARCH 2010



20 MARCH 2010



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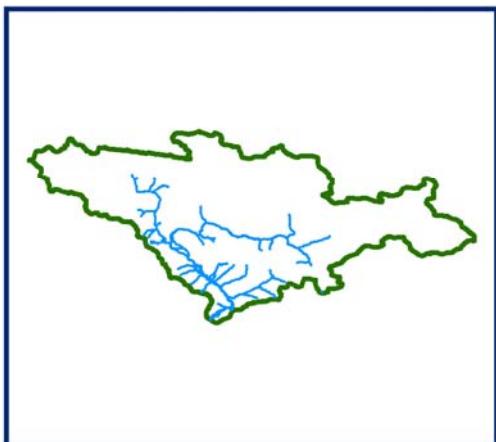
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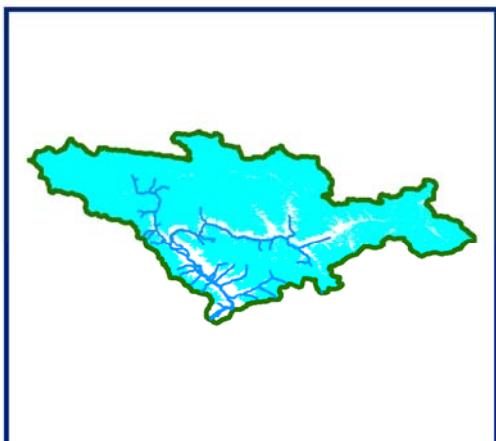
SNOW

03 02 01 00
Kilometers

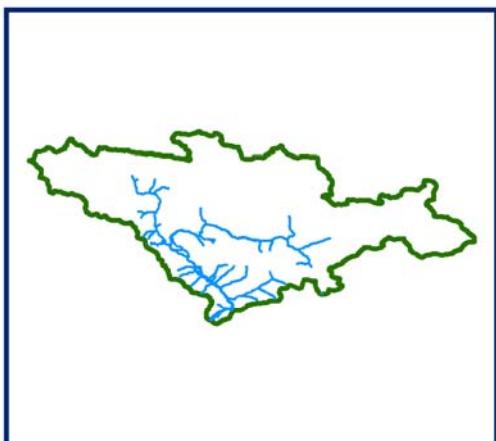
10 DAILY SNOW COVER MAP: SHIGAR BASIN



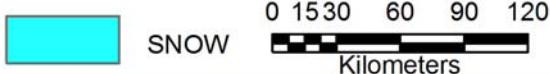
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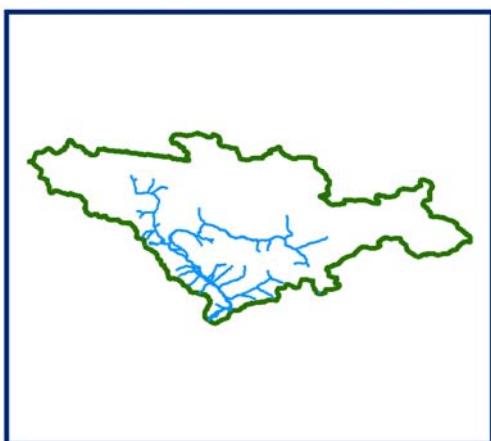
**DATA USED
15 MARCH 2010
20 MARCH 2010**



DATA NOT AVAILABLE

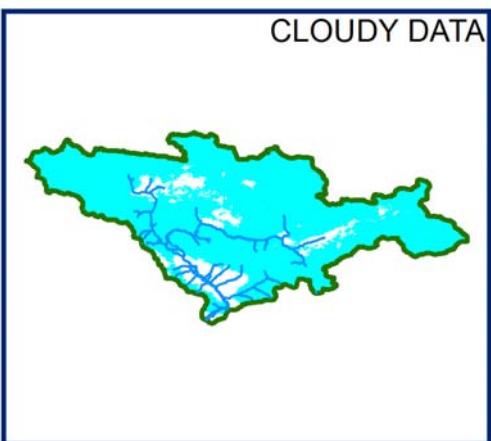
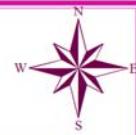


SNOW COVER MAP:

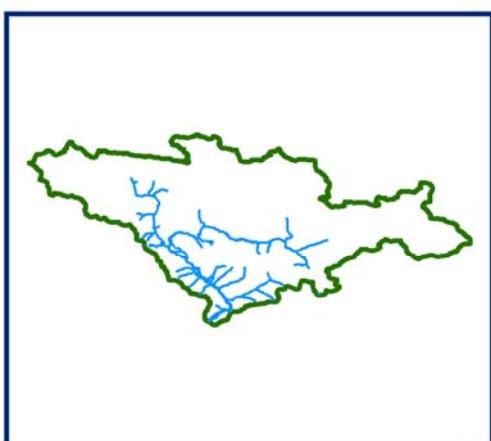


DATA NOT AVAILABLE

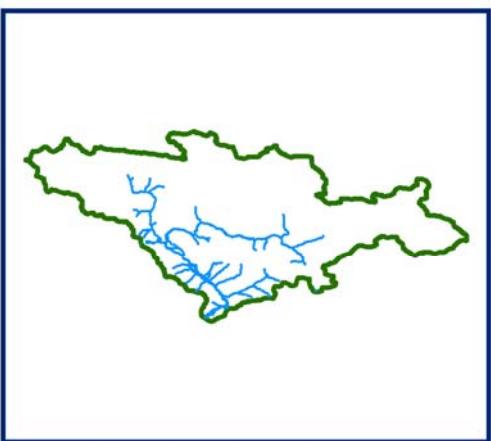
SHIGAR BASIN



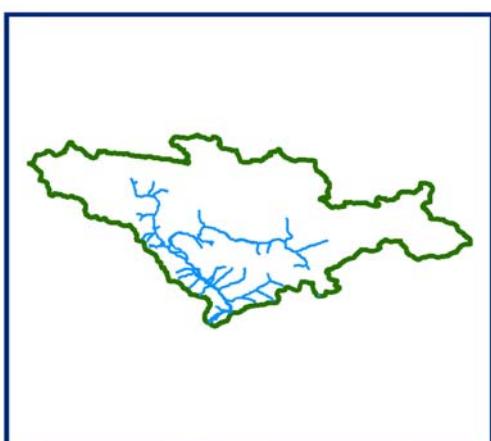
08 APRIL 2010



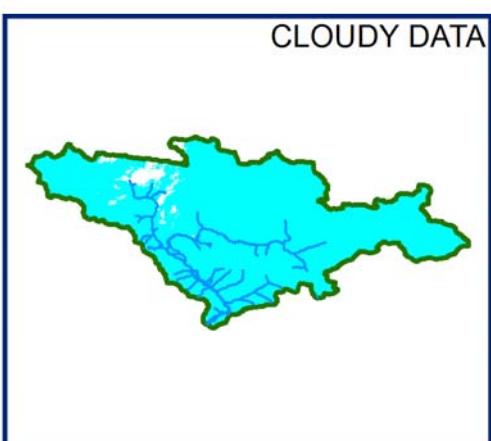
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



27 APRIL 2010

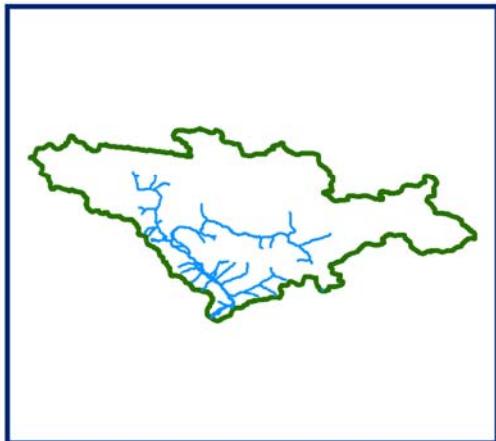


SNOW

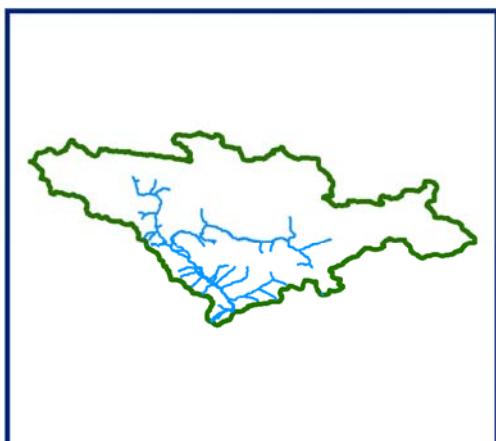


**0 20 40
Kilometers**

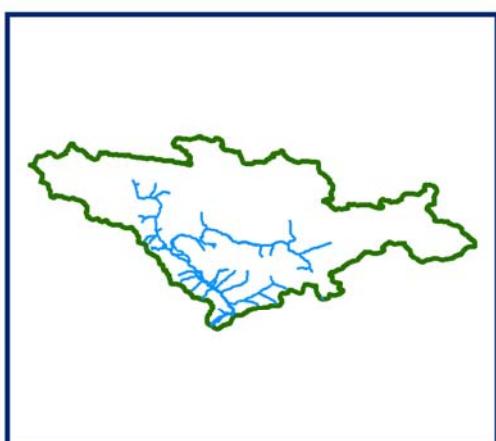
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA NOT AVAILABLE



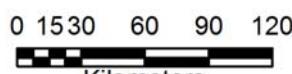
DATA NOT AVAILABLE



DATA NOT AVAILABLE



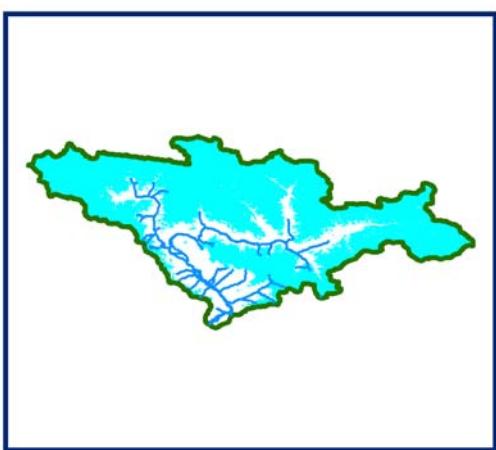
SNOW



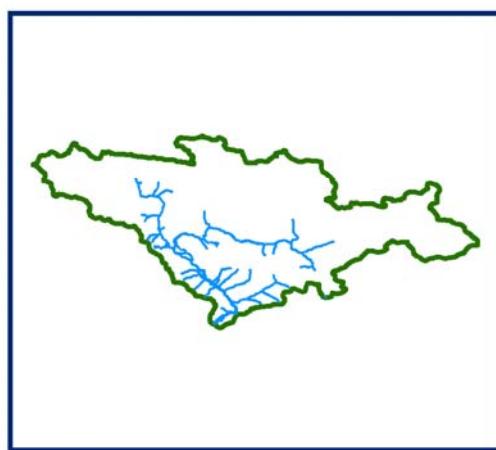
Kilometers

SNOW COVER MAP:

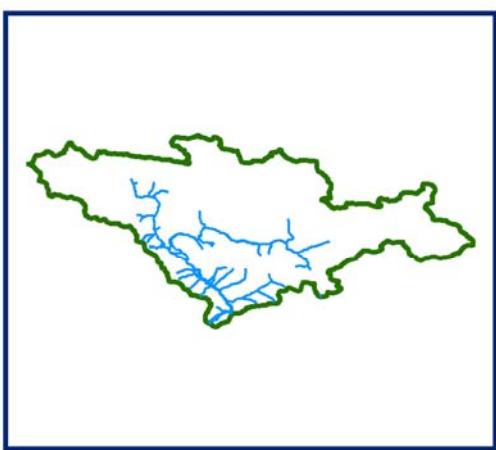
SHIGAR BASIN



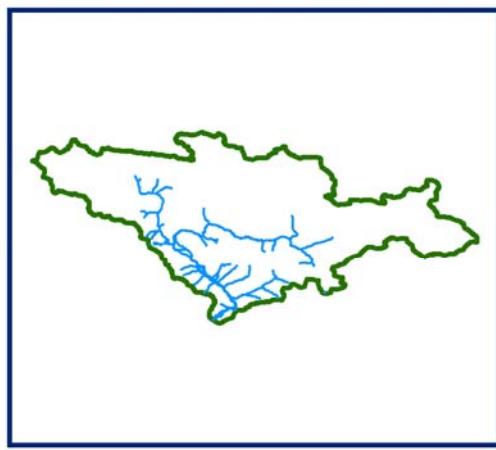
02 MAY 2010



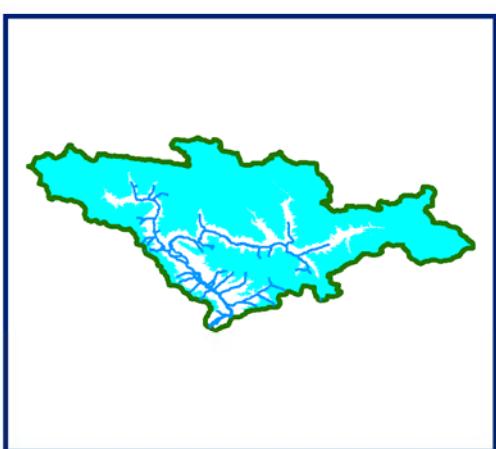
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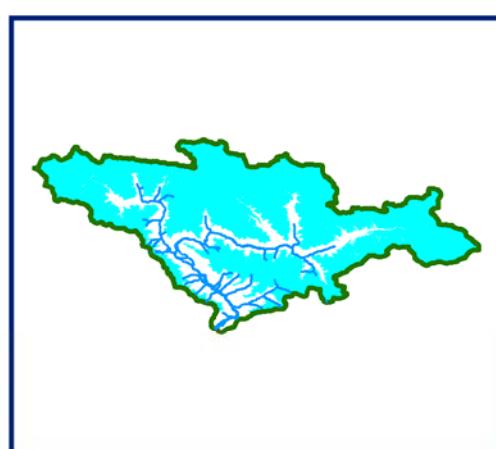
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DATA NOT AVAILABLE



21 MAY 2010



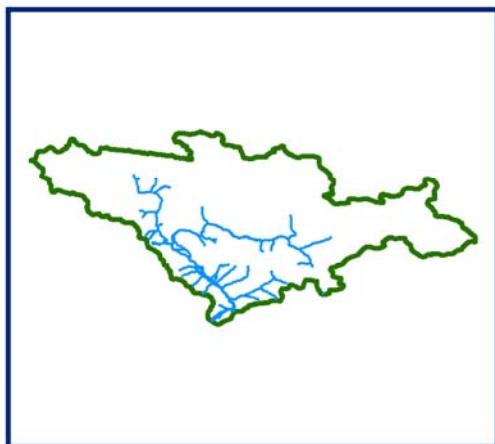
31 MAY 2010



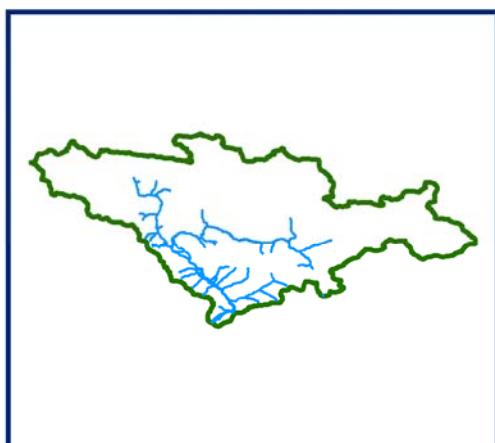
SNOW

00 02 04 06
Kilometers

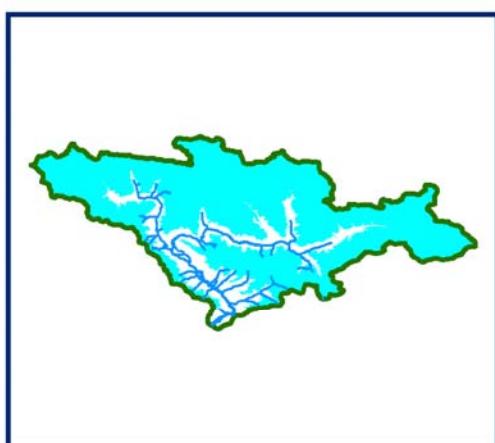
10 DAILY SNOW COVER MAP: SHIGAR BASIN



DATA NOT AVAILABLE



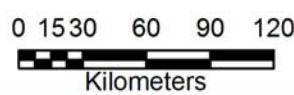
DATA NOT AVAILABLE



**DATA USED
21 MAY 2010
31 MAY 2010**

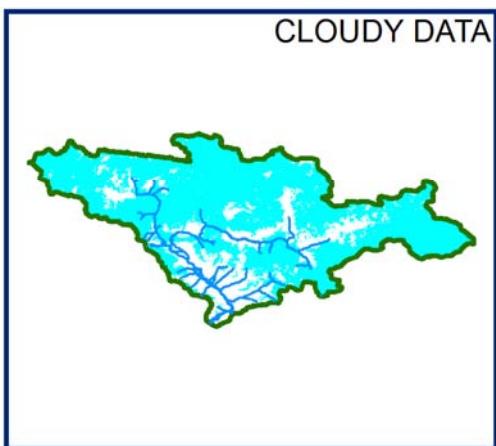
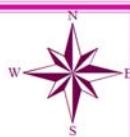


SNOW

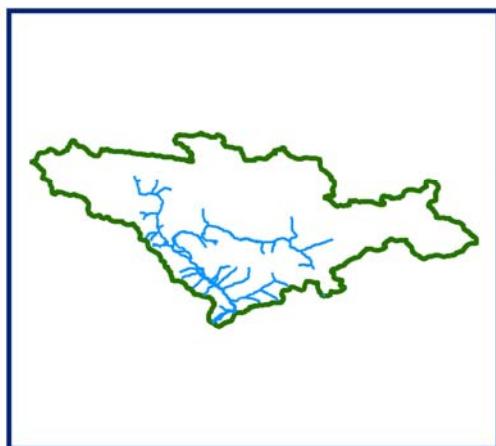


SNOW COVER MAP:

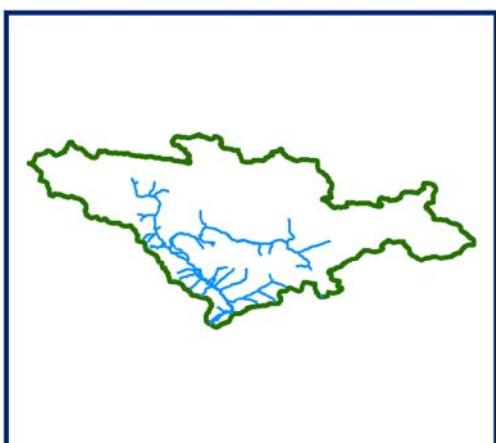
SHIGAR BASIN



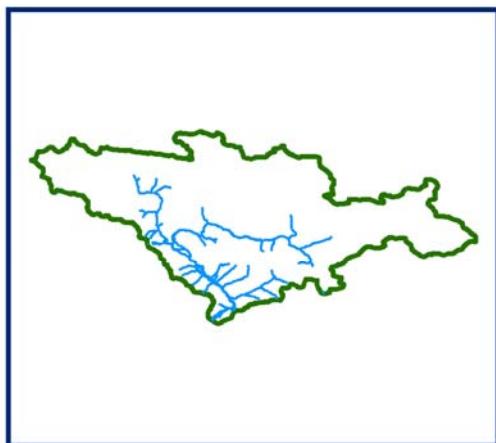
05 JUNE 2010



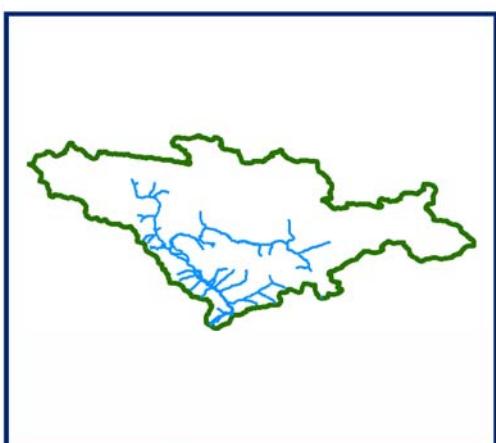
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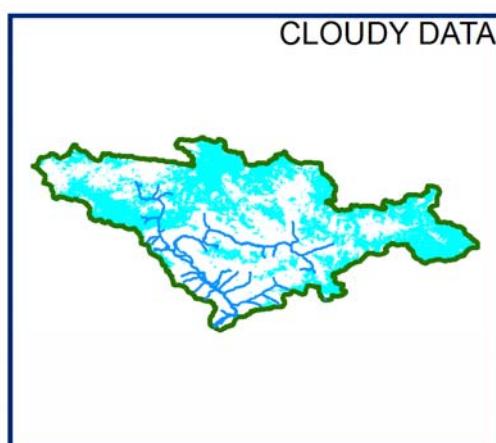
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DATA NOT AVAILABLE



DATA NOT AVAILABLE



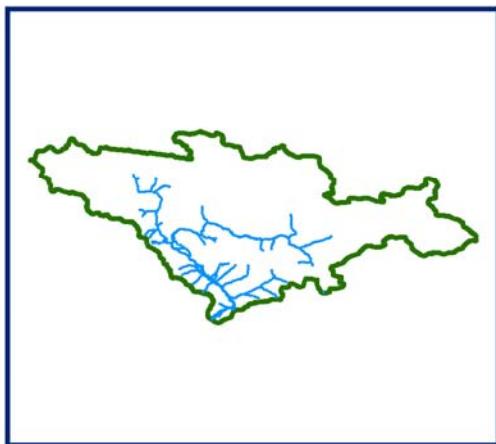
29 JUNE 2010



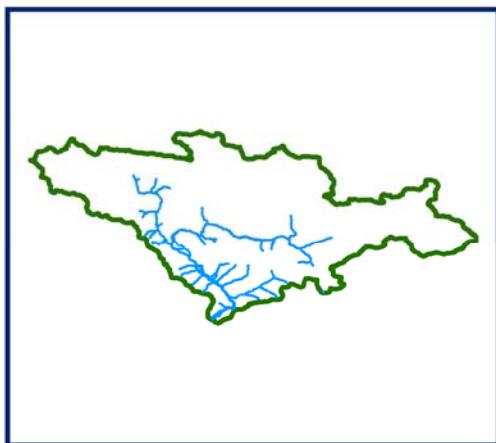
SNOW

08 0203040
 Kilometers

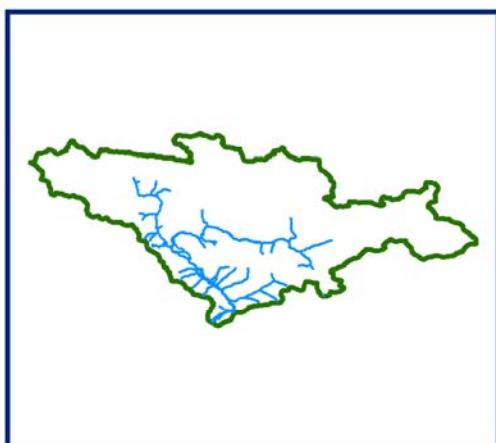
10 DAILY SNOW COVER MAP: SHIGAR BASIN



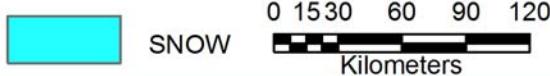
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



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 2009							
1	03-Oct-09	3164	23	5	17-Oct-09	7400	54
2	07-Oct-09	6462	47	6	27-Oct-09	7615	56
3	08-Oct-09	8951	65	7	31-Oct-09	8649	63
4	12-Oct-09	7615	56				
November 2009							
1	01-Nov-09	7952	58	4	20-Nov-09	9516	69
2	10-Nov-09	10054	73	5	24-Nov-09	8453	62
3	15-Nov-09	7541	55	6	25-Nov-09	7065	52
December 2009							
1	04-Dec-09	6481	47	3	19-Dec-09	11129	81
2	18-Dec-09	11823	86	4	23-Dec-09	11760	86
January 2010							
1	02-Jan-10	11200	82	4	21-Jan-10	9264	68
2	07-Jan-10	9807	72	5	26-Jan-10	9367	68
3	11-Jan-10	1137	8				
February 2010							
1	04-Feb-10	9978	73	2	05-Feb-10	9590	70
March 2010							
1	15-Mar-10	10682	78	3	24-Mar-10	11187	82
2	20-Mar-10	10054	73				
APRIL 2010							
1	08-Apr-10	10653	78	2	27-Apr-10	9822	72
MAY 2010							
1	02-May-10	9455	69	4	26-May-10	9099	66
2	11-May-10	7741	56	5	31-May-10	9176	67
3	21-May-10	9891	72				
JUNE 2010							
1	05-Jun-10	9910	72	3	29-Jun-10	4099	30
2	28-Jun-10	6394	47				

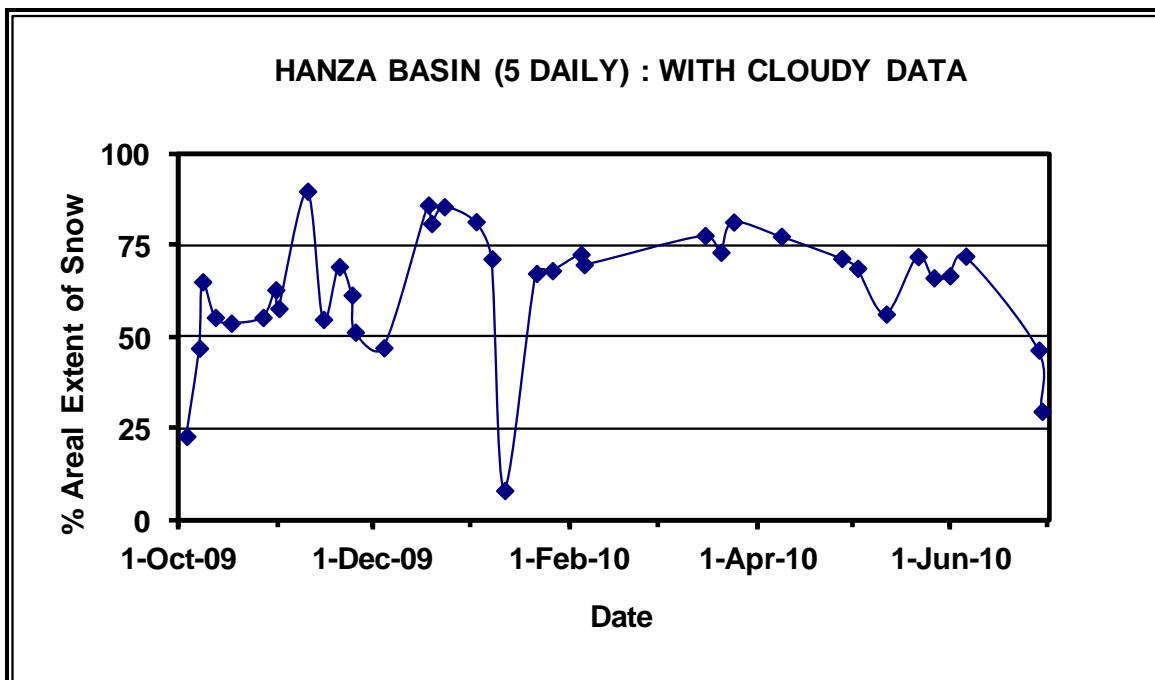
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: HANZA

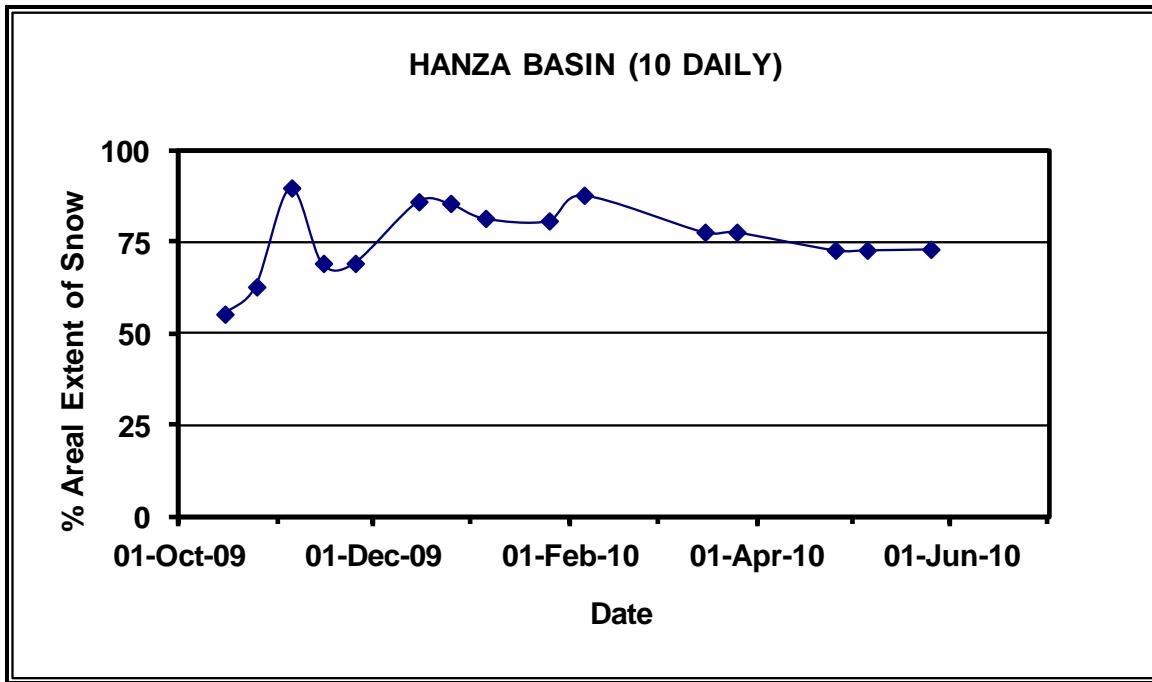
BASIN AREA: 13711 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	12-Oct-09	7615	56	2	31-Oct-09	8638	63
November 2009							
1	05-Nov-09	12340	90	3	25-Nov-09	9516	69
2	15-Nov-09	9516	69				
December 2009							
1	18-Dec-09	11823	86	2	23-Dec-09	11760	86
January 2010							
1	02-Jan-10	11200	82	2	25-Jan-10	11106	81
February 2010							
1	05-Feb-10	12066	88				
March 2010							
1	15-Mar-10	10682	78	2	25-Mar-10	10682	78
April 2010							
1	25-Apr-10	10009	73				
May 2010							
1	05-May-10	10009	73	2	21-May-10	10043	73

Snow cover depletion curve



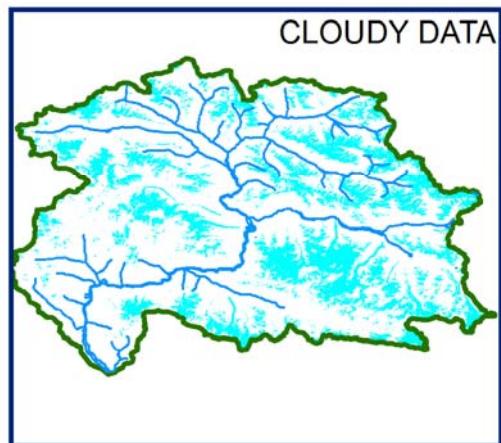
Snow cover depletion curve



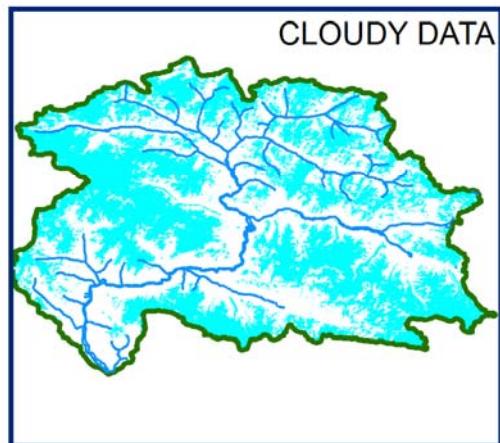
SNOW COVER MAP

SNOW COVER MAP:

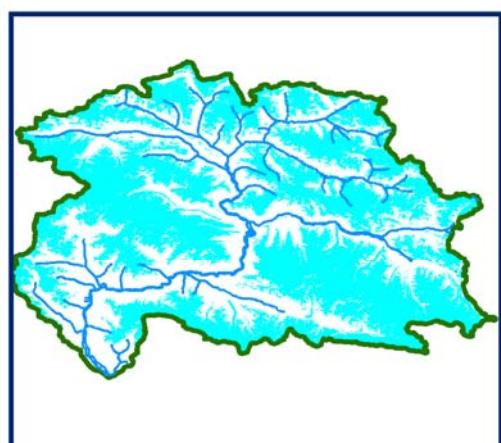
GILGIT BASIN



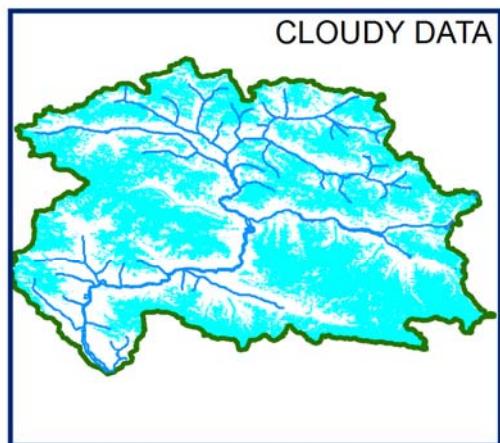
03 OCTOBER 2009



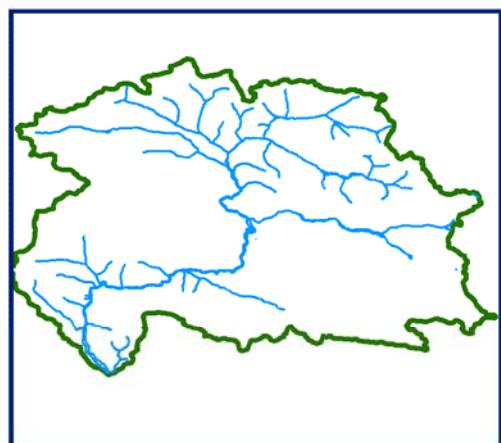
07 OCTOBER 2009



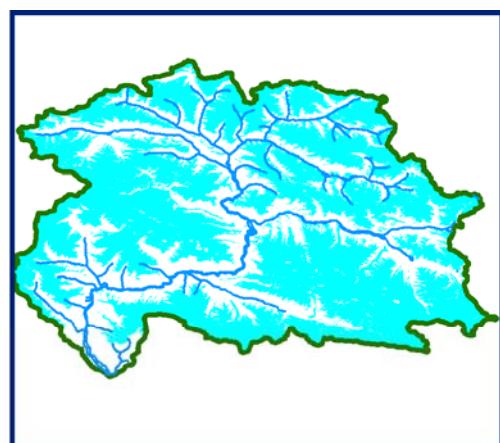
12 OCTOBER 2009



17 OCTOBER 2009



DATA NOT AVAILABLE



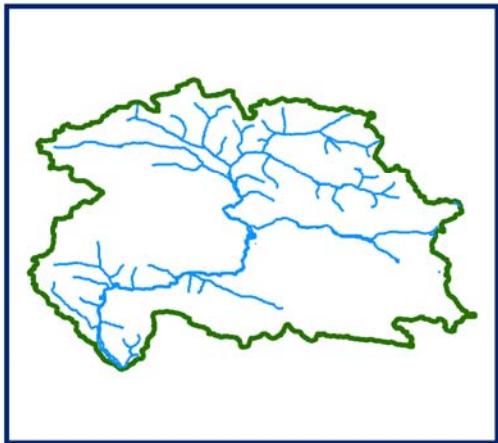
31 OCTOBER 2009



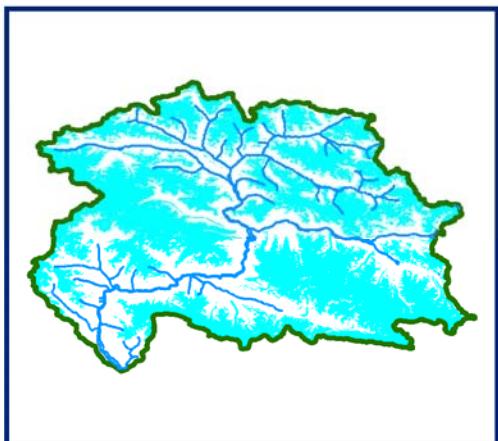
SNOW

0310203040
Kilometers

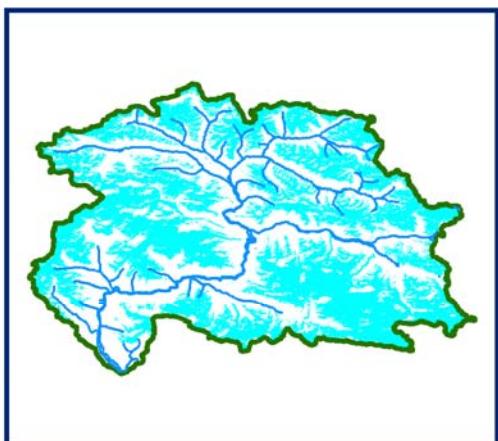
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



**DATA USED
12 OCTOBER 2009**



**DATA USED
27 OCTOBER 2009
31 OCTOBER 2009**



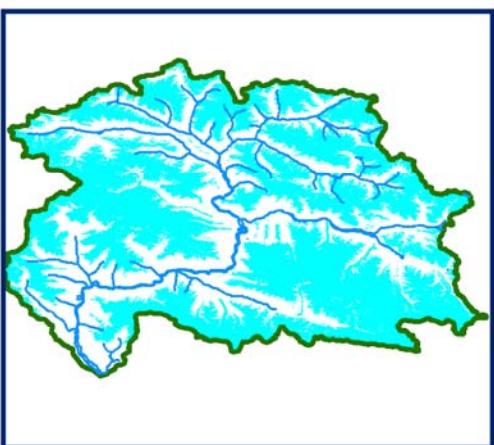
SNOW

0 20 40 80 120 160

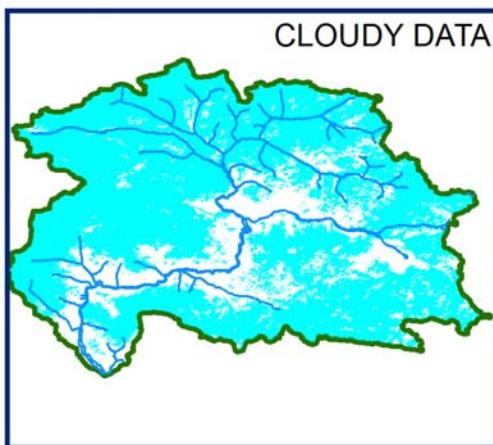
Kilometers

SNOW COVER MAP:

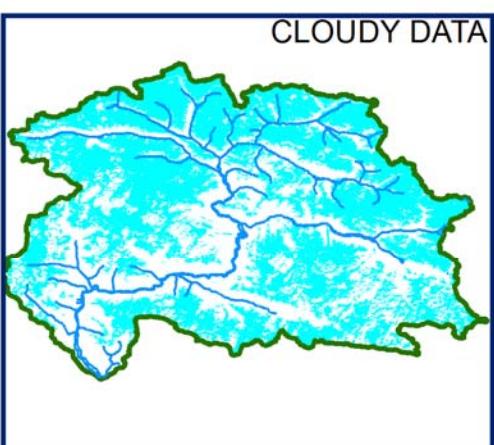
HANZA BASIN



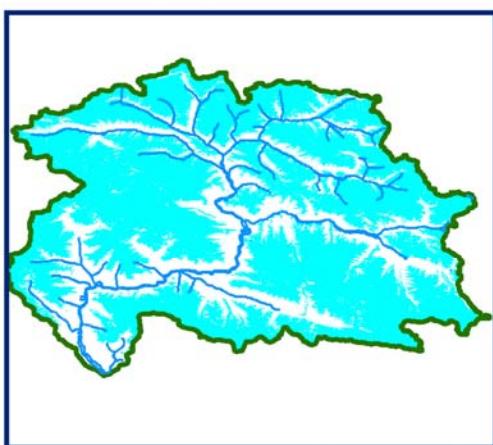
01 NOVEMBER 2009



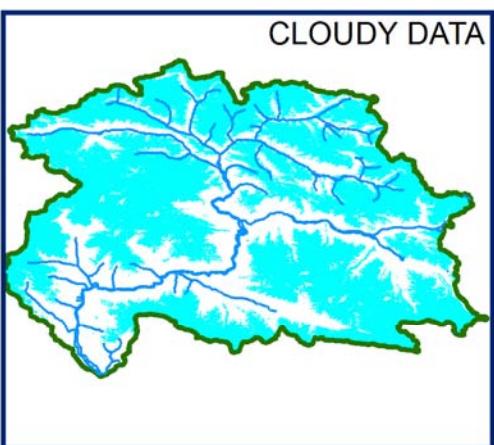
10 NOVEMBER 2009



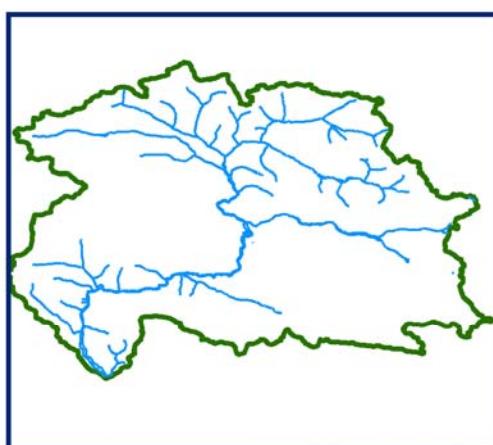
15 NOVEMBER 2009



20 NOVEMBER 2009



24 NOVEMBER 2009



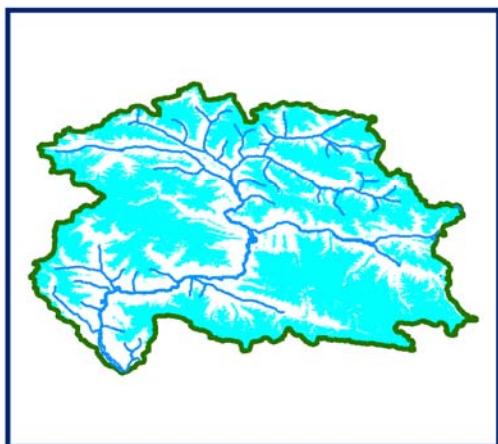
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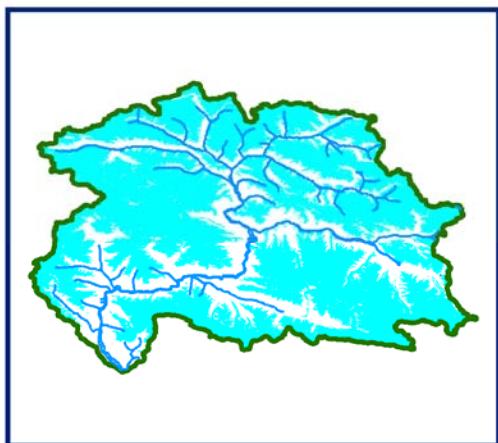
SNOW

05 02 03 040
 Kilometers

10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
01 NOVEMBER 2009



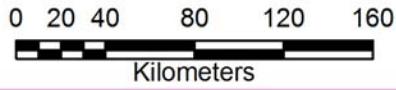
DATA USED
20 NOVEMBER 2009



DATA NOT AVAILABLE

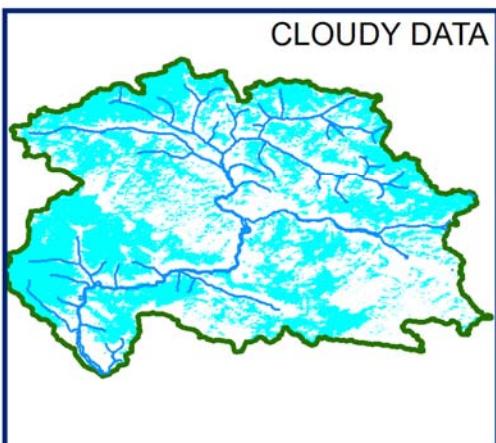


SNOW

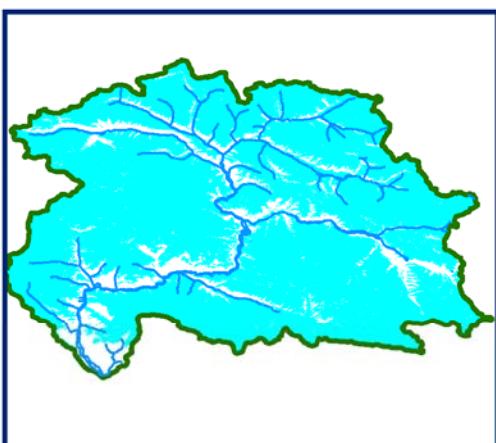
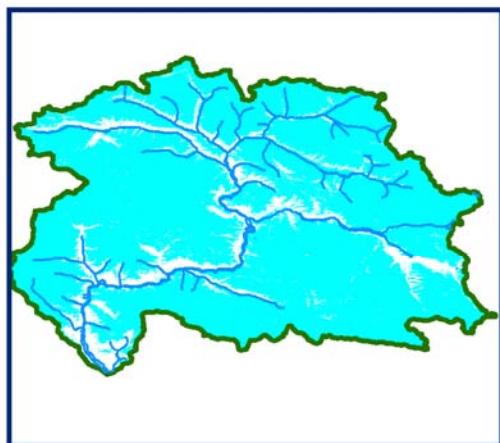
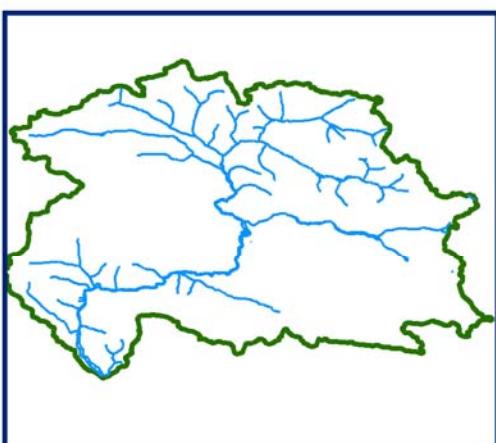
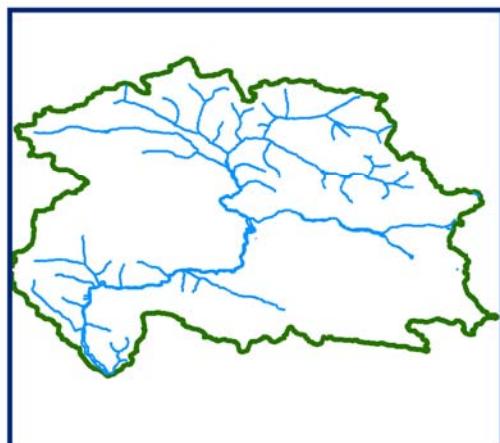


SNOW COVER MAP:

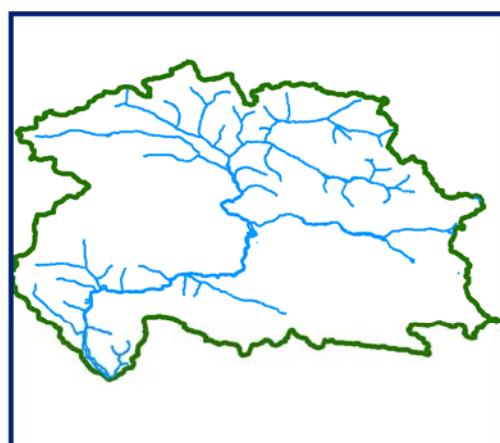
HANZA BASIN



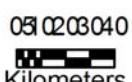
04 DECEMBER 2009



23 DECEMBER 2009

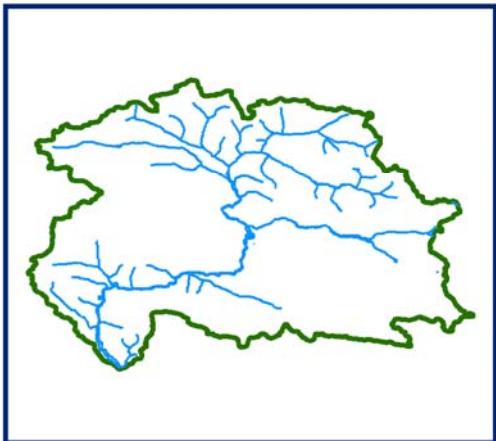


SNOW

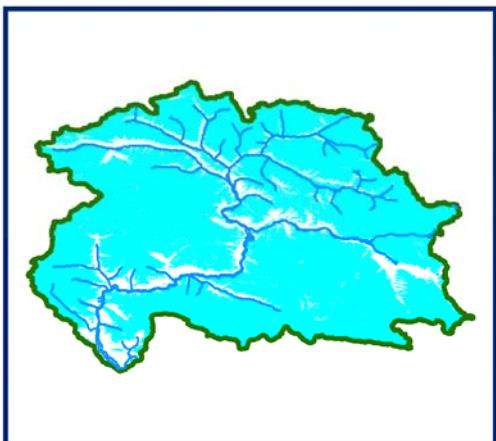


0 10 20 30 40
Kilometers

10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



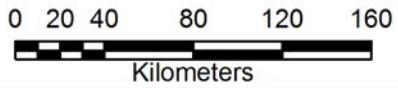
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18 DECEMBER 2009**



**DATA USED
23 DECEMBER 2009**

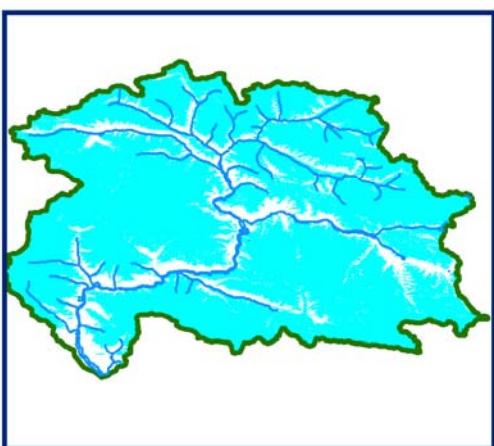


SNOW

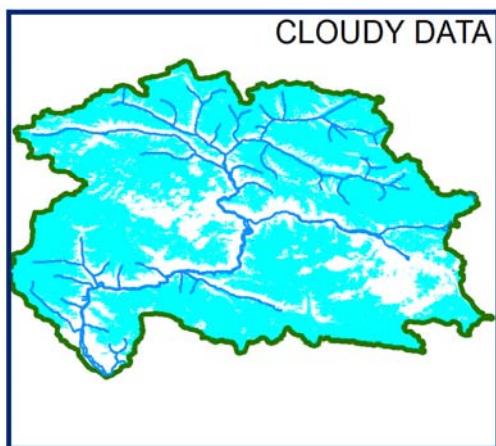


SNOW COVER MAP:

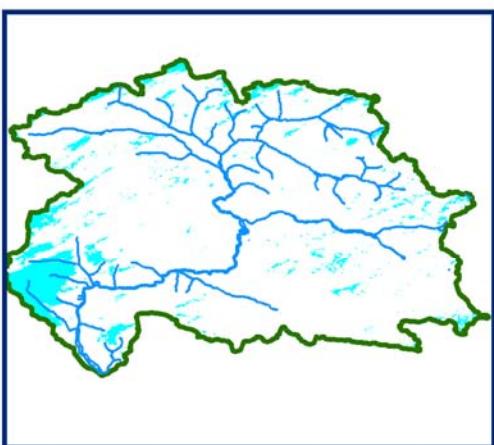
HANZA BASIN



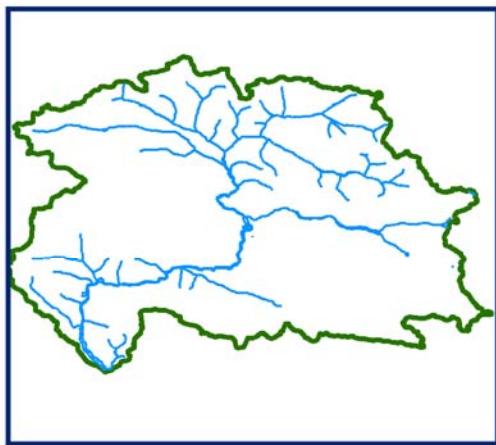
02 JANUARY 2010



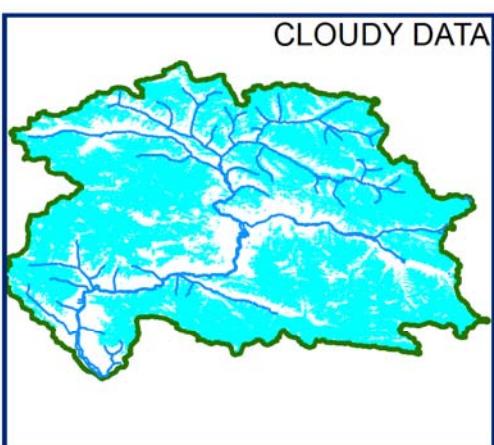
07 JANUARY 2010



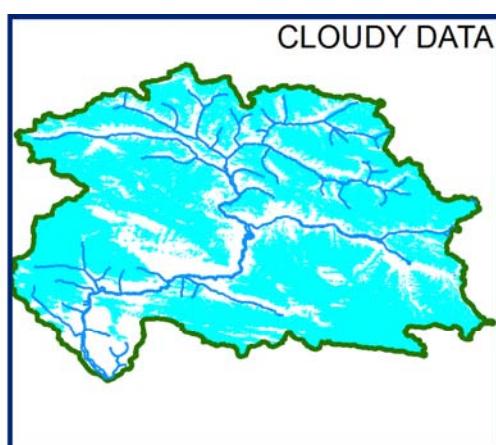
11 JANUARY 2010



DATA NOT AVAILABLE



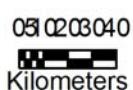
21 JANUARY 2010



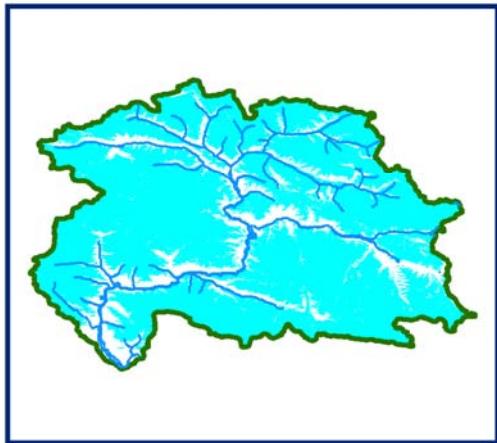
26 JANUARY 2010



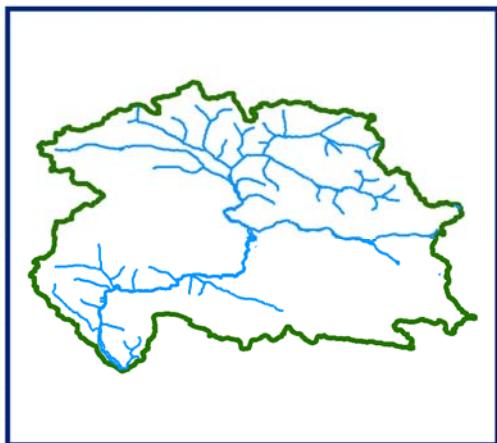
SNOW



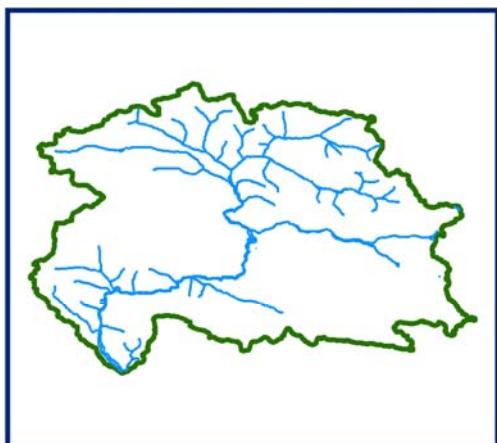
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA USED
02 JANUARY 2010



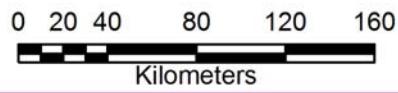
DATA NOT AVAILABLE



DATA NOT AVAILABLE

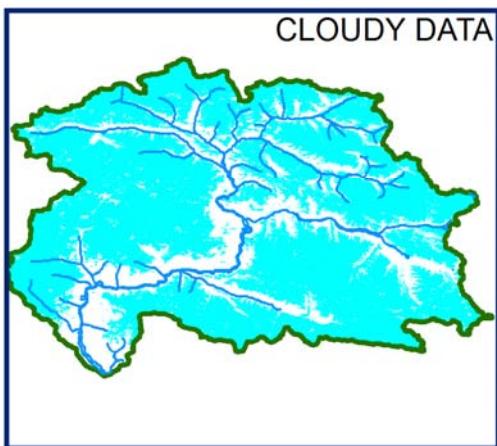


SNOW

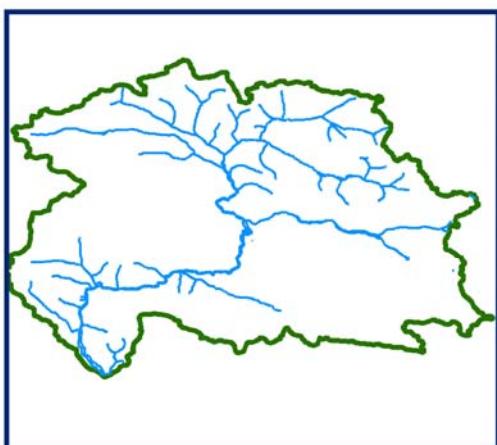
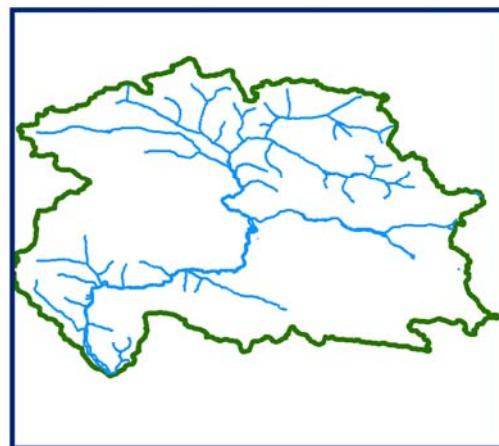


SNOW COVER MAP:

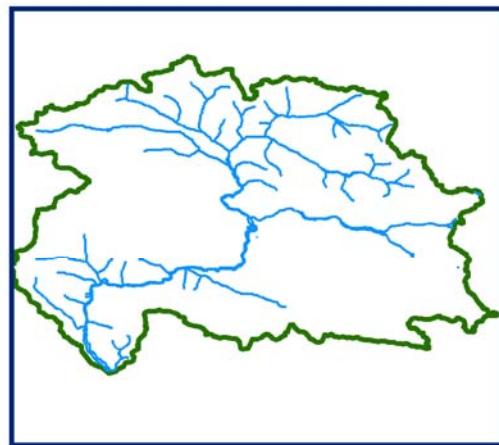
HANZA BASIN



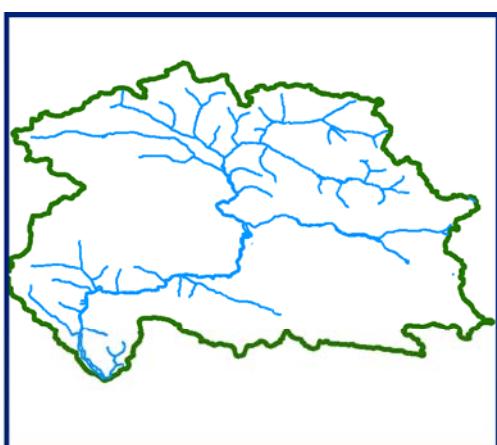
04 FEBRUARY 2010



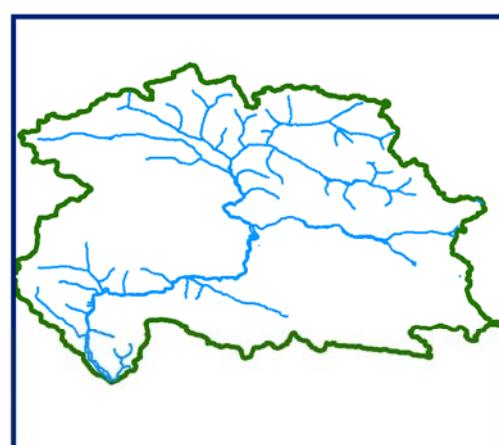
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



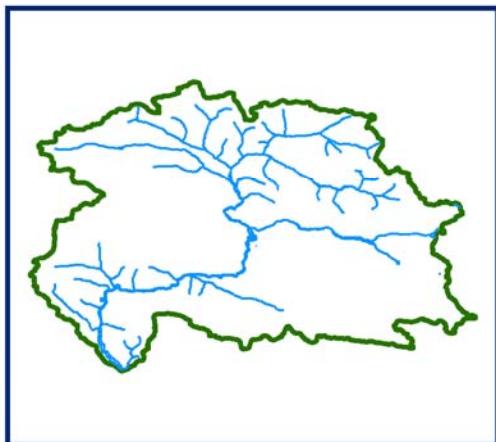
DATA NOT AVAILABLE



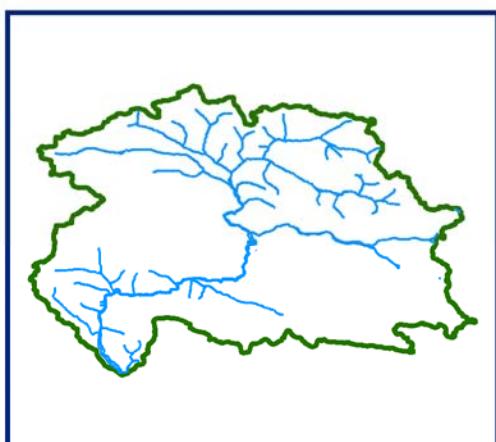
SNOW

05 02 03 040
Kilometers

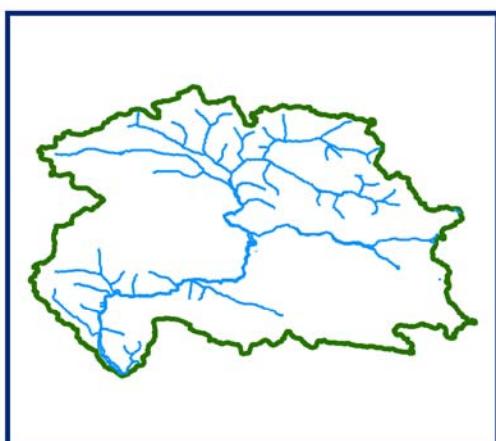
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



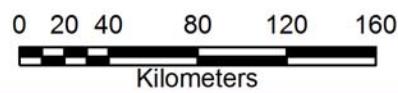
DATA NOT AVAILABLE



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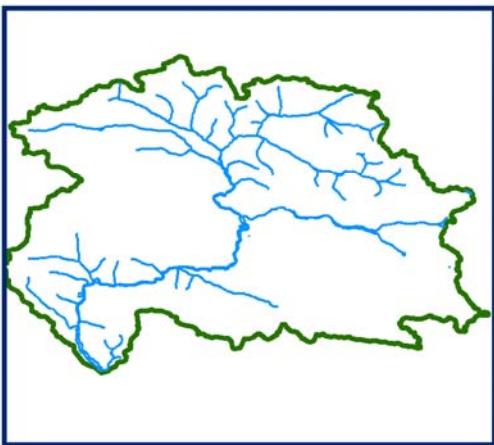


SNOW

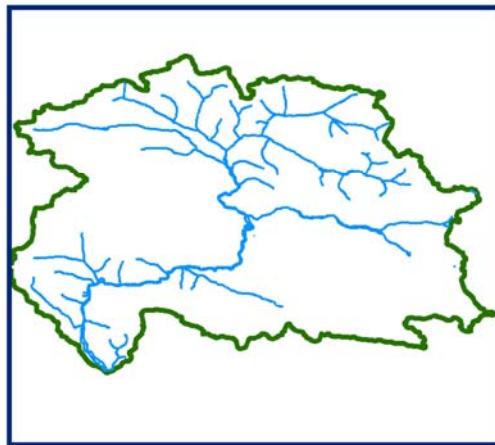


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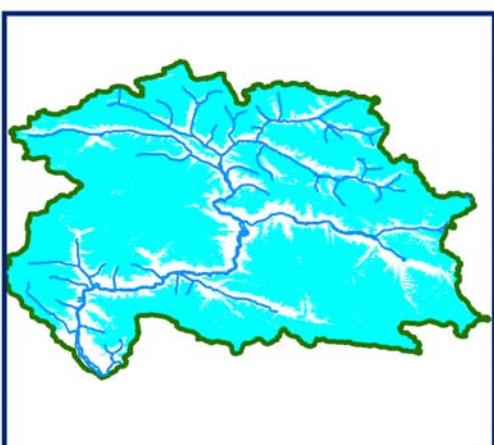
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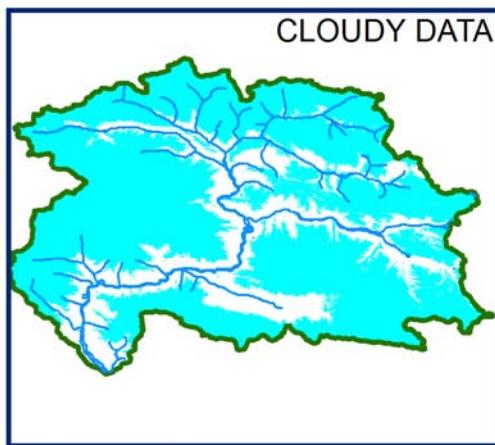
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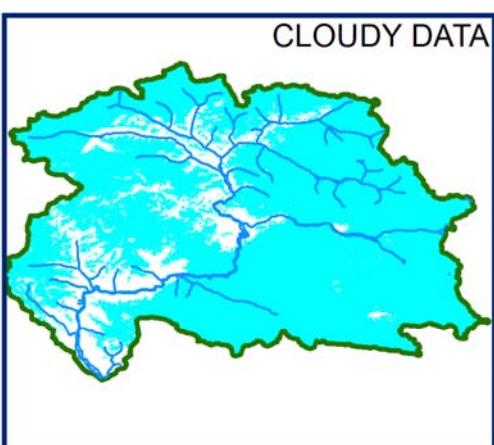
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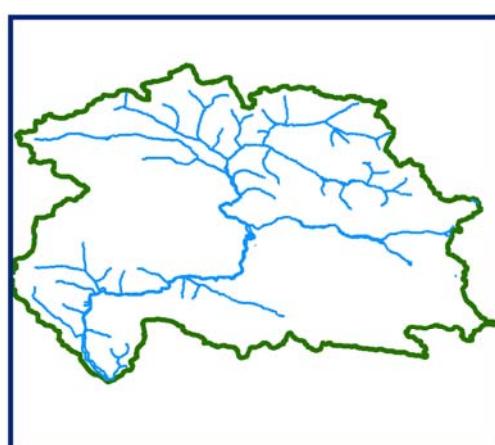
15 MARCH 2010



20 MARCH 2010



24 MARCH 2010



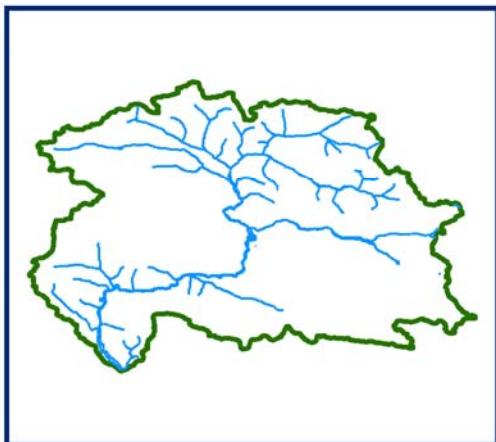
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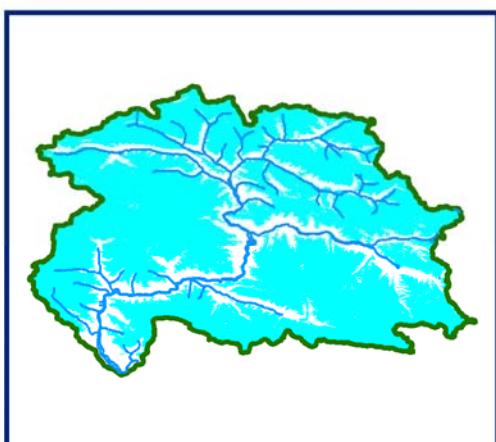
SNOW

0510203040
 Kilometers

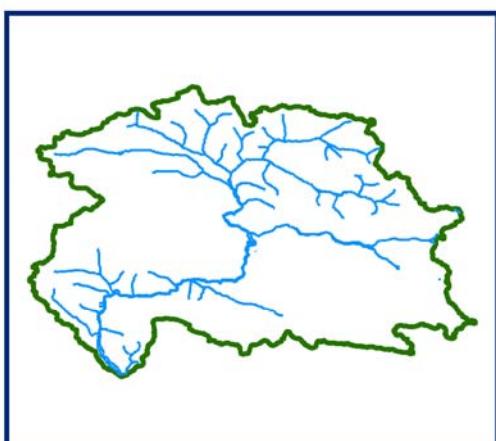
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



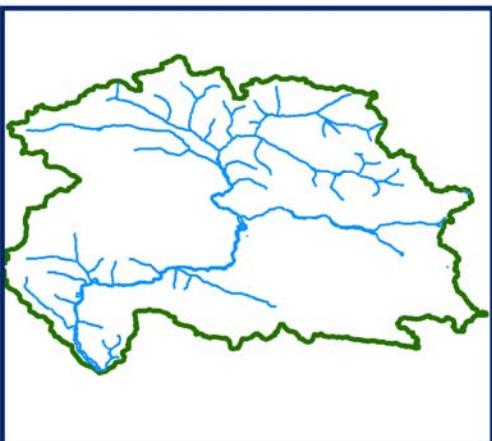
**DATA USED
15 MARCH 2010**



DATA NOT AVAILABLE

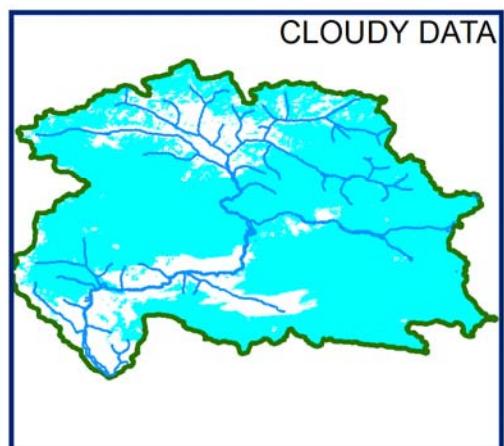


SNOW COVER MAP:

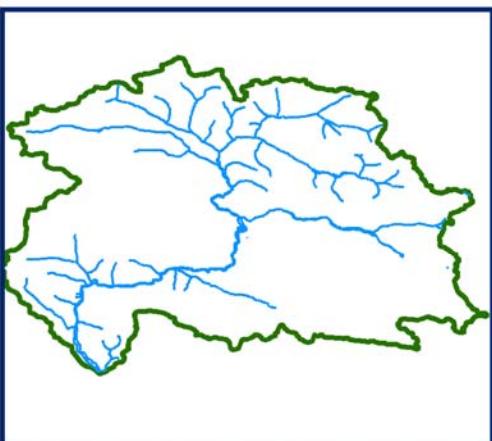


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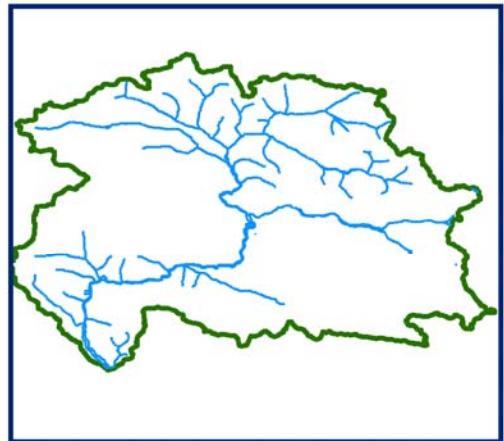
HANZA BASIN



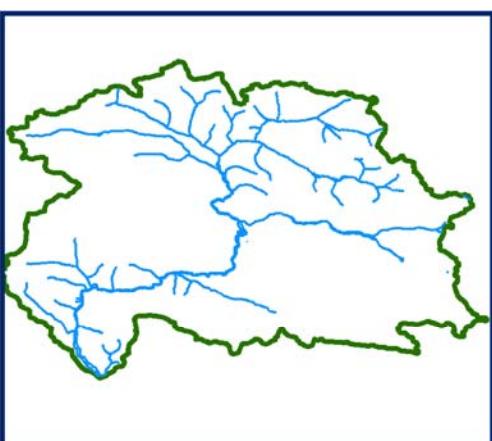
08 APRIL 2010



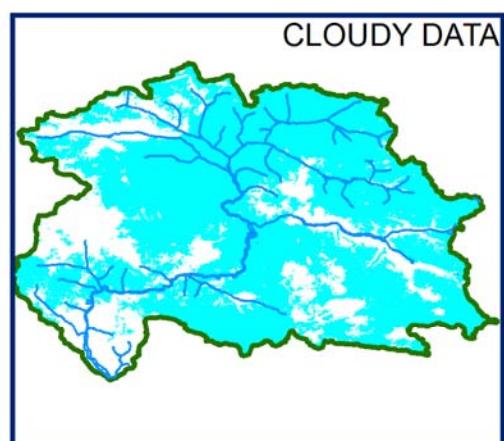
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



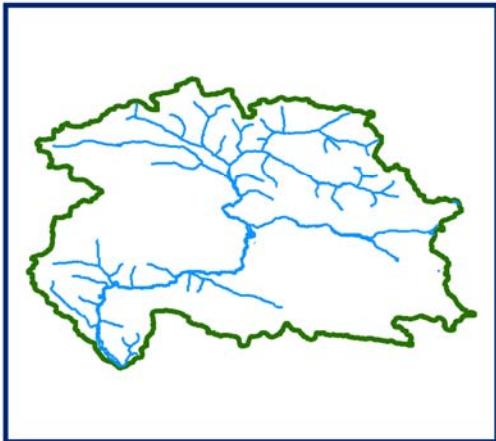
27 APRIL 2010



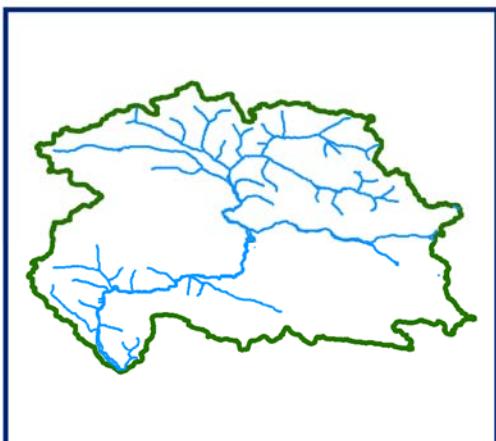
SNOW

05 02 03 040
Kilometers

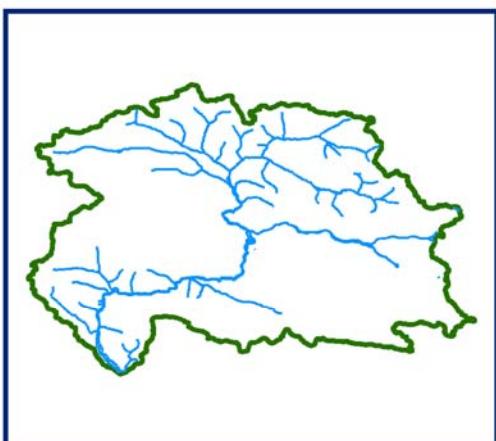
10 DAILY SNOW COVER MAP: HANZA BASIN



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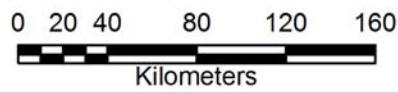
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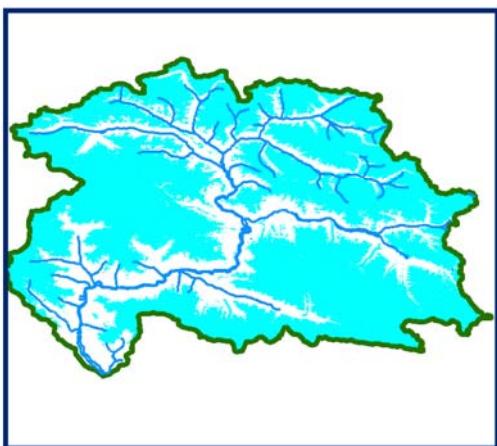


SNOW

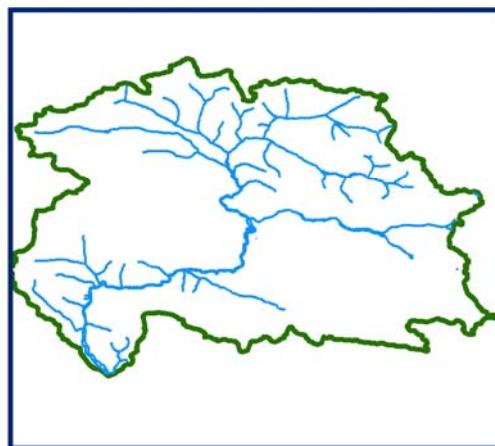


SNOW COVER MAP:

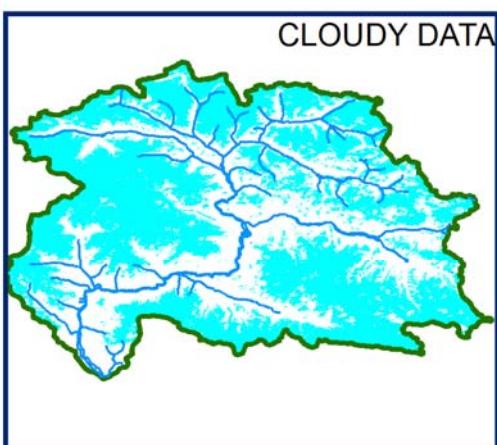
HANZA BASIN



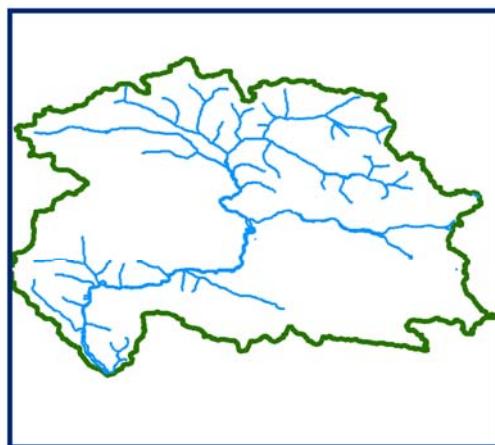
02 MAY 2010



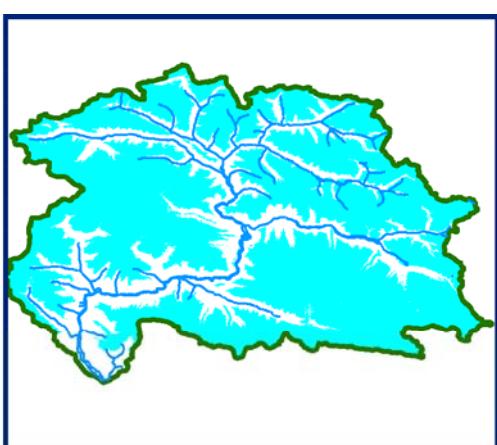
DATA NOT AVAILABLE



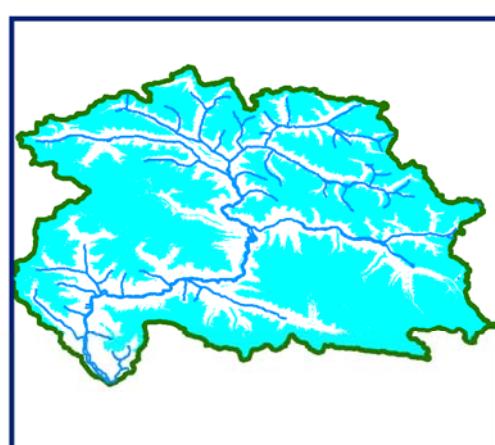
11 MAY 2010



DATA NOT AVAILABLE



21 MAY 2010



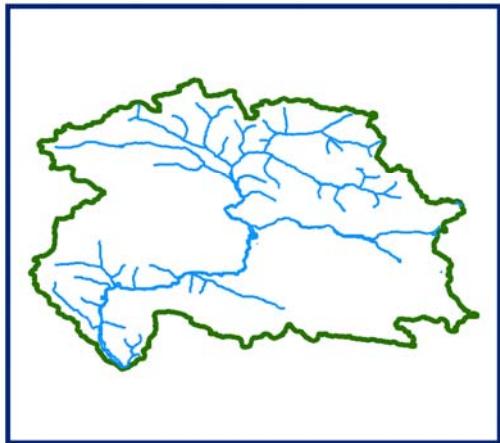
31 MAY 2010



SNOW

05 0203040
 Kilometers

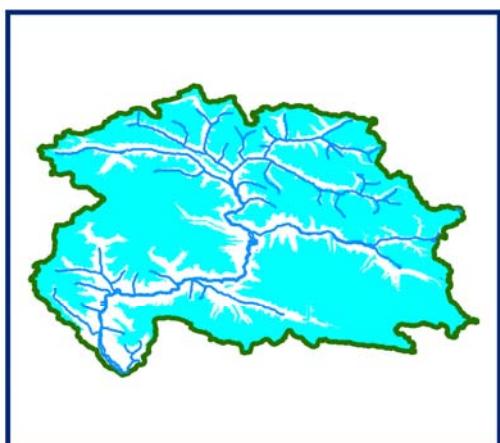
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE



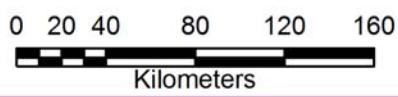
DATA USED

21 MAY 2010

31 MAY 2010



SNOW

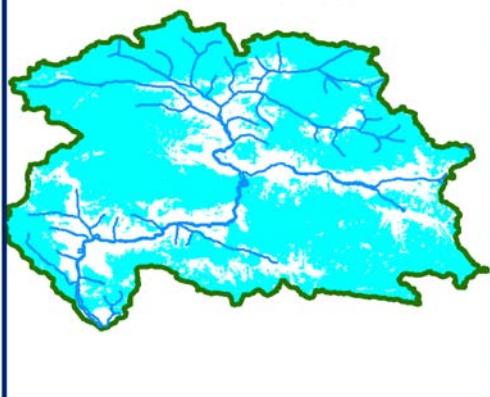


SNOW COVER MAP:

HANZA BASIN

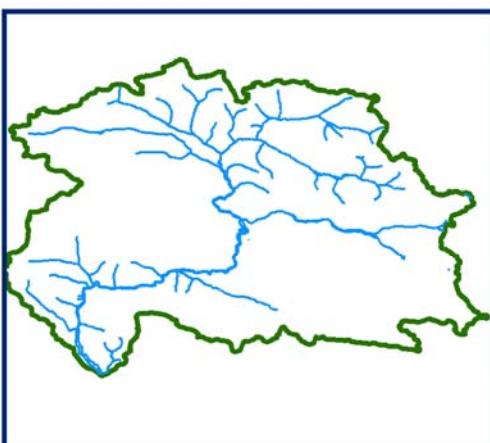


CLOUDY DATA

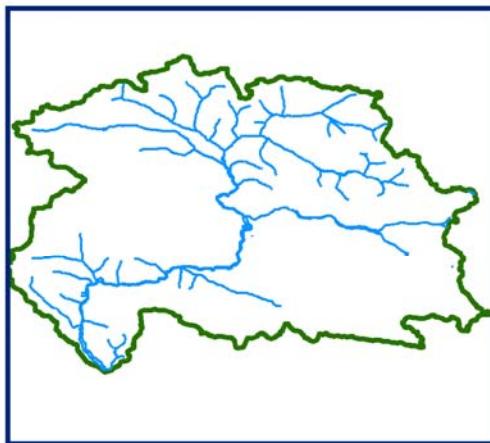


05 JUNE 2010

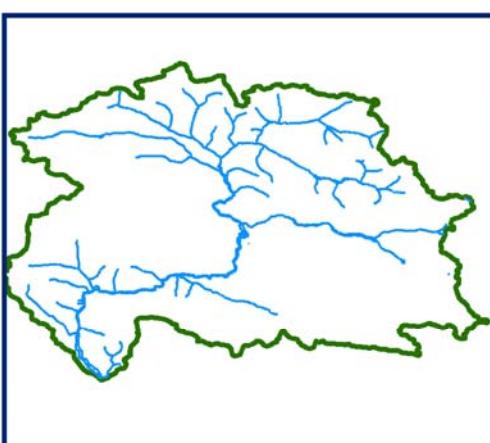
DATA NOT AVAILABLE



DATA NOT AVAILABLE

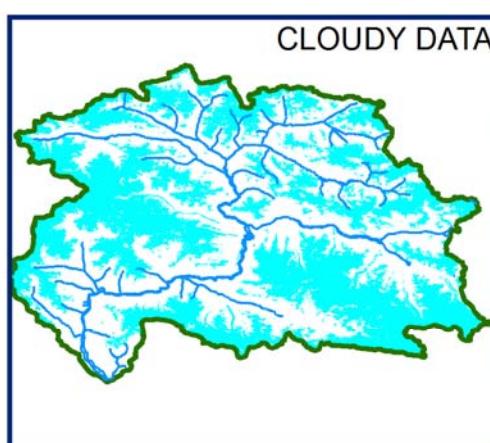


DATA NOT AVAILABLE



DATA NOT AVAILABLE

CLOUDY DATA



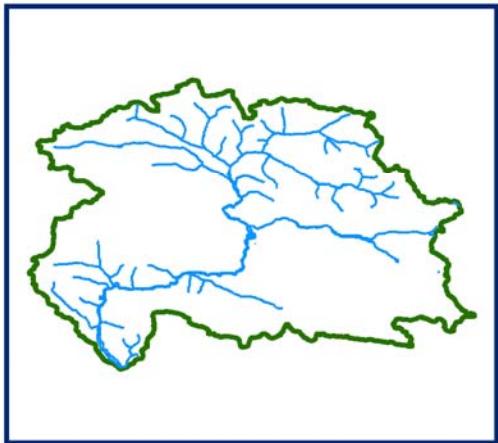
28 JUNE 2010



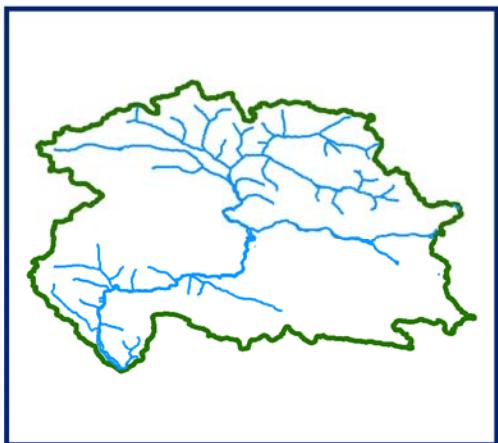
SNOW

05/0203040
Kilometers

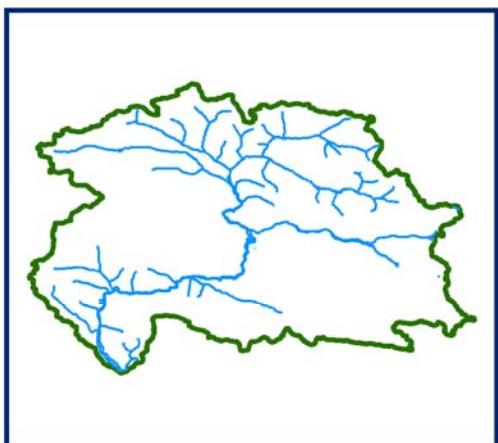
10 DAILY SNOW COVER MAP: HANZA BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE



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 2009							
1	03-Oct-09	629	5	5	17-Oct-09	5427	40
2	07-Oct-09	4419	32	6	27-Oct-09	5457	40
3	08-Oct-09	4038	30	7	31-Oct-09	6857	50
4	12-Oct-09	3844	28				
November 2009							
1	01-Nov-09	7319	54	4	20-Nov-09	8778	64
2	10-Nov-09	10377	76	5	24-Nov-09	7593	56
3	15-Nov-09	7539	55				
December 2009							
1	04-Dec-09	8875	65	4	23-Dec-09	11818	87
2	14-Dec-09	11076	81	5	28-Dec-09	8833	65
3	18-Dec-09	11943	88				
January 2010							
1	02-Jan-10	11597	85	4	21-Jan-10	9723	71
2	07-Jan-10	11394	84	5	26-Jan-10	10640	78
3	11-Jan-10	9438	69	6	31-Jan-10	12729	93
February 2010							
1	04-Feb-10	11297	83				
MARCH 2010							
1	05-Mar-10	10928	80	3	20-Mar-10	11641	86
2	15-Mar-10	11581	85	4	24-Mar-10	10736	79
APRIL 2010							
1	08-Apr-10	7120	52	2	27-Apr-10	1806	13
MAY 2010							
1	02-May-10	8587	63	4	26-May-10	8128	60
2	11-May-10	8155	60	5	31-May-10	7632	56
3	21-May-10	8478	62				
JUNE 2010							
1	28-Jun-10	5408	40				

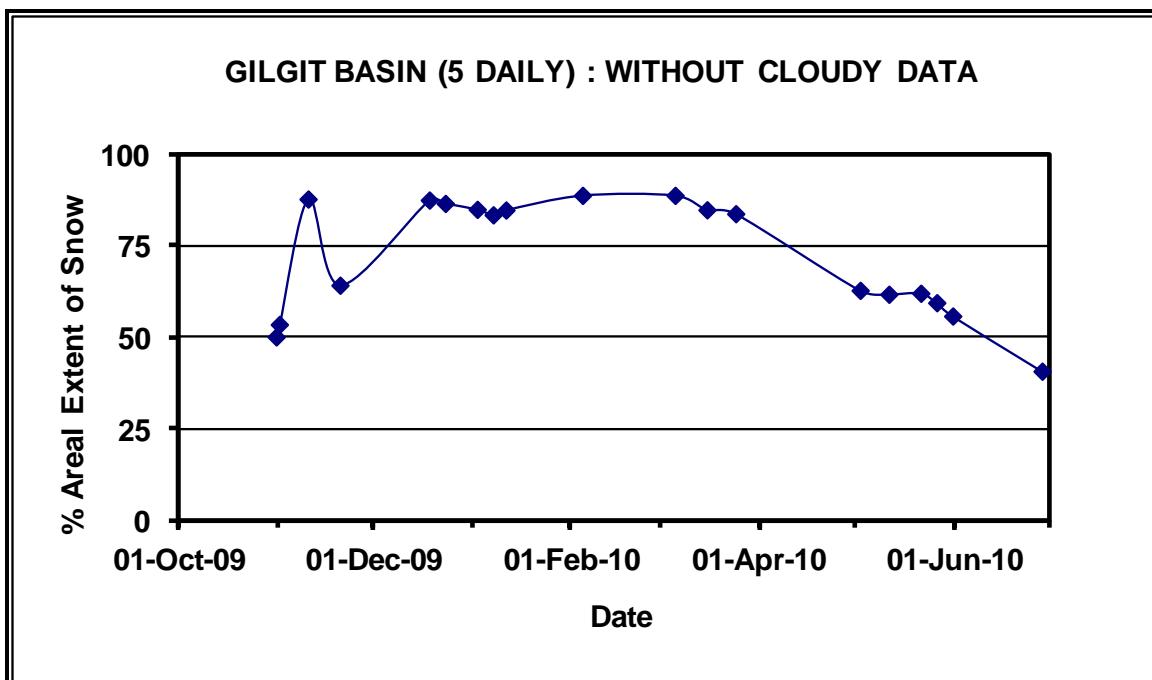
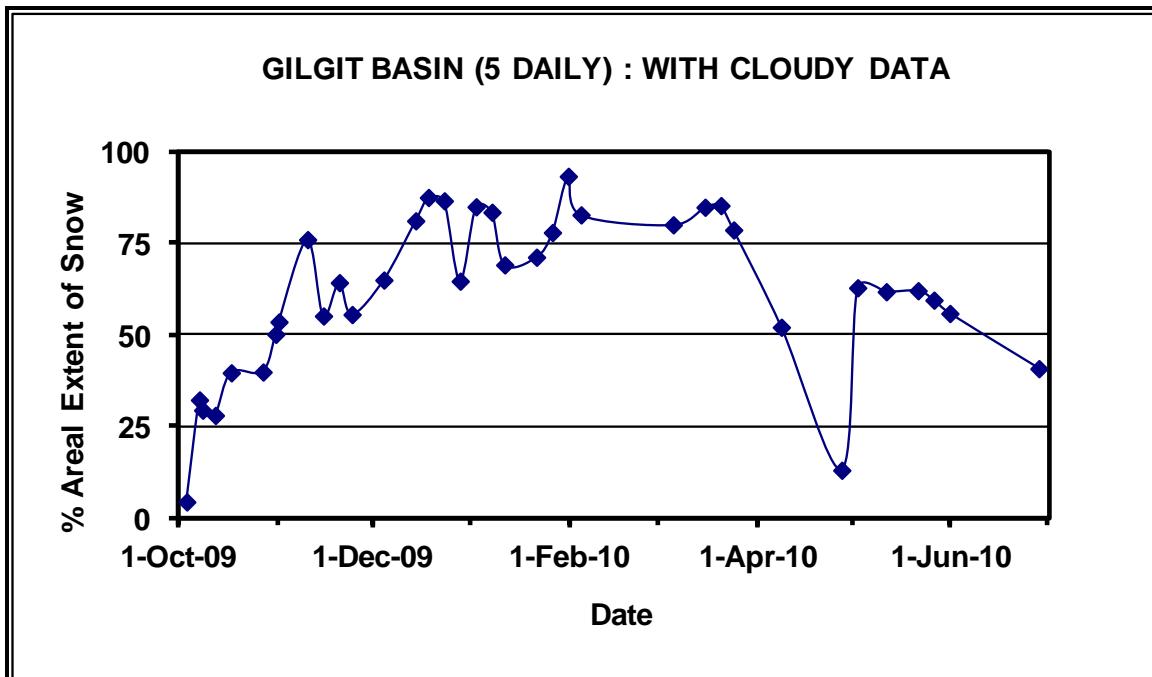
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: GILGIT

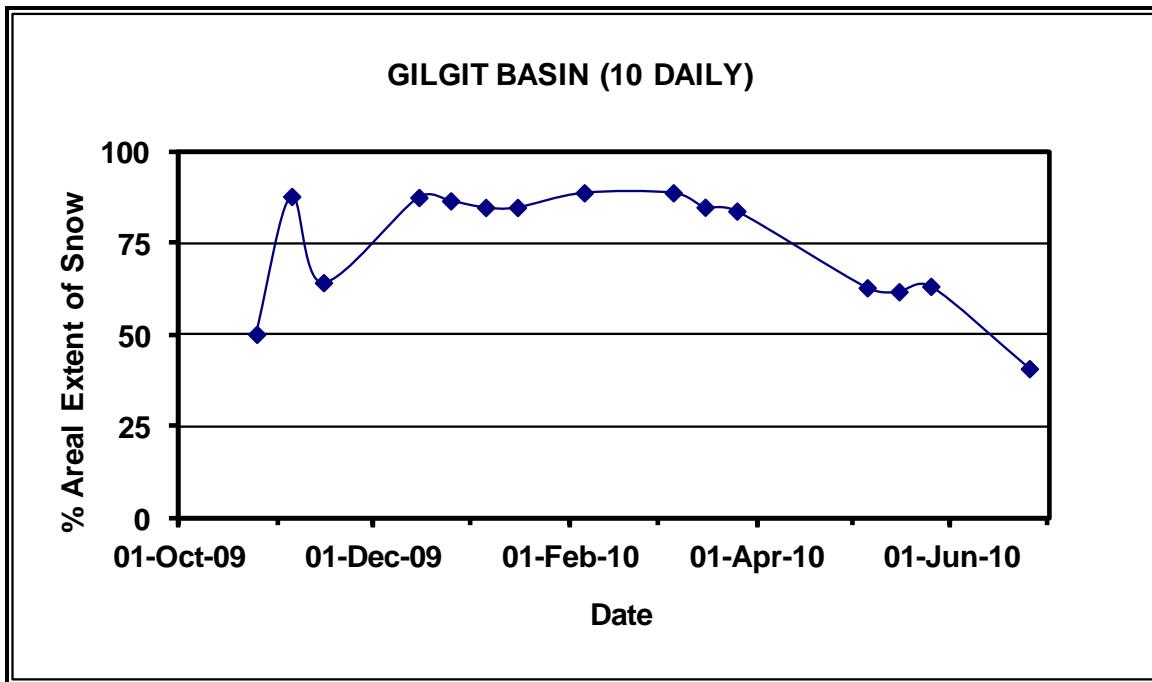
BASIN AREA: 13615 sq km

S. No	Date	Snow cover (sq km)	Snow cover (%)	S. No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	31-Oct-09	6857	50				
November 2009							
1	01-Nov-09	11981	88	2	20-Nov-09	8778	64
December 2009							
1	18-Dec-09	11943	88	2	23-Dec-09	11818	87
January 2010							
1	07-Jan-10	11573	85	2	15-Jan-10	11573	85
February 2010							
1	05-Feb-10	12117	89				
March 2010							
1	05-Mar-10	12117	89	3	25-Mar-10	11437	84
2	15-Mar-10	11581	85				
May 2010							
1	5-May-10	8640	63	3	25-May-10	8640	63
2	15-May-10	8441	62				
June 2010							
1	25-Jun-10	5582	41				

Snow cover depletion curve



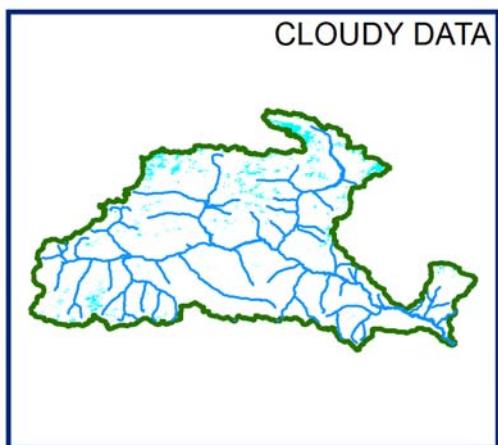
Snow cover depletion curve



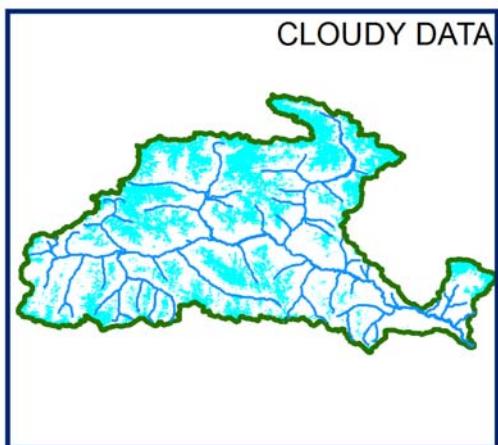
SNOW COVER MAP

SNOW COVER MAP:

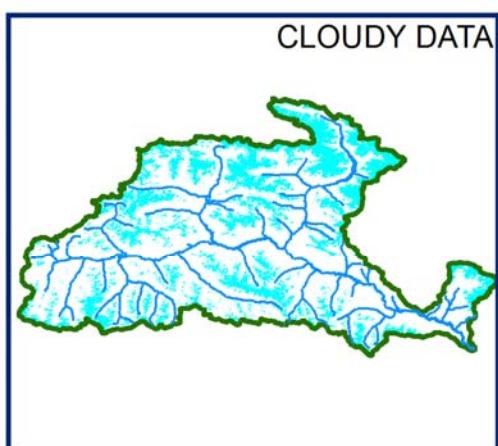
GILGIT BASIN



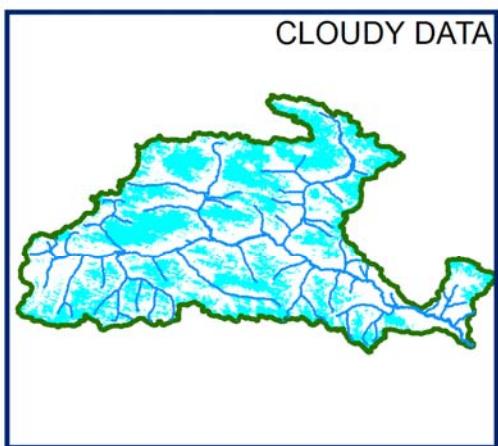
03 OCTOBER 2009



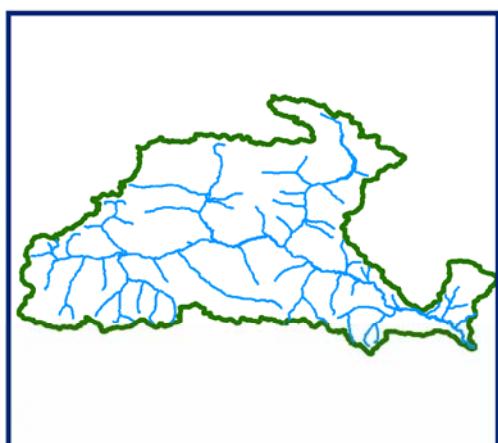
07 OCTOBER 2009



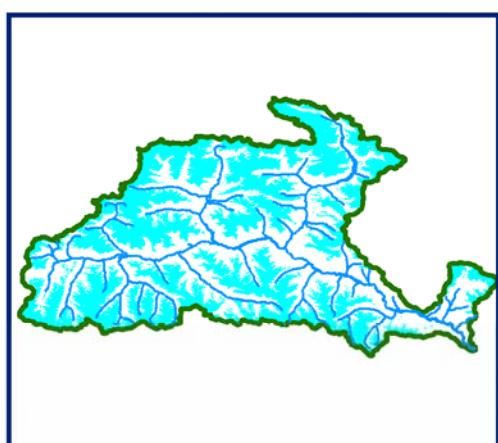
12 OCTOBER 2009



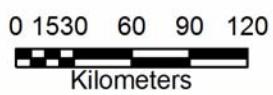
17 OCTOBER 2009



DATA NOT AVAILABLE



31 OCTOBER 2009



10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



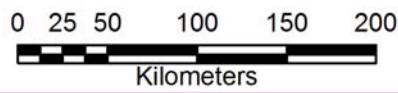
DATA NOT AVAILABLE



DATA USED
31 OCTOBER 2009

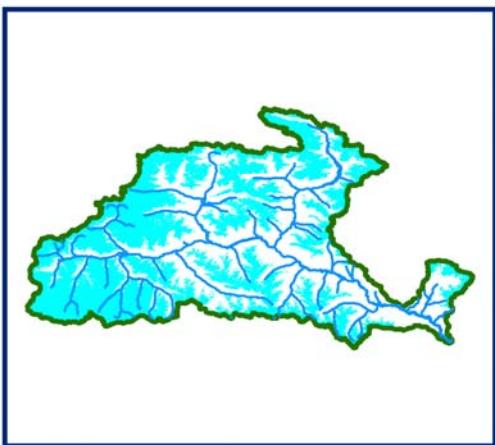
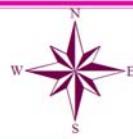


SNOW

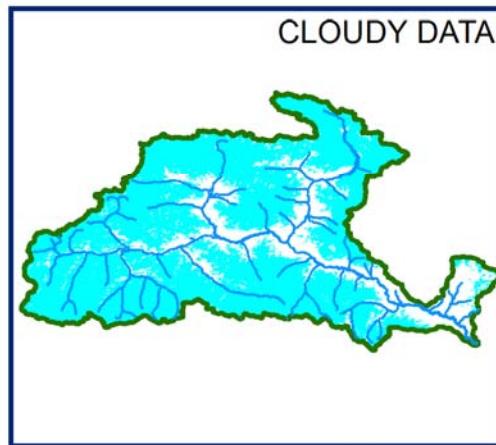


SNOW COVER MAP:

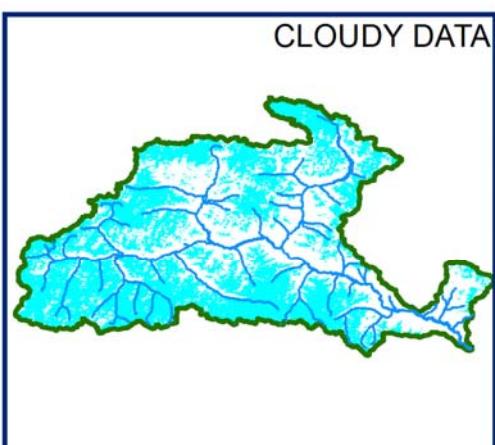
GILGIT BASIN



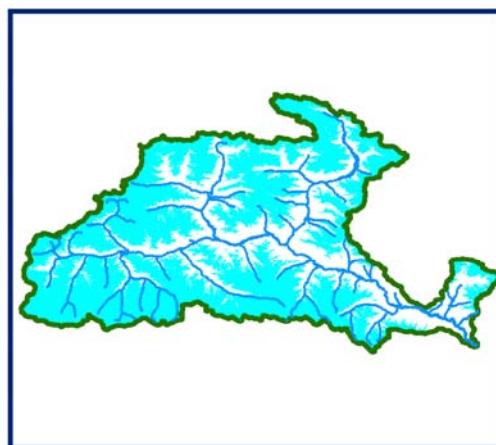
01 NOVEMBER 2009



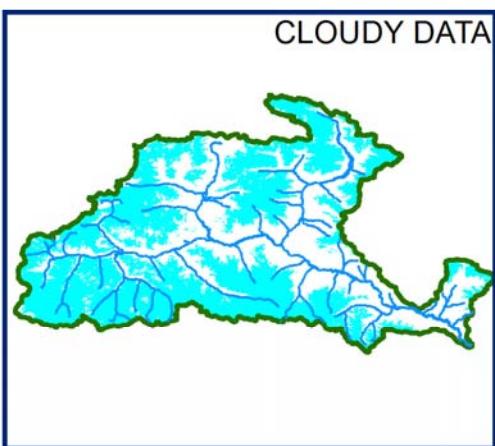
10 NOVEMBER 2009



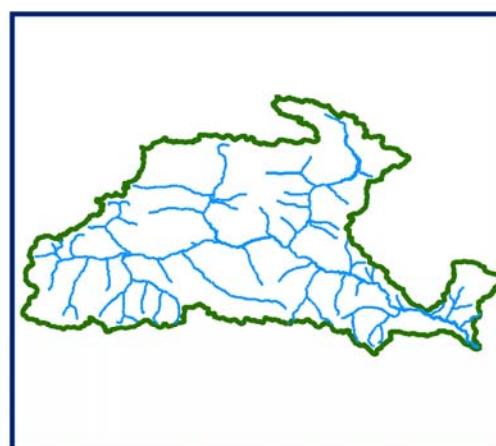
15 NOVEMBER 2009



20 NOVEMBER 2009



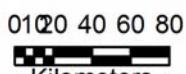
24 NOVEMBER 2009



DATA NOT AVAILABLE



SNOW



10 DAILY SNOW COVER MAP: GILGIT BASIN



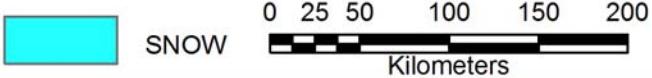
DATA USED
01 NOVEMBER 2009



DATA USED
20 NOVEMBER 2009



DATA NOT AVAILABLE



SNOW COVER MAP:

GILGIT BASIN



CLOUDY DATA

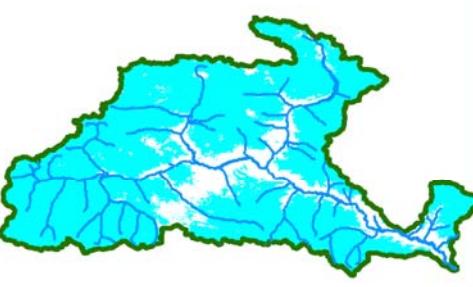


04 DECEMBER 2009



DATA NOT AVAILABLE

CLOUDY DATA



14 DECEMBER 2009

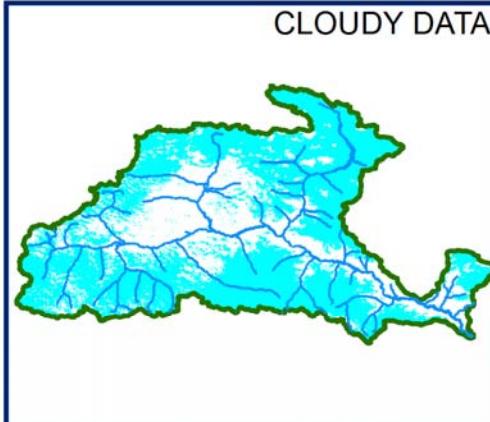


18 DECEMBER 2009

CLOUDY DATA



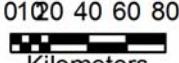
23 DECEMBER 2009



28 DECEMBER 2009

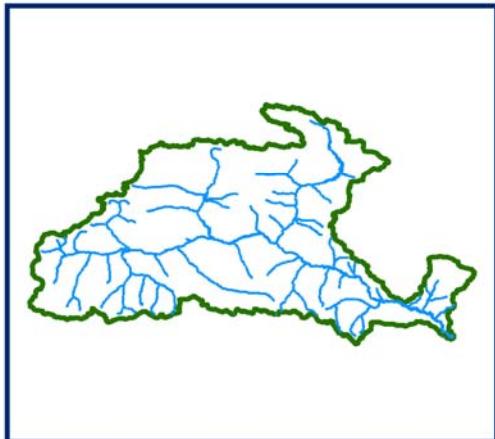


SNOW

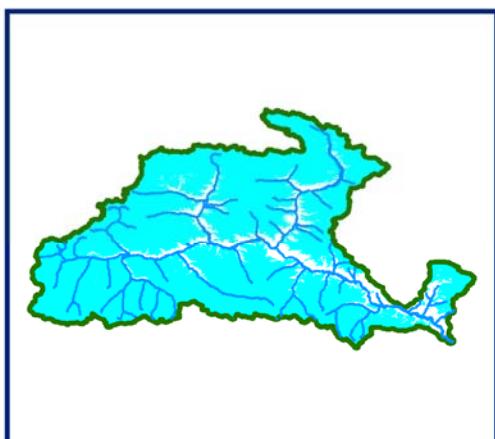


Kilometers

10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



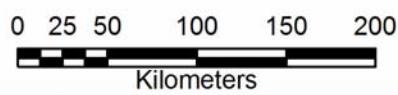
**DATA USED
18 DECEMBER 2009**



**DATA USED
23 DECEMBER 2009**



SNOW



SNOW COVER MAP:

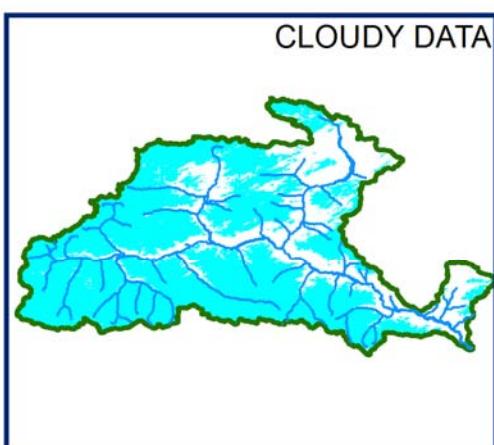
GILGIT BASIN



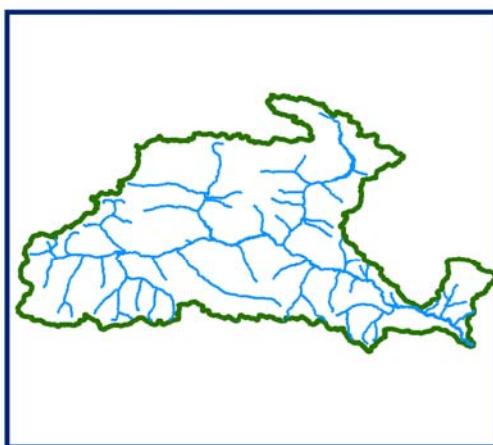
02 JANUARY 2010



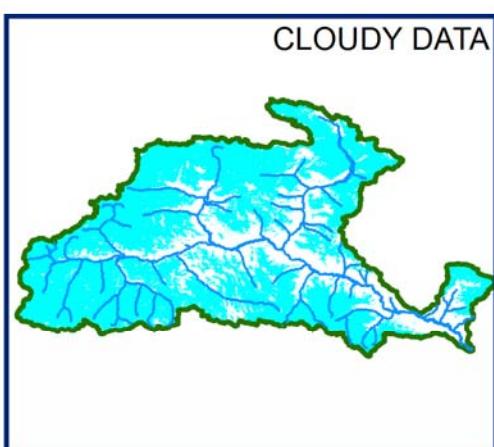
07 JANUARY 2010



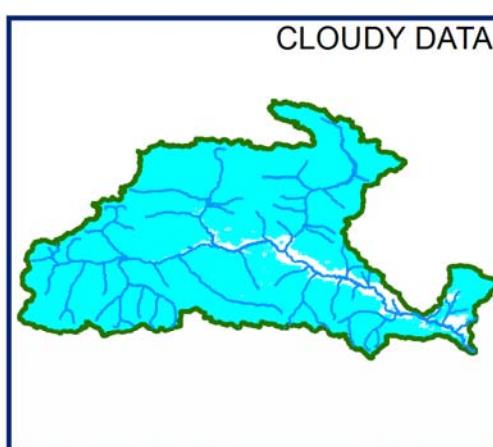
11 JANUARY 2010



DATA NOT AVAILABLE



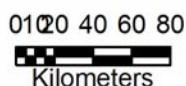
21 JANUARY 2010



31 JANUARY 2010



SNOW



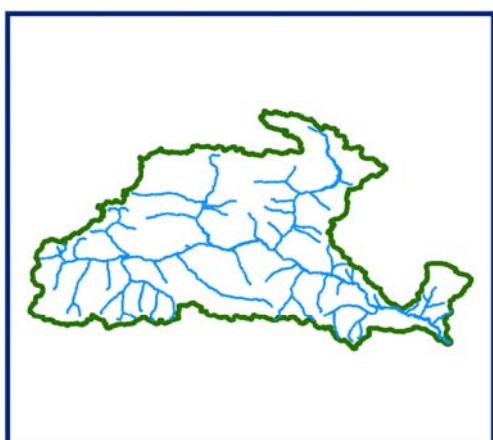
10 DAILY SNOW COVER MAP: GILGIT BASIN



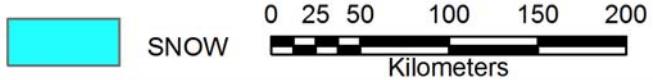
DATA USED
02 JANUARY 2010
07 JANUARY 2010



DATA NOT AVAILABLE

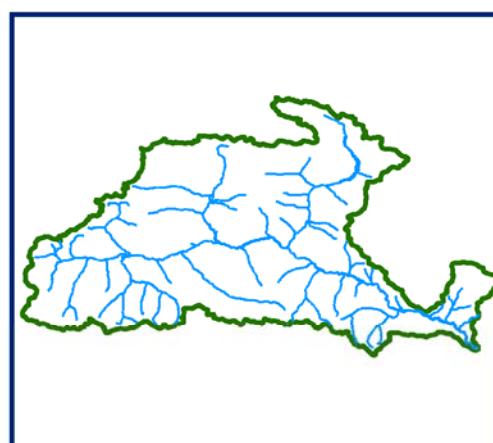
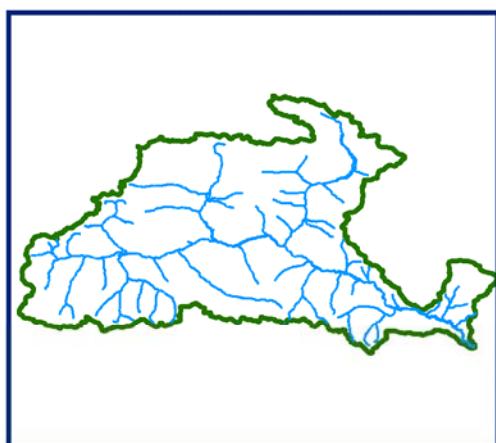
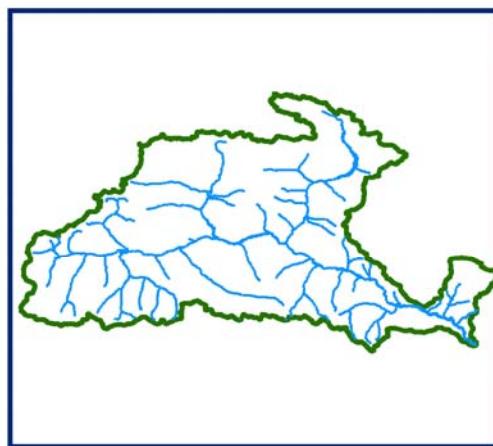
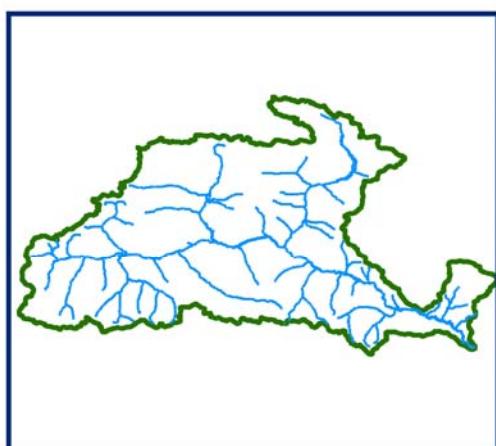
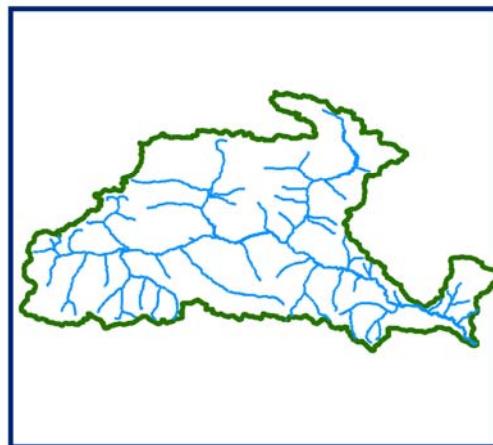
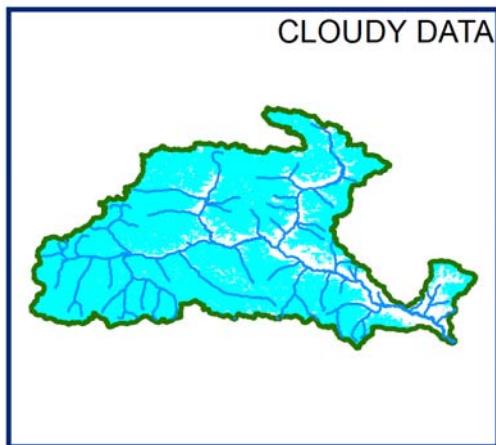


DATA NOT AVAILABLE



SNOW COVER MAP:

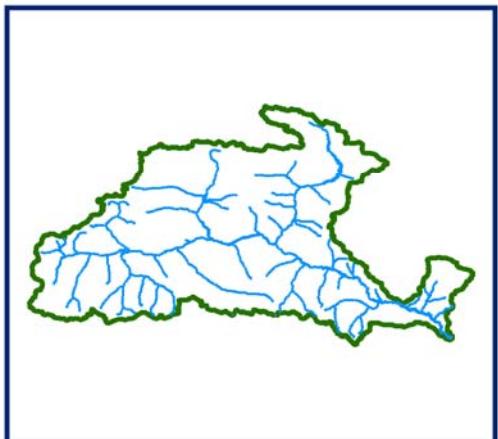
GILGIT BASIN



SNOW

01 20 40 60 80
Kilometers

10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE

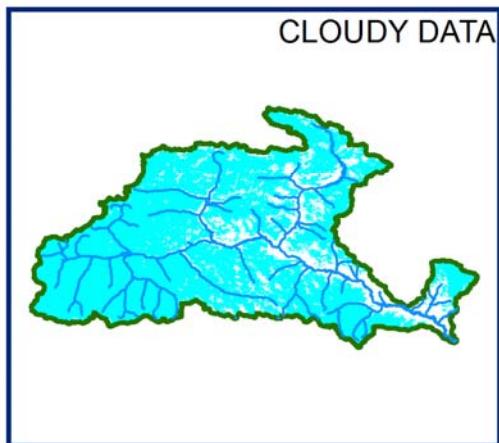


DATA NOT AVAILABLE

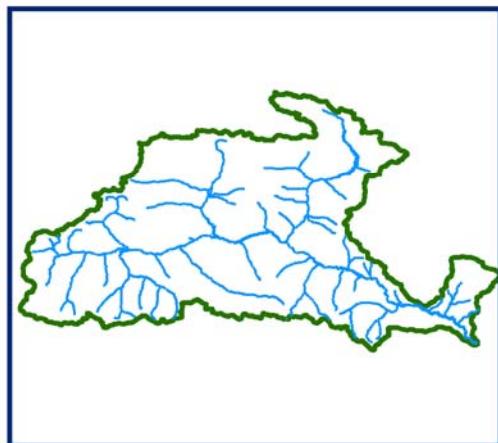


SNOW COVER MAP:

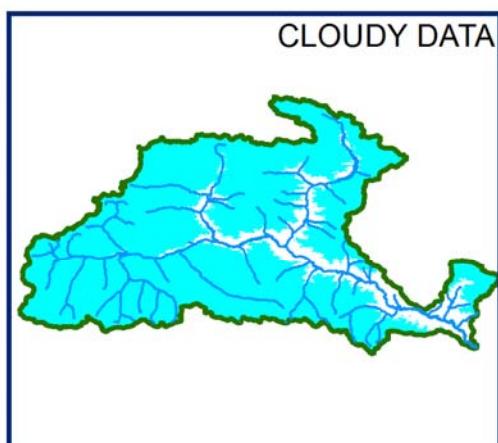
GILGIT BASIN



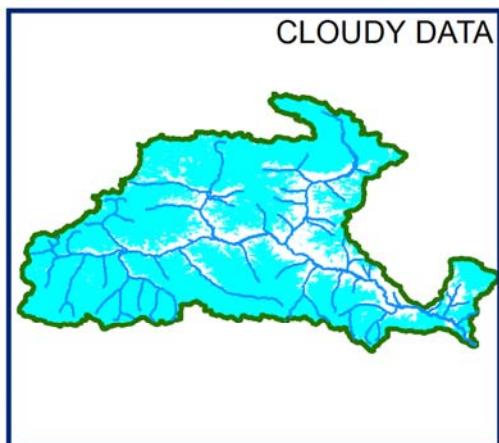
05 MARCH 2010



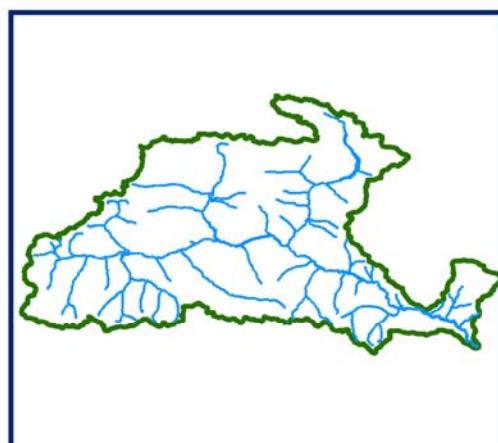
15 MARCH 2010



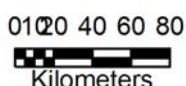
20 MARCH 2010



24 MARCH 2010



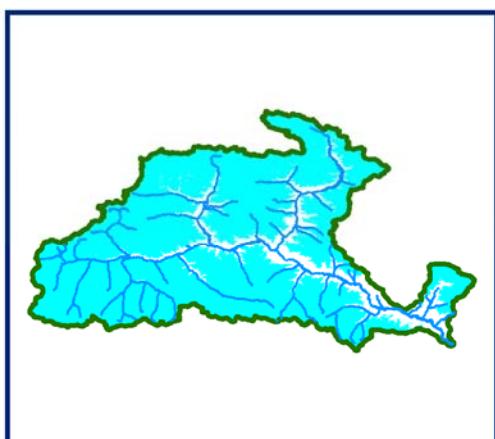
SNOW



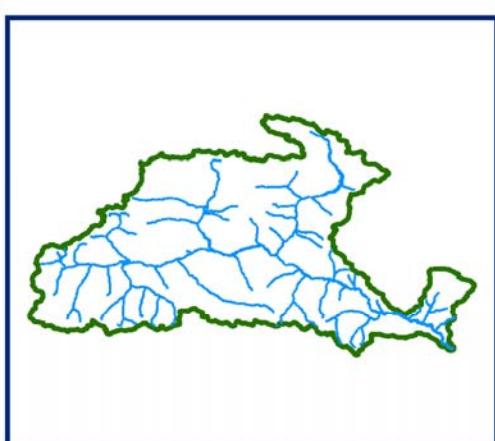
10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



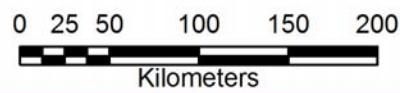
**DATA USED
15 MARCH 2010**



DATA NOT AVAILABLE

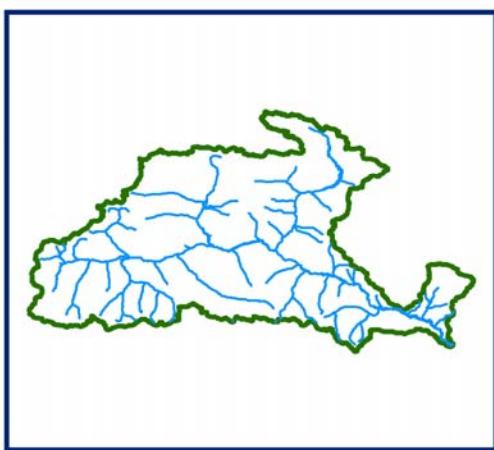


SNOW

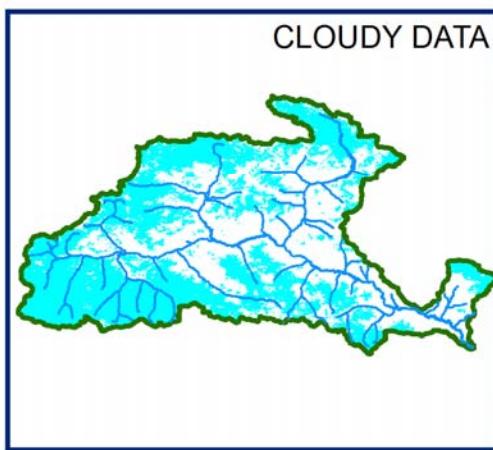


SNOW COVER MAP:

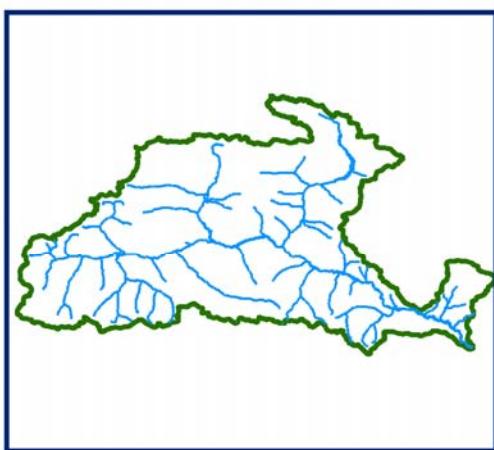
GILGIT BASIN



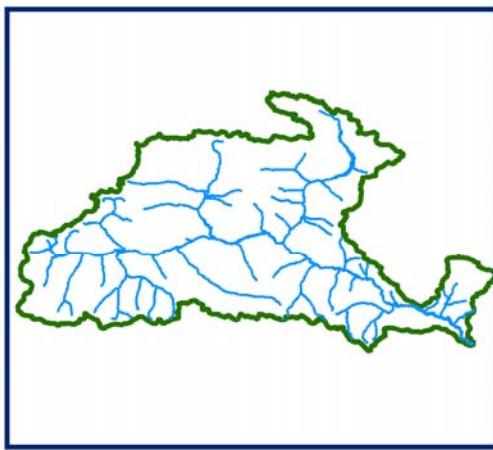
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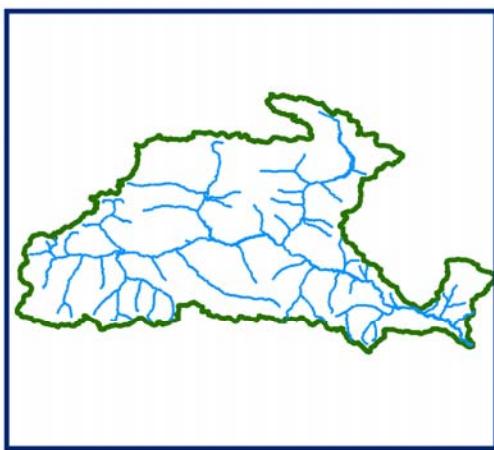
08 APRIL 2010



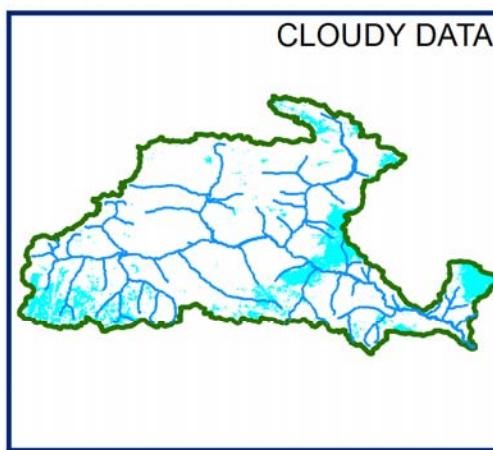
DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



27 APRIL 2010



SNOW

0 10 20 40 60 80
Kilometers

10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



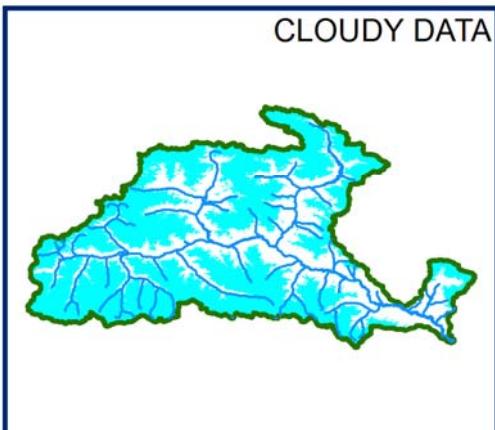
SNOW

0 25 50 100 150 200

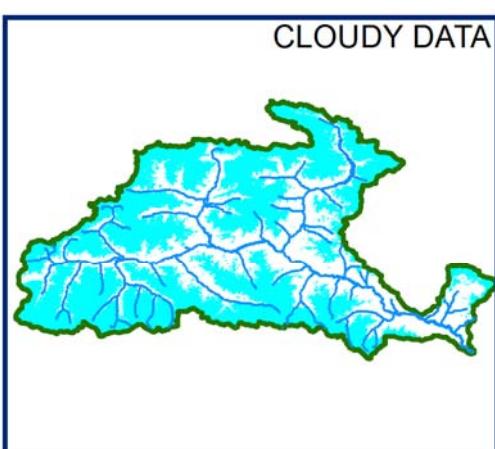
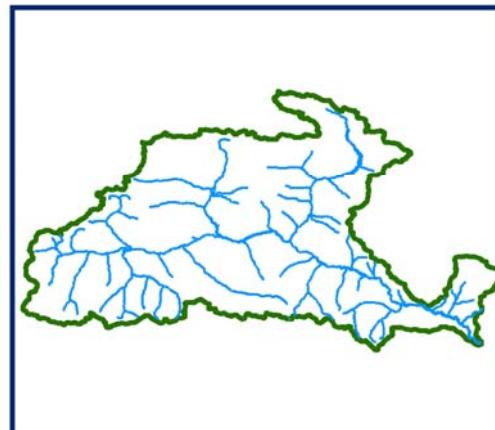
Kilometers

SNOW COVER MAP:

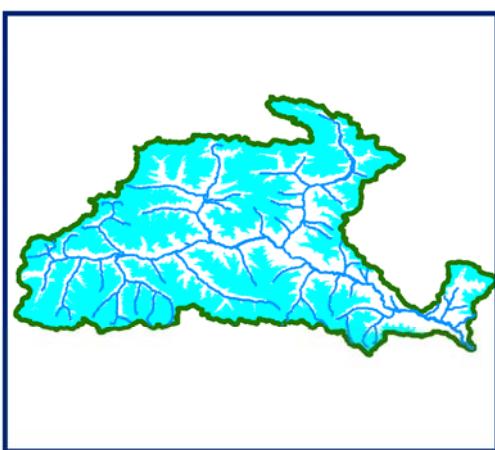
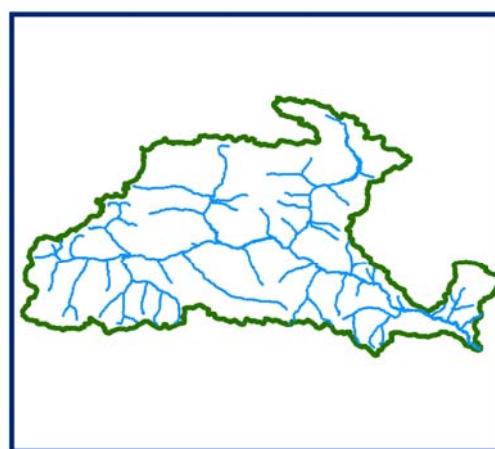
GILGIT BASIN



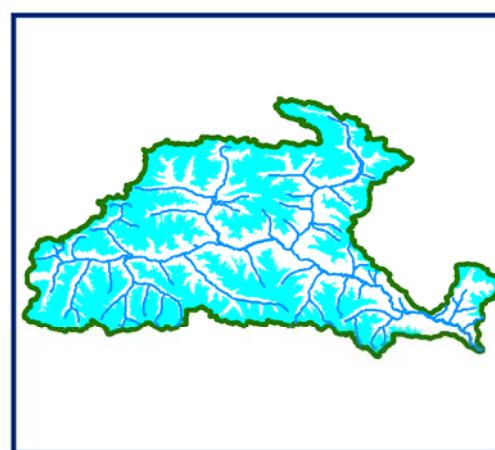
02 MAY 2010



11 MAY 2010



21 MAY 2010



31 MAY 2010



SNOW



Kilometers

10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



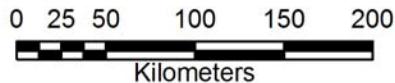
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DATA USED
21 MAY 2010
31 MAY 2010

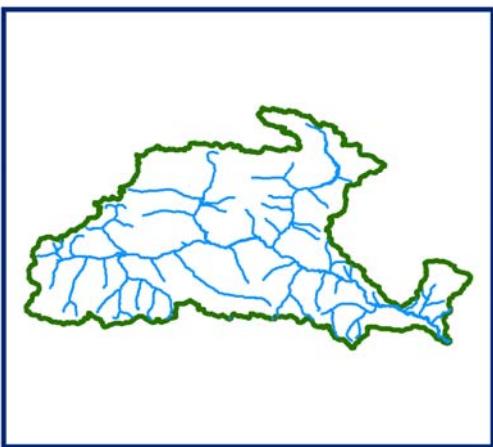


SNOW

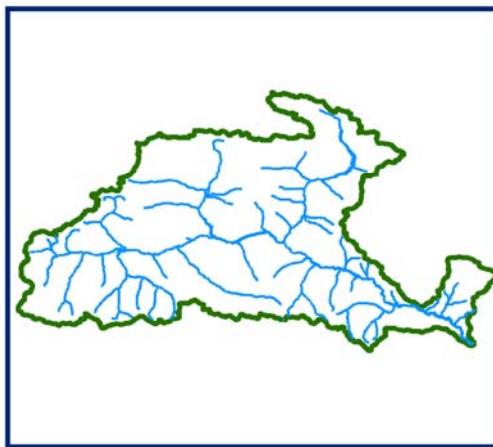


SNOW COVER MAP:

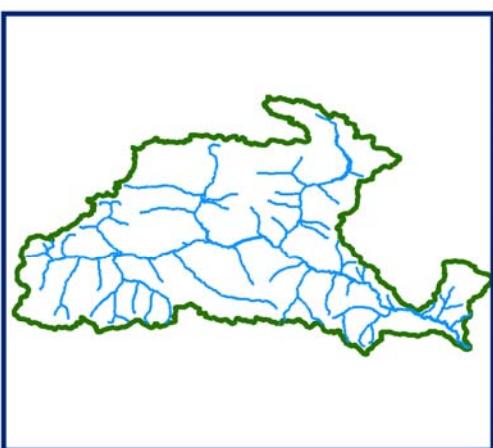
GILGIT BASIN



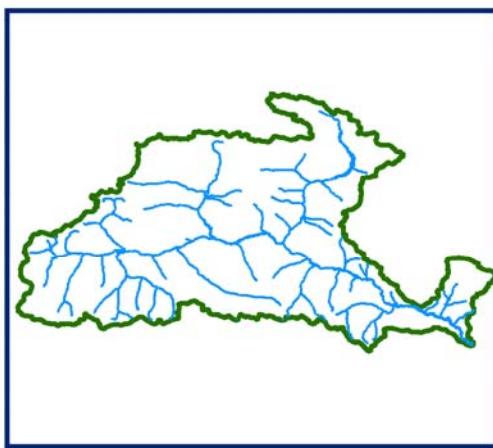
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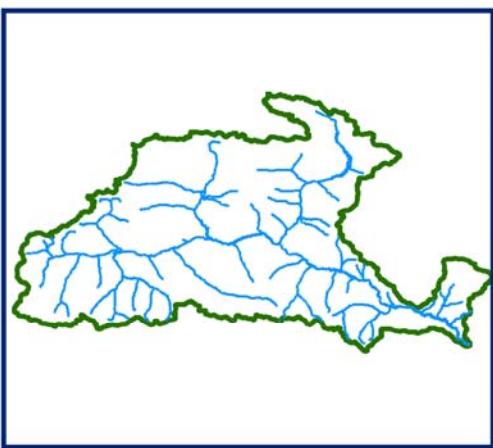
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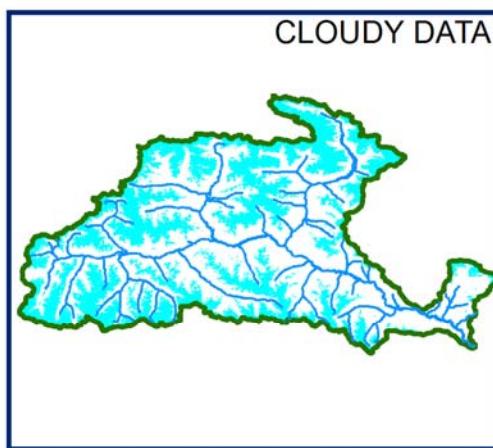
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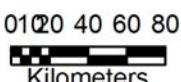
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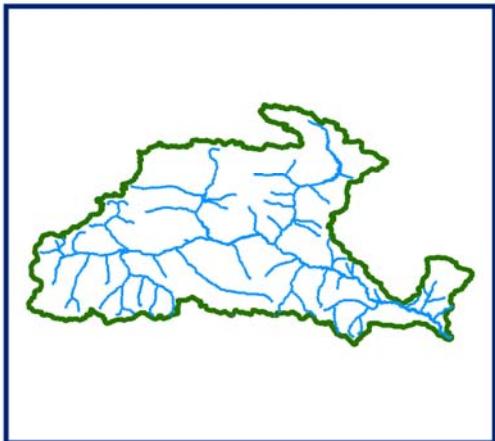
28 JUNE 2010



SNOW



10 DAILY SNOW COVER MAP: GILGIT BASIN



DATA NOT AVAILABLE



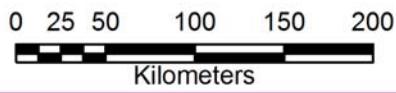
DATA NOT AVAILABLE



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 2009							
1	03-Oct-09	2785	37	4	12-Oct-09	4267	56
2	07-Oct-09	3530	46	5	17-Oct-09	4017	53
3	08-Oct-09	7292	96	6	27-Oct-09	4137	54
November 2009							
1	01-Nov-09	4357	57	5	15-Nov-09	3537	46
2	06-Nov-09	3758	49	6	20-Nov-09	5507	72
3	10-Nov-09	2735	36	7	25-Nov-09	4191	55
4	11-Nov-09	5534	73				
December 2009							
1	04-Dec-09	2326	31	5	24-Dec-09	4749	62
2	14-Dec-09	5257	69	6	28-Dec-09	4040	53
3	19-Dec-09	4862	64	7	29-Dec-09	3166	42
4	23-Dec-09	5016	66				
January 2010							
1	02-Jan-10	4519	59	3	21-Jan-10	4298	56
2	07-Jan-10	3412	45	4	26-Jan-10	4162	55
February 2010							
1	05-Feb-10	3478	46				
MARCH 2010							
1	11-Mar-10	4784	63	3	20-Mar-10	4237	56
2	15-Mar-10	4598	60				
APRIL 2010							
1	08-Apr-10	5330	70	2	27-Apr-10	5450	72
MAY 2010							
1	02-May-10	4840	64	4	26-May-10	4731	62
2	21-May-10	5437	71	5	31-May-10	5523	73
3	22-May-10	4106	54				
JUNE 2010							
1	05-Jun-10	4347	57	2	29-Jun-10	2800	37

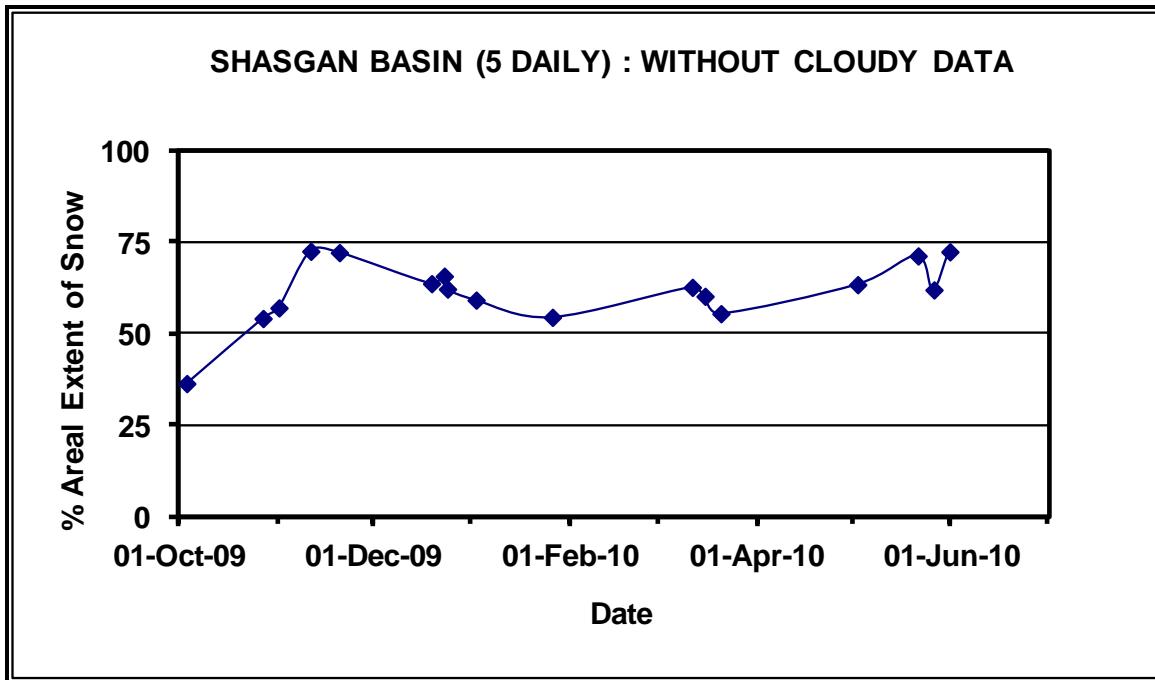
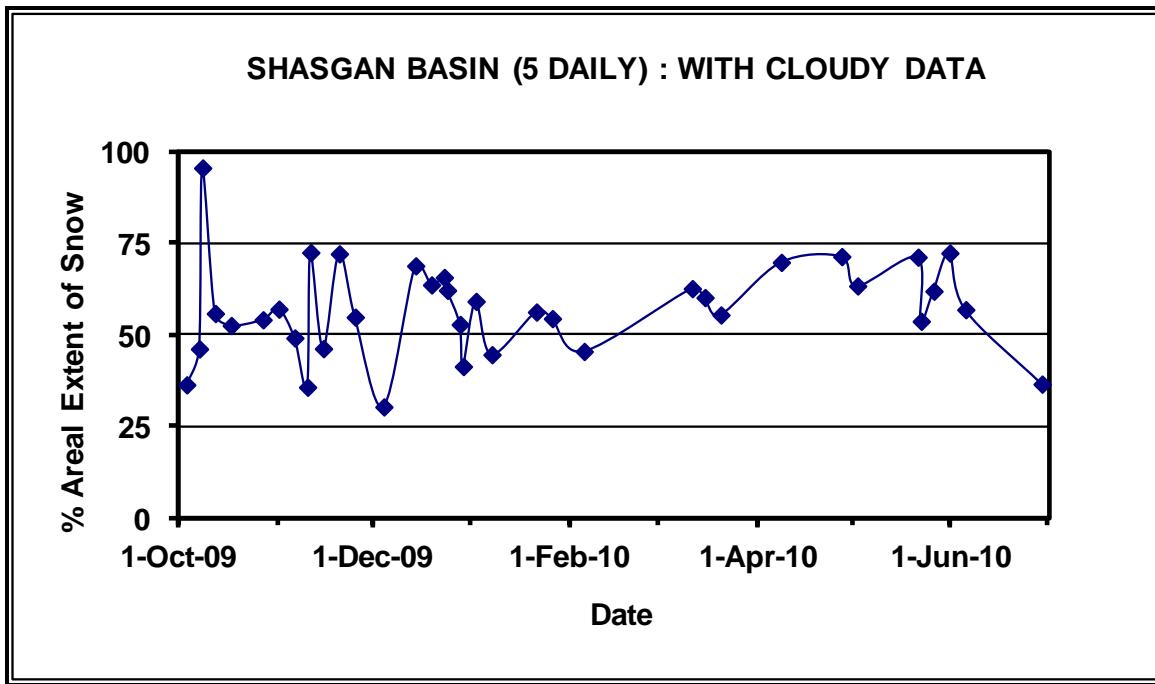
AREAL EXTENT OF SNOW (10 DAILY)

BASIN NAME: SHASGAN

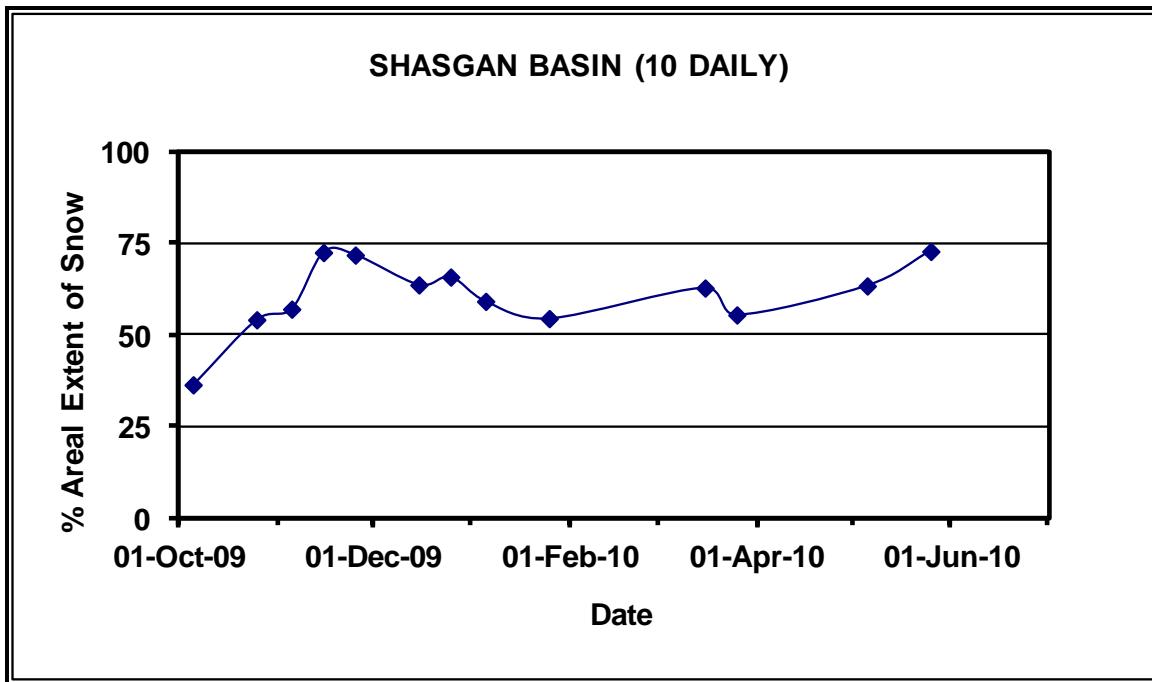
BASIN AREA: 7613 sq km

S No	Date	Snow cover (sq km)	Snow cover (%)	S No	Date	Snow cover (sq km)	Snow cover (%)
October 2009							
1	03-Oct-09	2785	37	2	27-Oct-09	4137	54
November 2009							
1	01-Nov-09	4357	57	3	20-Nov-09	5481	72
2	20-Nov-09	5534	73				
December 2009							
1	19-Dec-09	4862	64	2	24-Dec-09	5025	66
January 2010							
1	02-Jan-10	4519	59	2	26-Jan-10	4162	55
March 2010							
1	11-Mar-10	4796	63	2	25-Mar-10	4237	56
May 2010							
1	02-May-10	4840	64	2	26-May-10	5557	73

Snow cover depletion curve



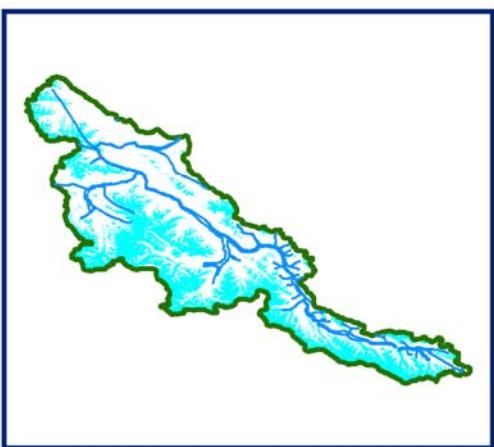
Snow cover depletion curve



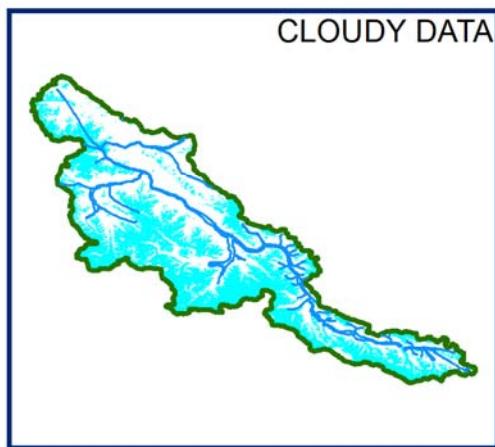
SNOW COVER MAP

SNOW COVER MAP:

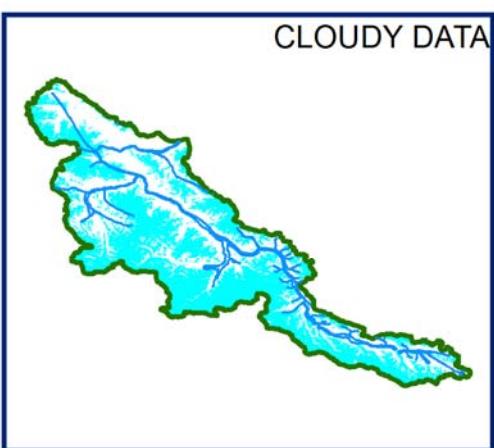
SHASGAN BASIN



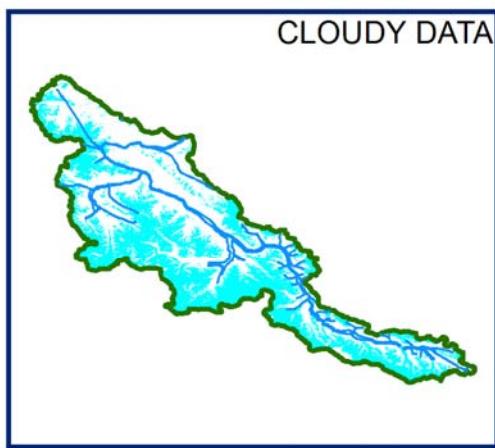
03 OCTOBER 2009



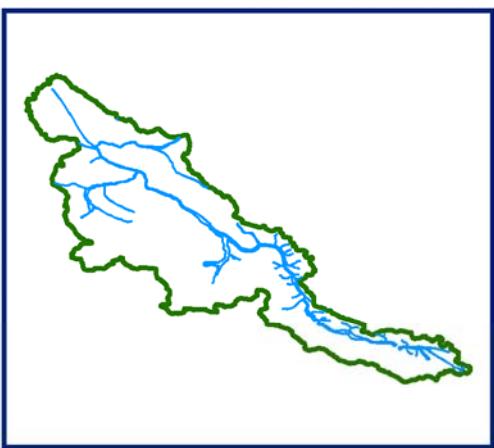
07 OCTOBER 2009



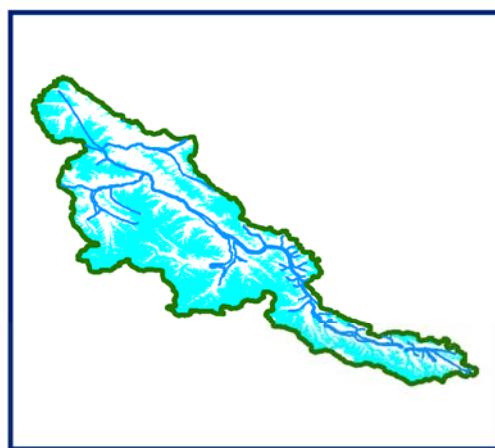
12 OCTOBER 2009



17 OCTOBER 2009



DATA NOT AVAILABLE



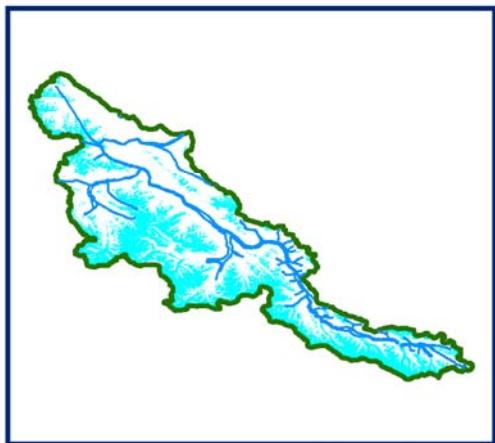
27 OCTOBER 2009



SNOW

05 02 03 04
 Kilometers

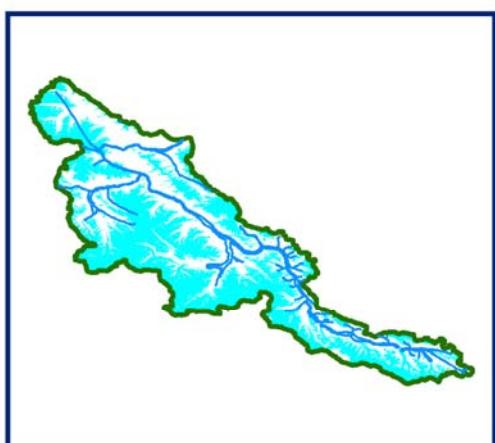
10 DAILY SNOW COVER MAP: SHASGAN BASIN



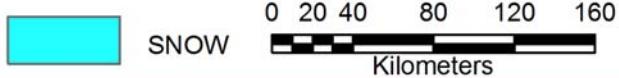
DATA USED
03 OCTOBER 2009



DATA NOT AVAILABLE

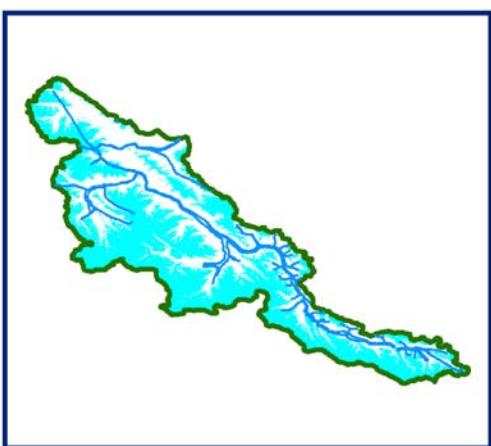
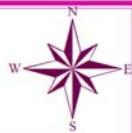


DATA USED
27 OCTOBER 2009

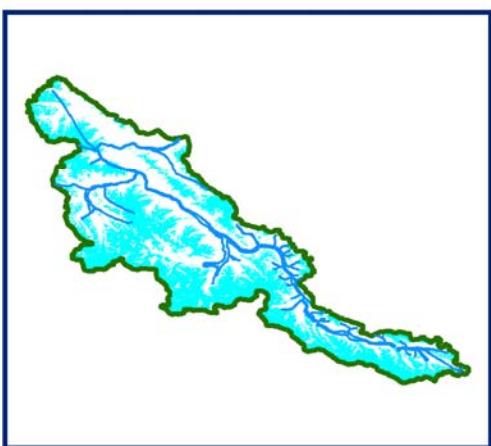


SNOW COVER MAP:

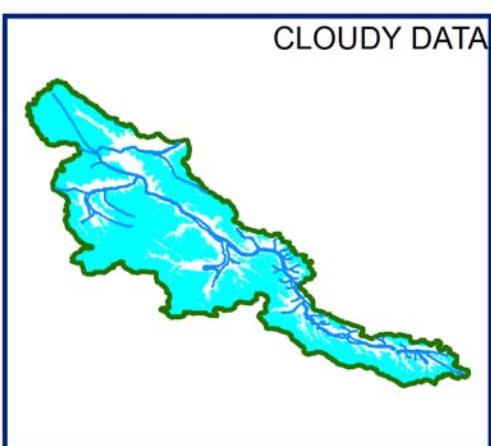
SHASGAN BASIN



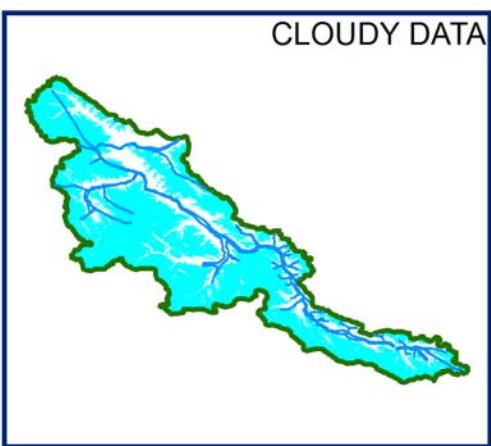
01 NOVEMBER 2009



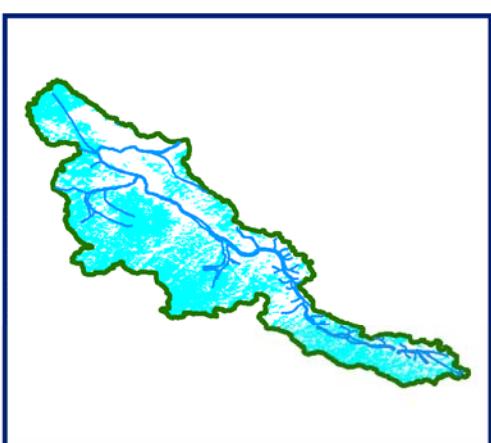
06 NOVEMBER 2009



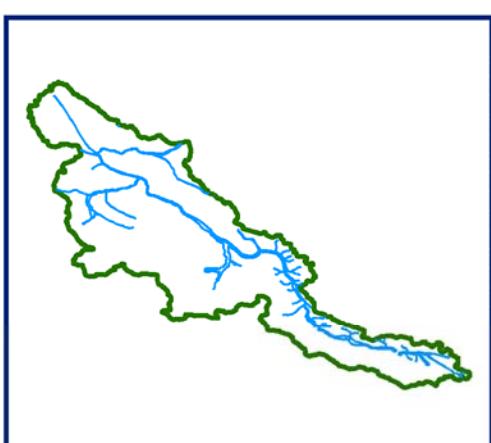
**CLOUDY DATA
11 NOVEMBER 2009**



**CLOUDY DATA
20 NOVEMBER 2009**



25 NOVEMBER 2009



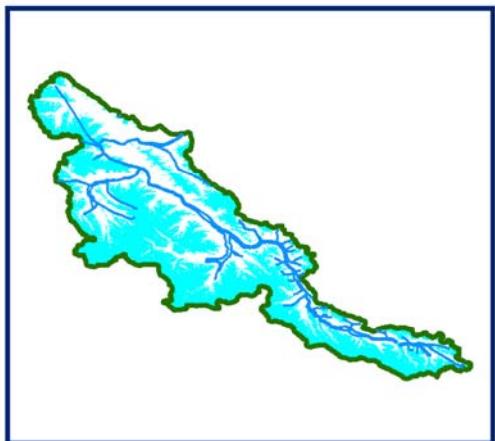
DATA NOT AVAILABLE



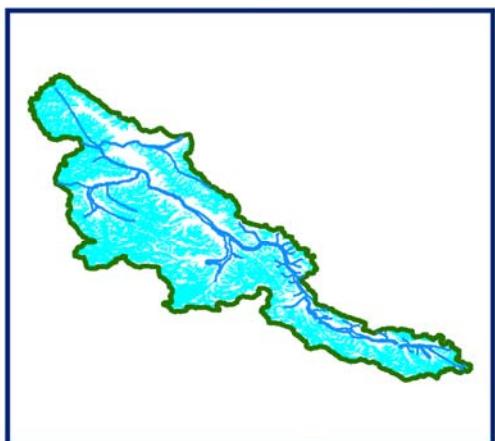
SNOW



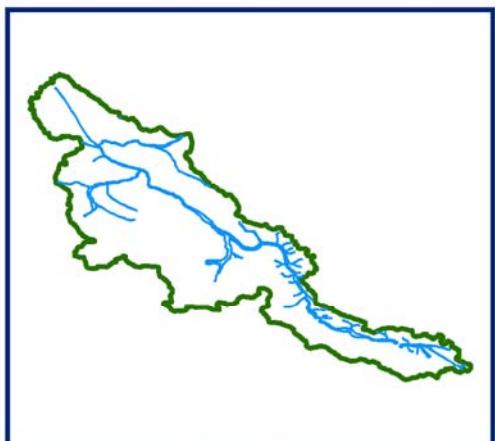
10 DAILY SNOW COVER MAP: SHASGAN BASIN



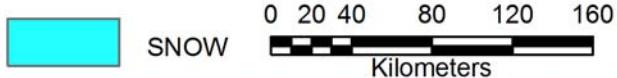
DATA USED
01 NOVEMBER 2009



DATA USED
11 NOVEMBER 2009
20 NOVEMBER 2009



DATA NOT AVAILABLE

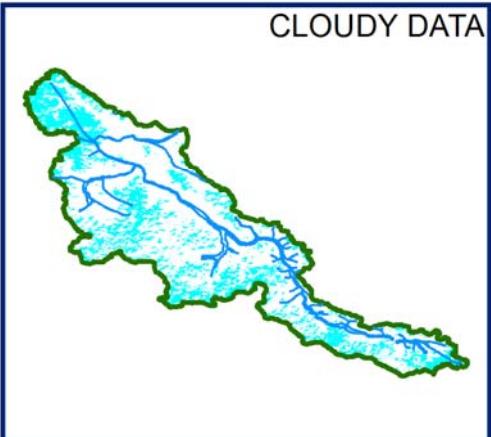


SNOW COVER MAP:

SHASGAN BASIN

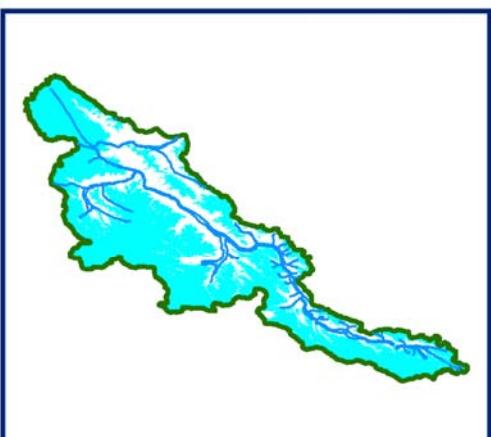


CLOUDY DATA

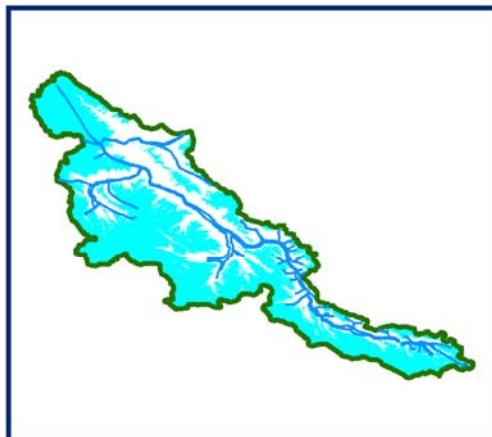


04 DECEMBER 2009

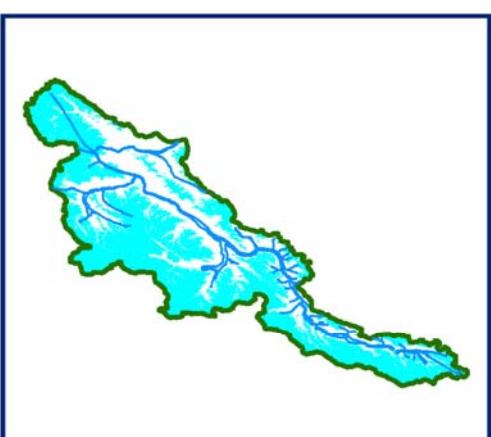
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14 DECEMBER 2009

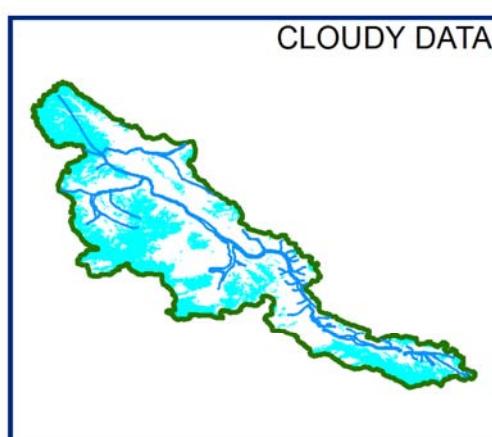


19 DECEMBER 2009



24 DECEMBER 2009

CLOUDY DATA



29 DECEMBER 2009



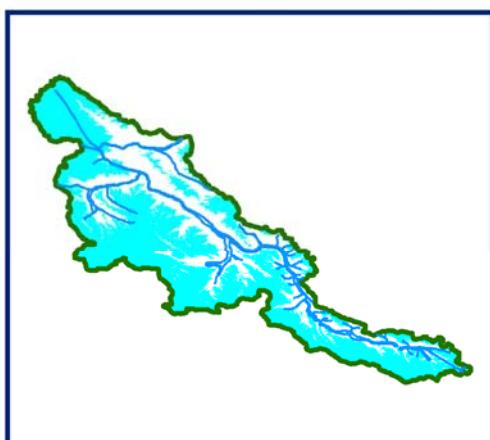
SNOW

05 02 03 04
Kilometers

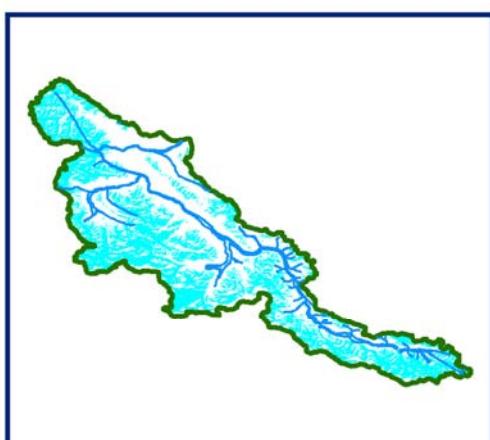
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA NOT AVAILABLE



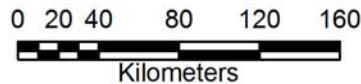
**DATA USED
19 DECEMBER 2009**



**DATA USED
23 DECEMBER 2009
24 DECEMBER 2009**

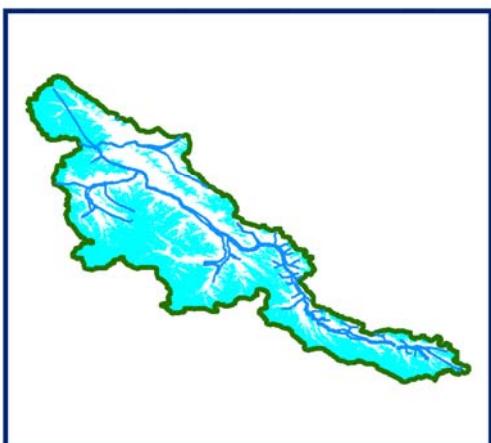


SNOW

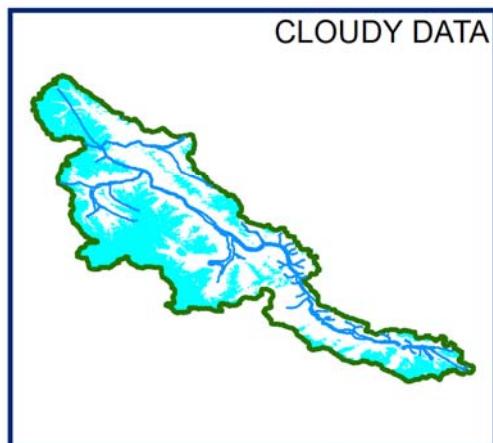


SNOW COVER MAP:

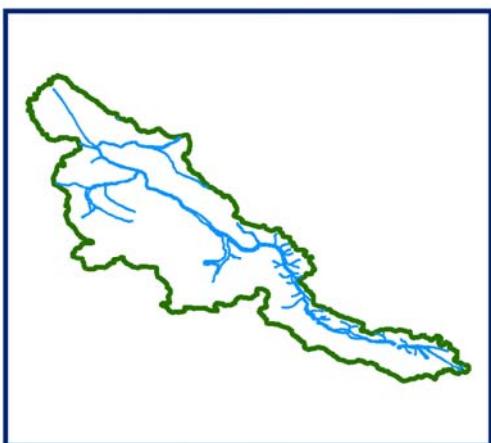
SHASGAN BASIN



02 JANUARY 2010



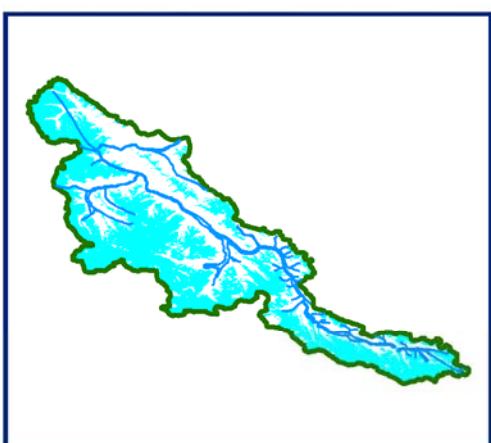
07 JANUARY 2010



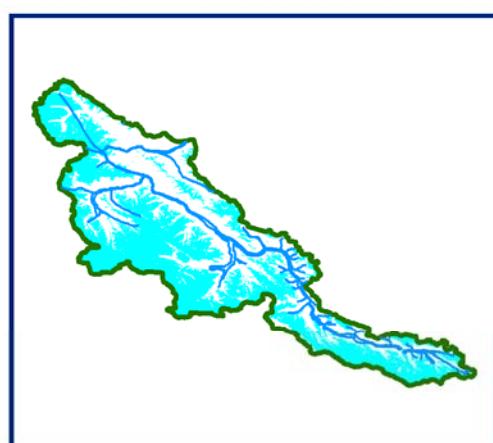
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 JANUARY 2010



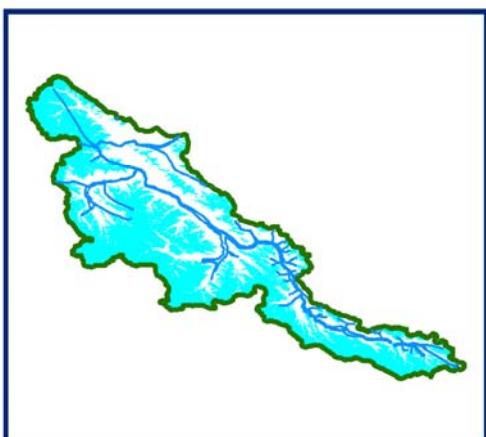
26 JANUARY 2010



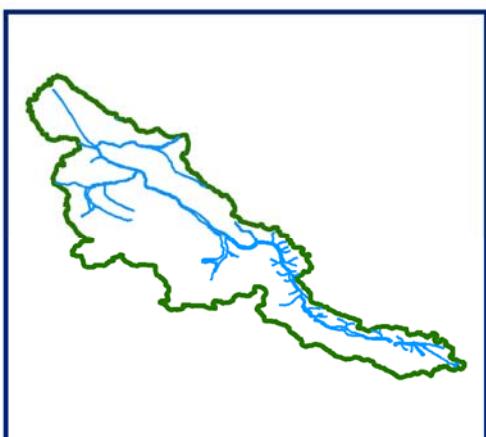
SNOW

01 02 03 04
Kilometers

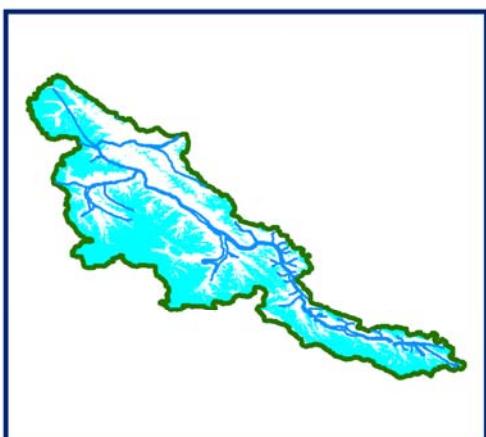
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA USED
02 JANUARY 2010



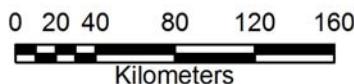
DATA NOT AVAILABLE



DATA USED
26 JANUARY 2010

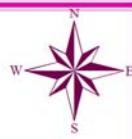


SNOW

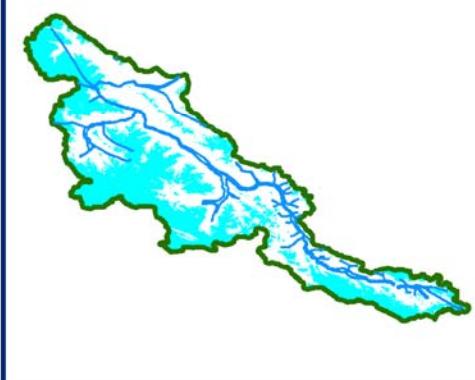


SNOW COVER MAP:

SHASGAN BASIN



CLOUDY DATA

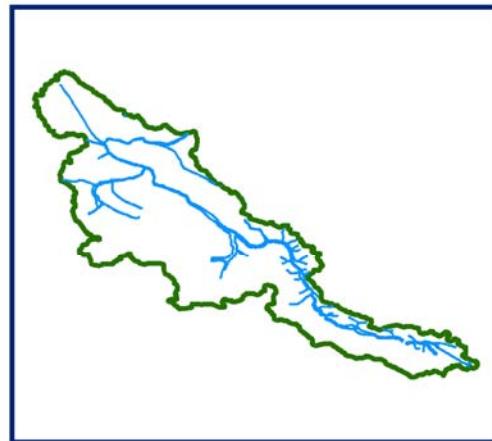


05 FEBRUARY 2010

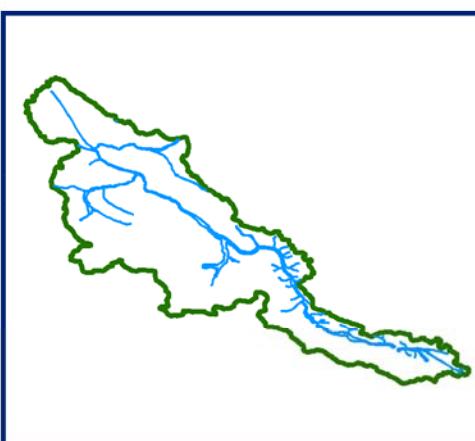
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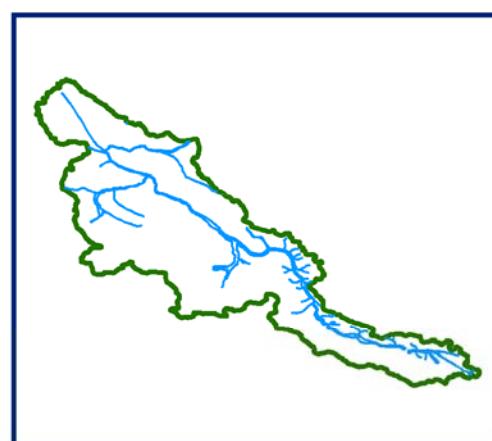
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DATA NOT AVAILABLE



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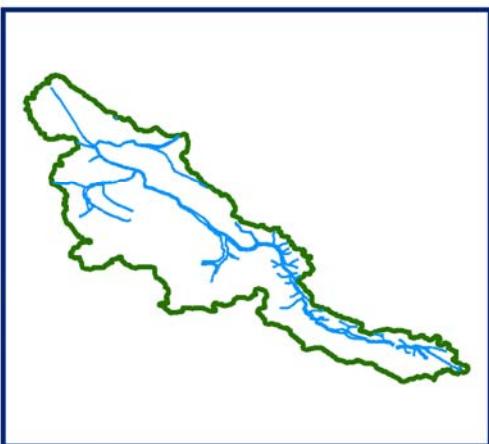


SNOW

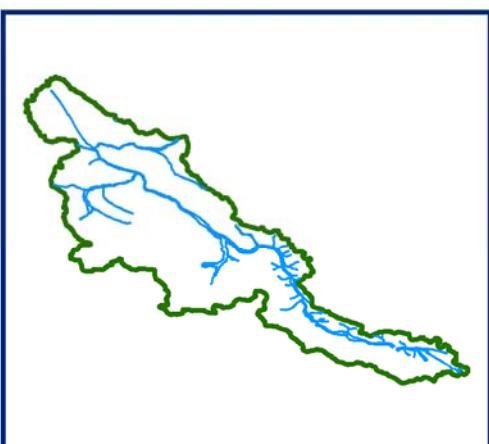


Kilometers

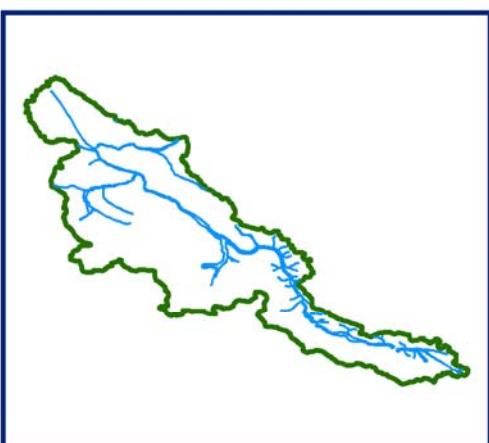
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA NOT AVAILABLE



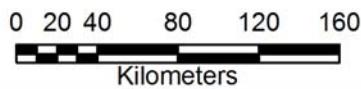
DATA NOT AVAILABLE



DATA NOT AVAILABLE

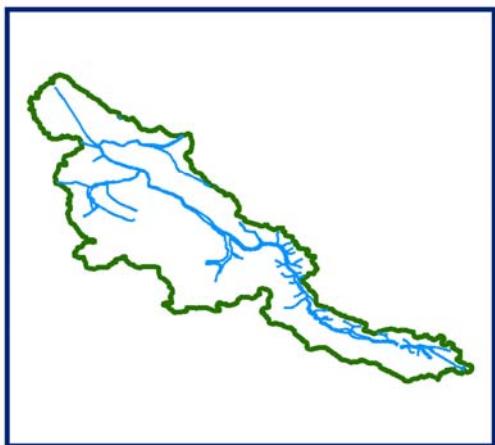


SNOW

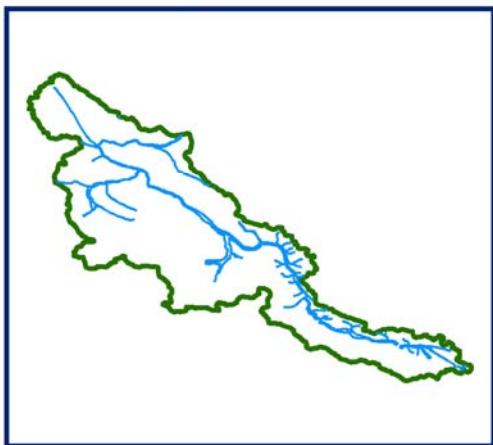


SNOW COVER MAP:

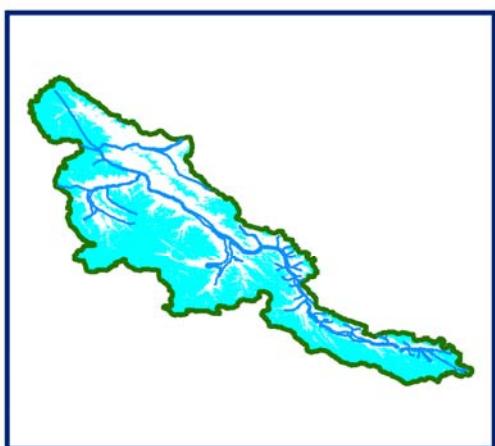
SHASGAN BASIN



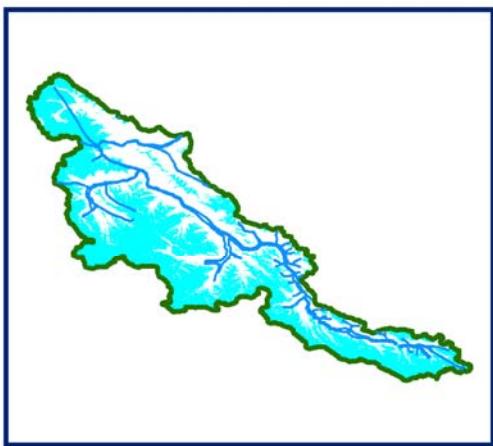
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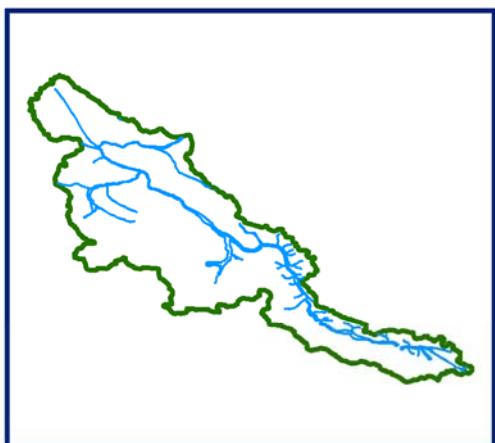
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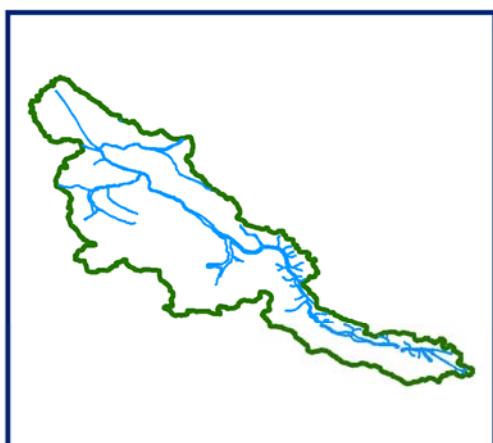
11 MARCH 2010



20 MARCH 2010



DATA NOT AVAILABLE



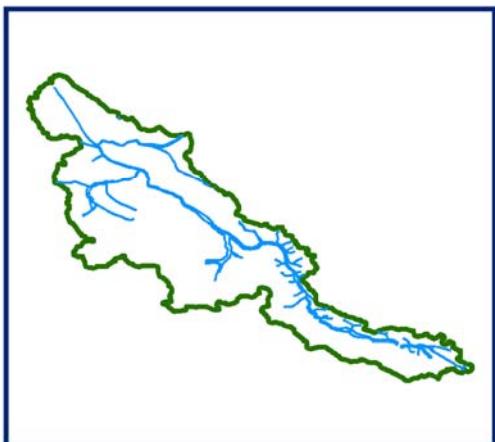
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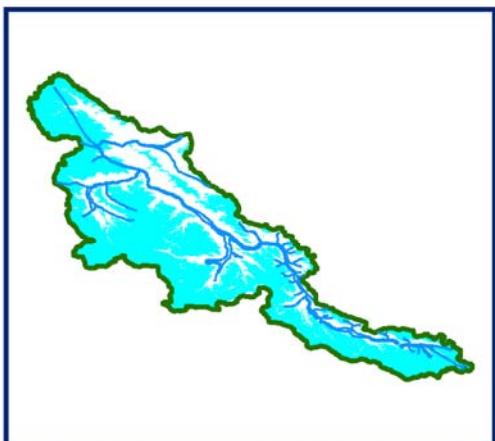
SNOW

05 02 03 04
 Kilometers

10 DAILY SNOW COVER MAP: SHASGAN BASIN



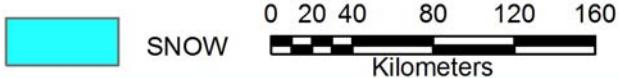
DATA NOT AVAILABLE



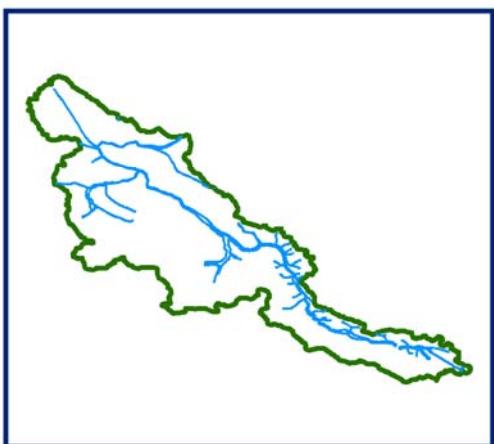
**DATA USED
11 MARCH 2010
15 MARCH 2010**



DATA NOT AVAILABLE



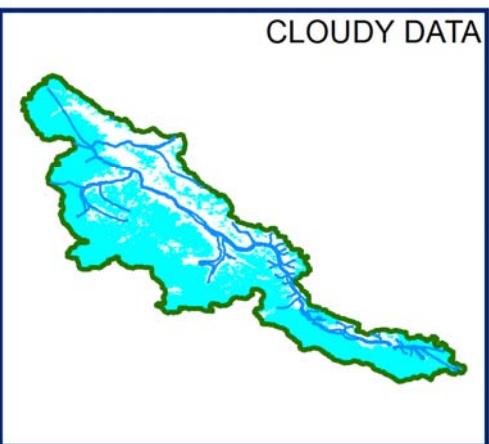
SNOW COVER MAP:



SHASGAN BASIN

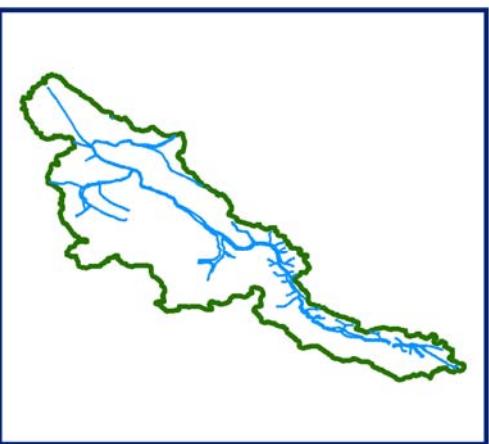
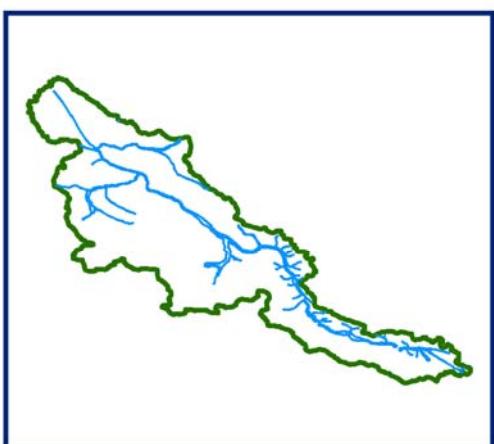


CLOUDY DATA



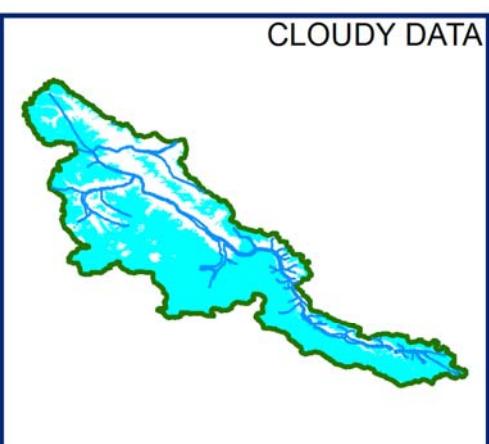
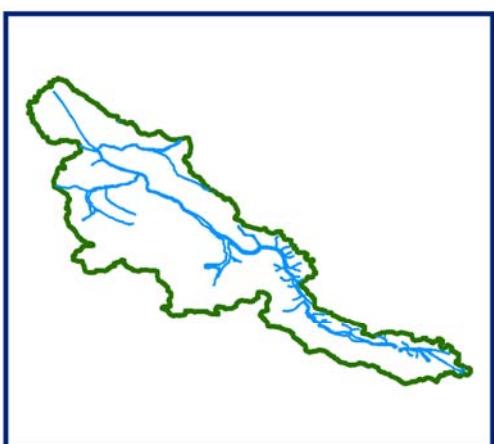
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08 APRIL 2010



DATA NOT AVAILABLE

DATA NOT AVAILABLE



DATA NOT AVAILABLE

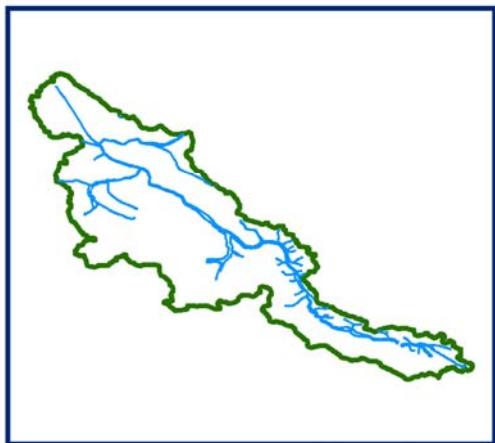
27 APRIL 2010



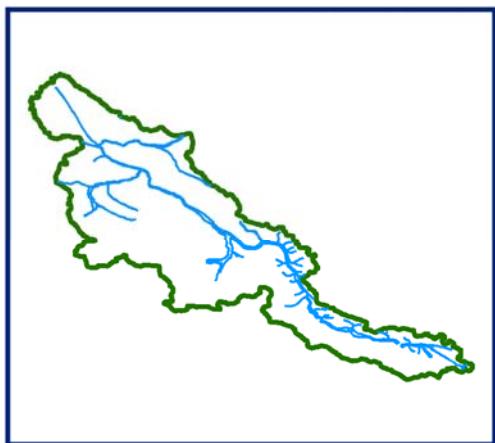
SNOW

08020304
Kilometers

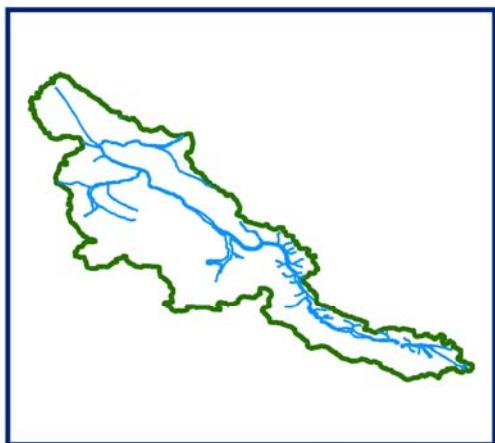
10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA NOT AVAILABLE



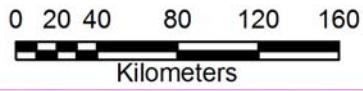
DATA NOT AVAILABLE



DATA NOT AVAILABLE

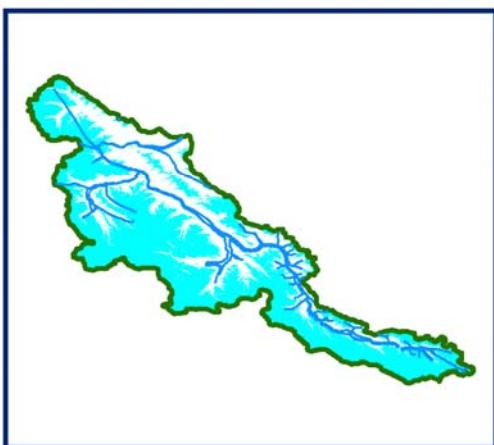


SNOW

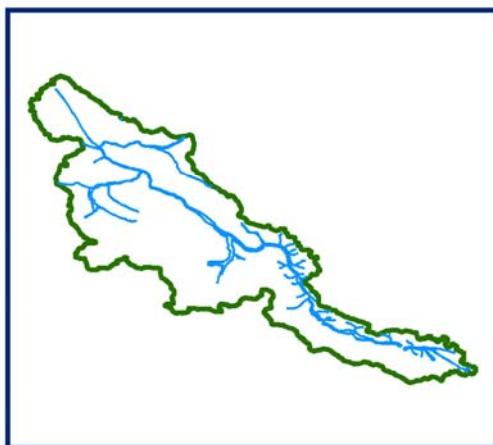


SNOW COVER MAP:

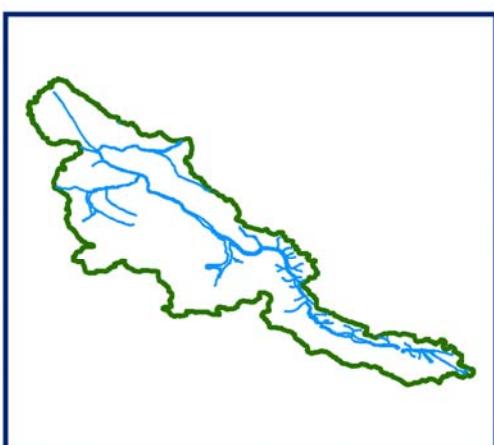
SHASGAN BASIN



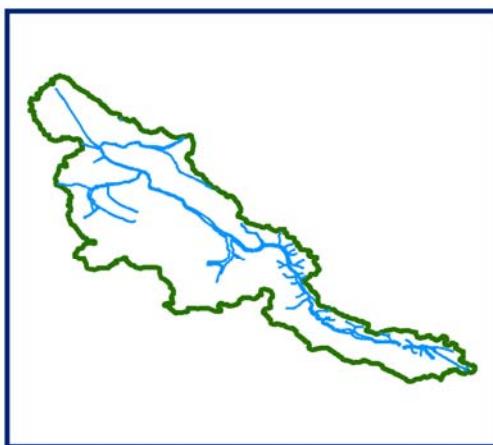
02 MAY 2010



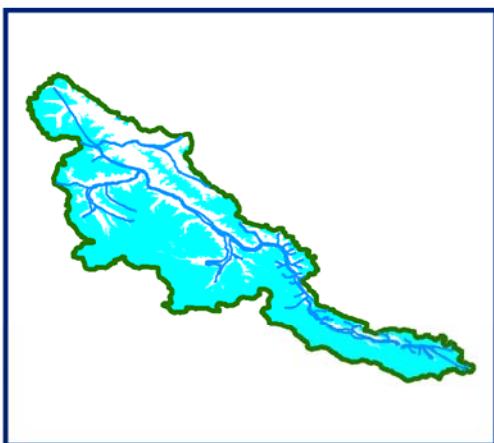
DATA NOT AVAILABLE



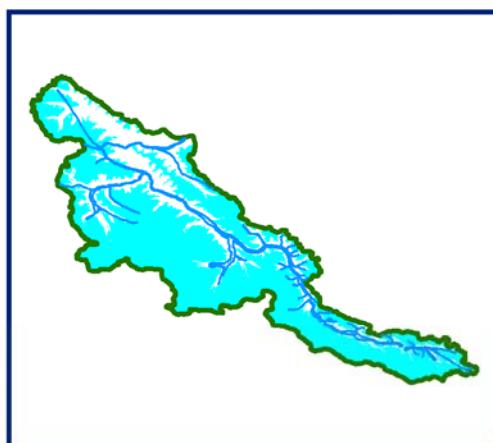
DATA NOT AVAILABLE



DATA NOT AVAILABLE



21 MAY 2010



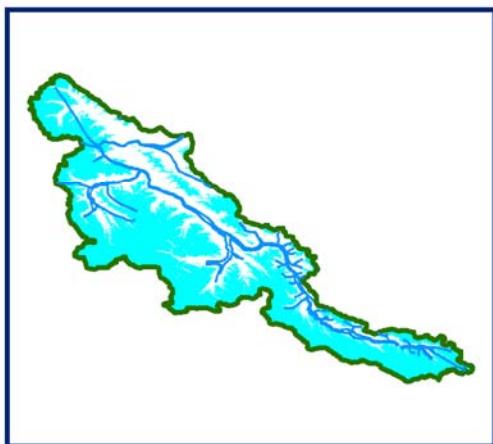
31 MAY 2010



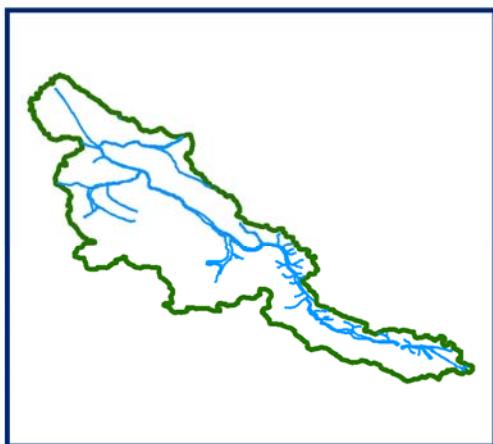
SNOW

050203040
 Kilometers

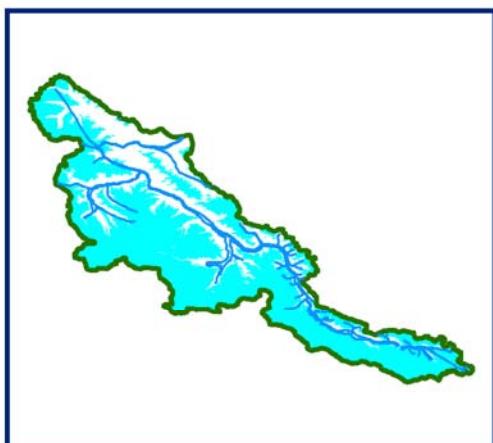
10 DAILY SNOW COVER MAP: SHASGAN BASIN



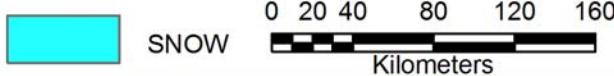
DATA USED
02 MAY 2010



DATA NOT AVAILABLE



DATA USED
21 MAY 2010
26 MAY 2010
31 MAY 2010

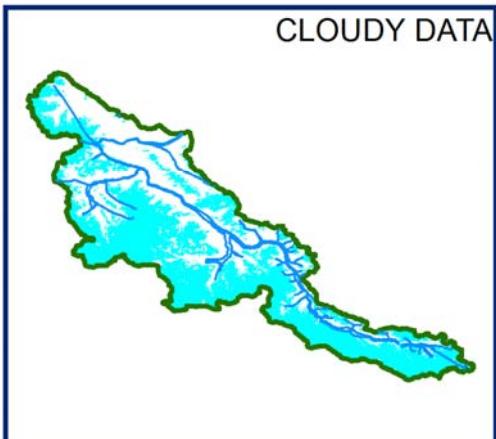


SNOW COVER MAP:

SHASGAN BASIN

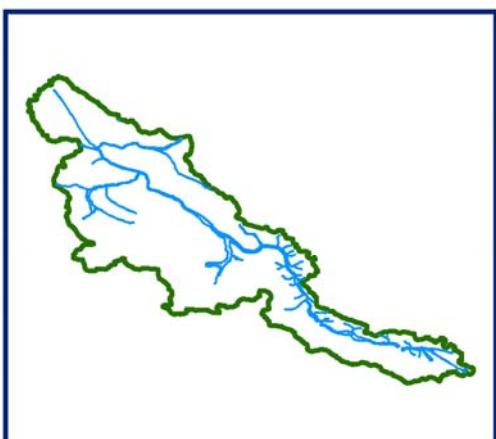


CLOUDY DATA

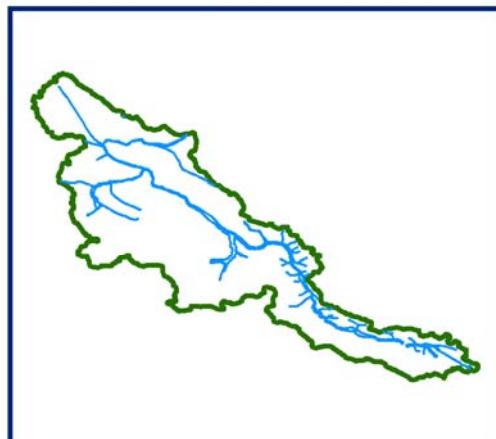


05 JUNE 2010

DATA NOT AVAILABLE

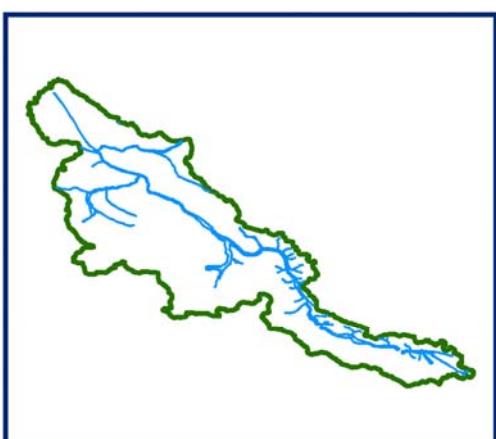


DATA NOT AVAILABLE



DATA NOT AVAILABLE

CLOUDY DATA



DATA NOT AVAILABLE

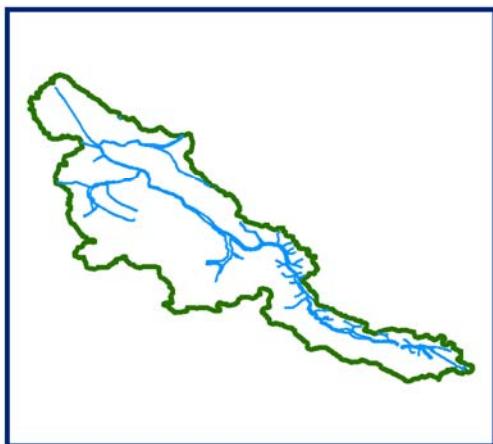
29 JUNE 2010



SNOW

06 02 03 04
 Kilometers

10 DAILY SNOW COVER MAP: SHASGAN BASIN



DATA NOT AVAILABLE



DATA NOT AVAILABLE



DATA NOT AVAILABLE



SNOW

