NOHRSC – National Operational Hydrologic Remote Sensing Center

NOHRSC Overview

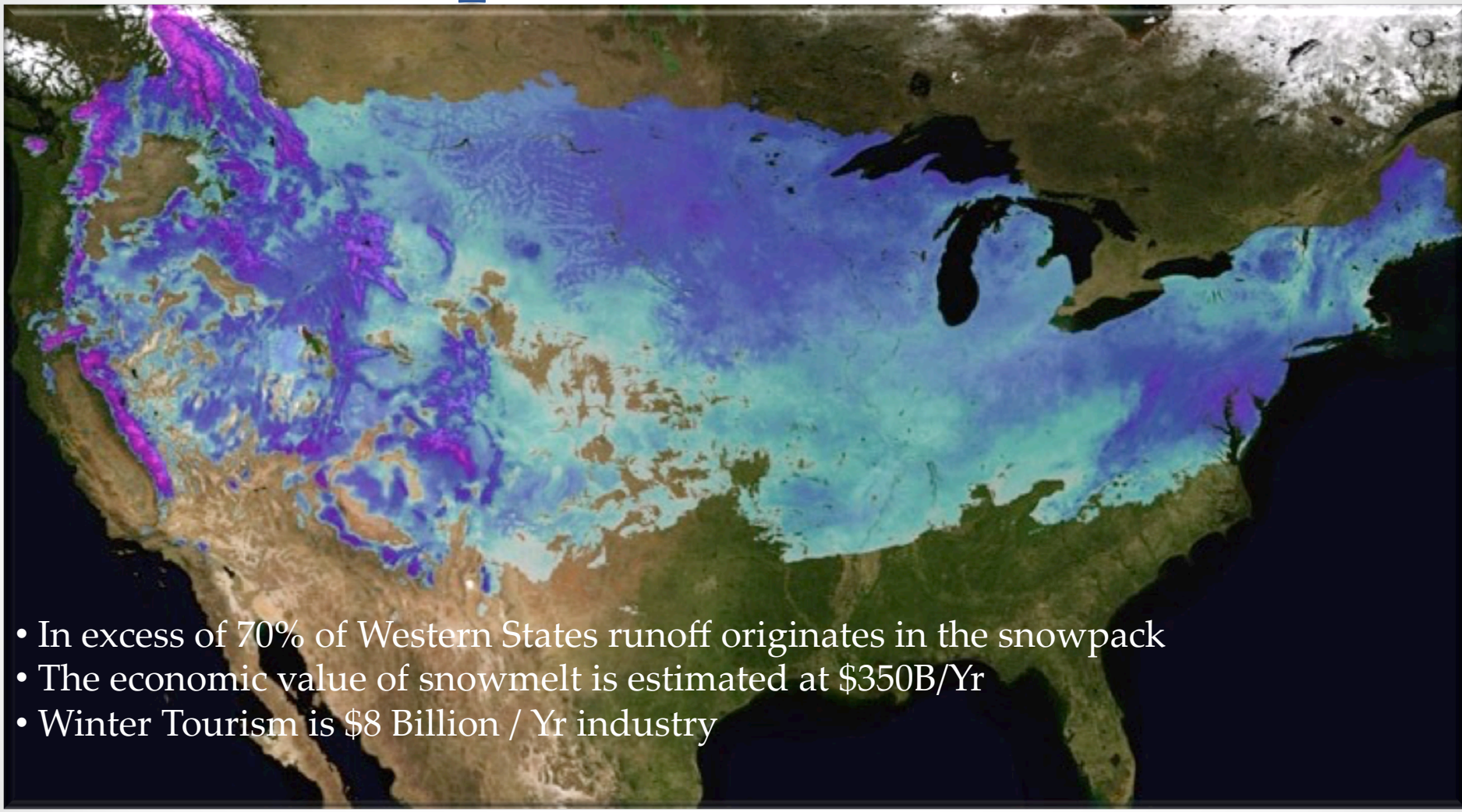
Carrie Olheiser – carrie.olheiser@noaa.gov

Operations Manager & Chief Snow Survey

NOHRSC Mission

To support the National Weather Service's mission by producing the best estimate of snow water equivalent using all available data including satellite, airborne, and in-situ observations to protect life and property and the enhancement of the national economy.

The Importance of Snow



"The Value of Snow and Snow Information Services" (2004)

Economic Cost of Snow

Snow Removal Exceeds $2 billion/ Yr

Road closures that cause lost retail trade, wages, and tax revenue exceeds $10 billion / day

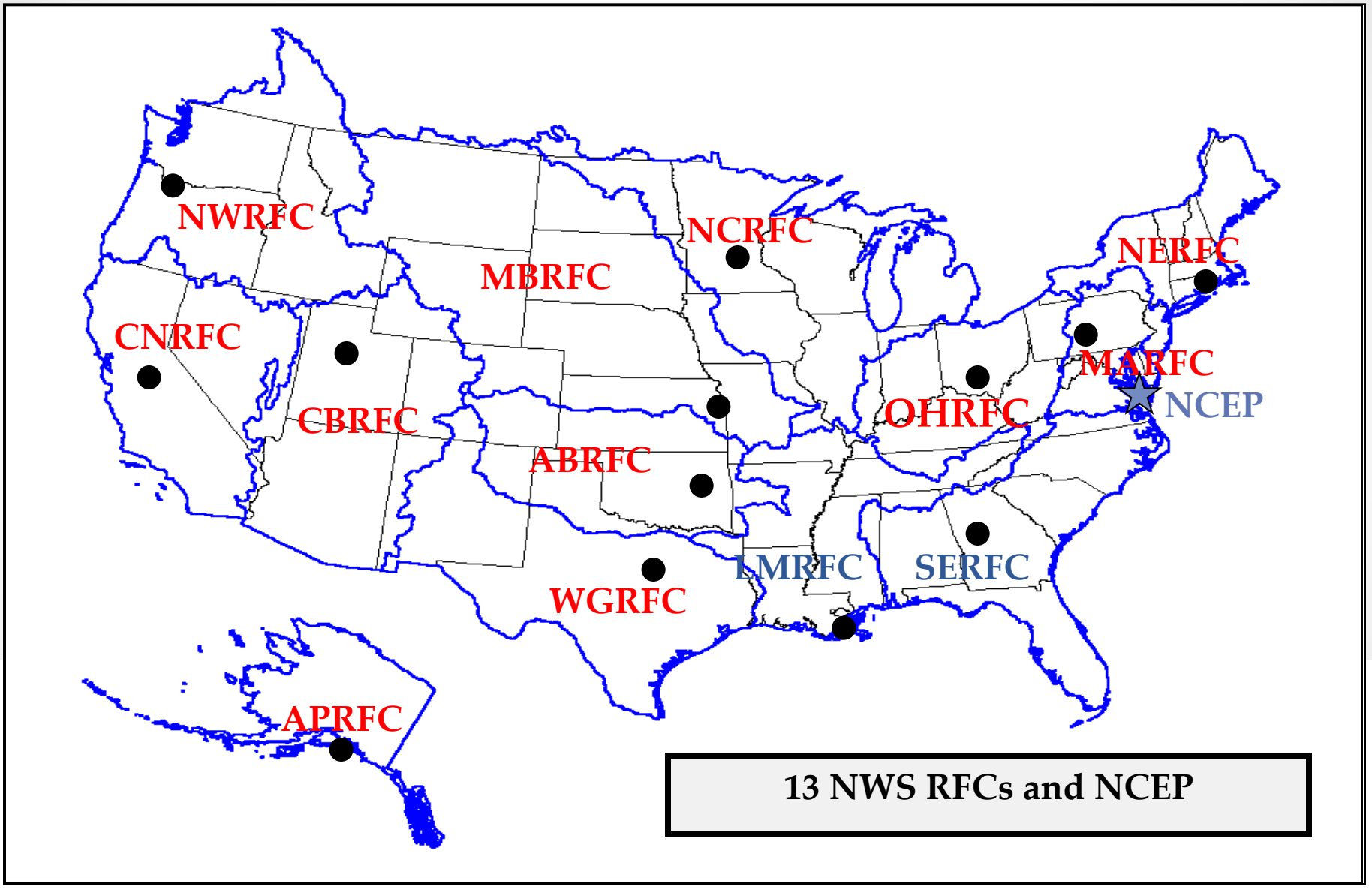
Snowmelt Flooding – $4.3 Billion Red River of the North Flood 1997

"… improved snow information and services have potential benefits greater than $1.3 billion annually."

"… investments that make only modest improvements in snow information will have *substantial economic payoffs.*"

"The Value of Snow and Snow Information Services" (2004)

NOHRSC NWS Clients



Who uses our information?

National Weather Service

- 13 River Forecast Centers
- Weather Forecast Offices

Federal and State Agencies

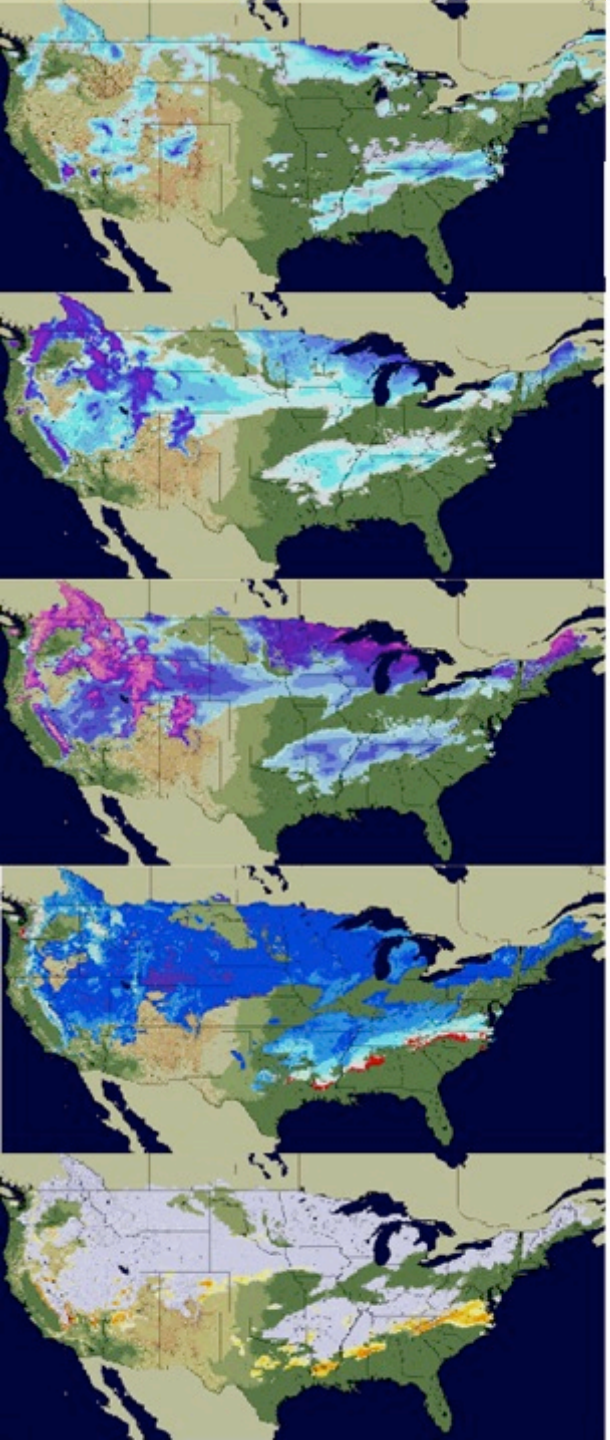
- U.S. Army Corps of Engineers
- Bureau of Reclamation
- New York Department of Environmental Protection
- Natural Resources Conservation Service
- Department of Transportation
- Montana Department of Emergency Services
- San Francisco Public Utilities Commission
- University of Albany ASRC/CESTM
- University of Wisconsin Sea Grant Institute
- National Snow and Ice Data Center
- FEMA

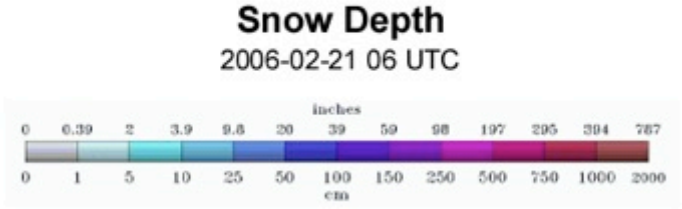
Private Sector

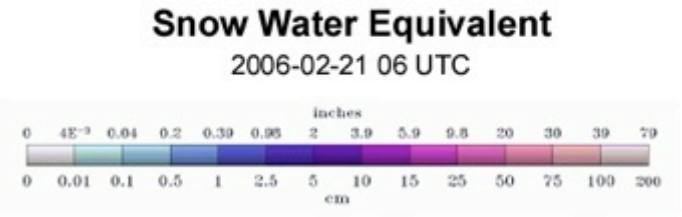
- Baron Advanced Meteorological Systems, LLC
- Weather Channel
- Meteorlogix, Inc.
- Merrril Lynch
- Weather Decision Technologies, Inc.
- SnowStreet
- AccuWeather
- Snow Plow Operators
- Oppenheimer
- Campbell Soup Company
- Snowmobile outfitters
- Mountaineers
- General Public

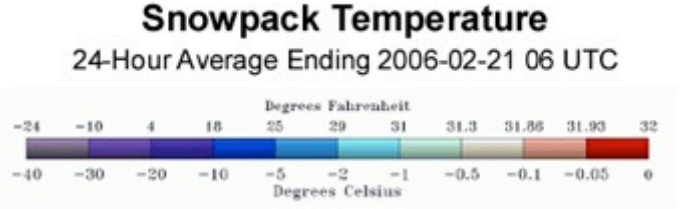
Canadian

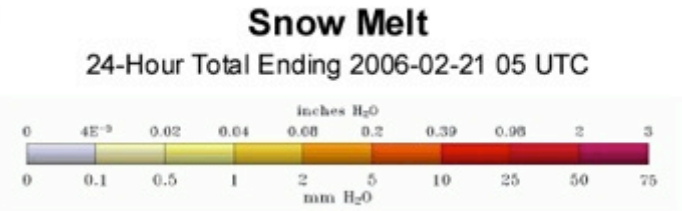
- Manitoba Department of Natural Resources
- New Brunswick Department of Natural Resources
- Alberta Environment
- BC Hydro
- British Columbia Ministry of Environment
- Environment Canada
- Saint John River Basin Commission





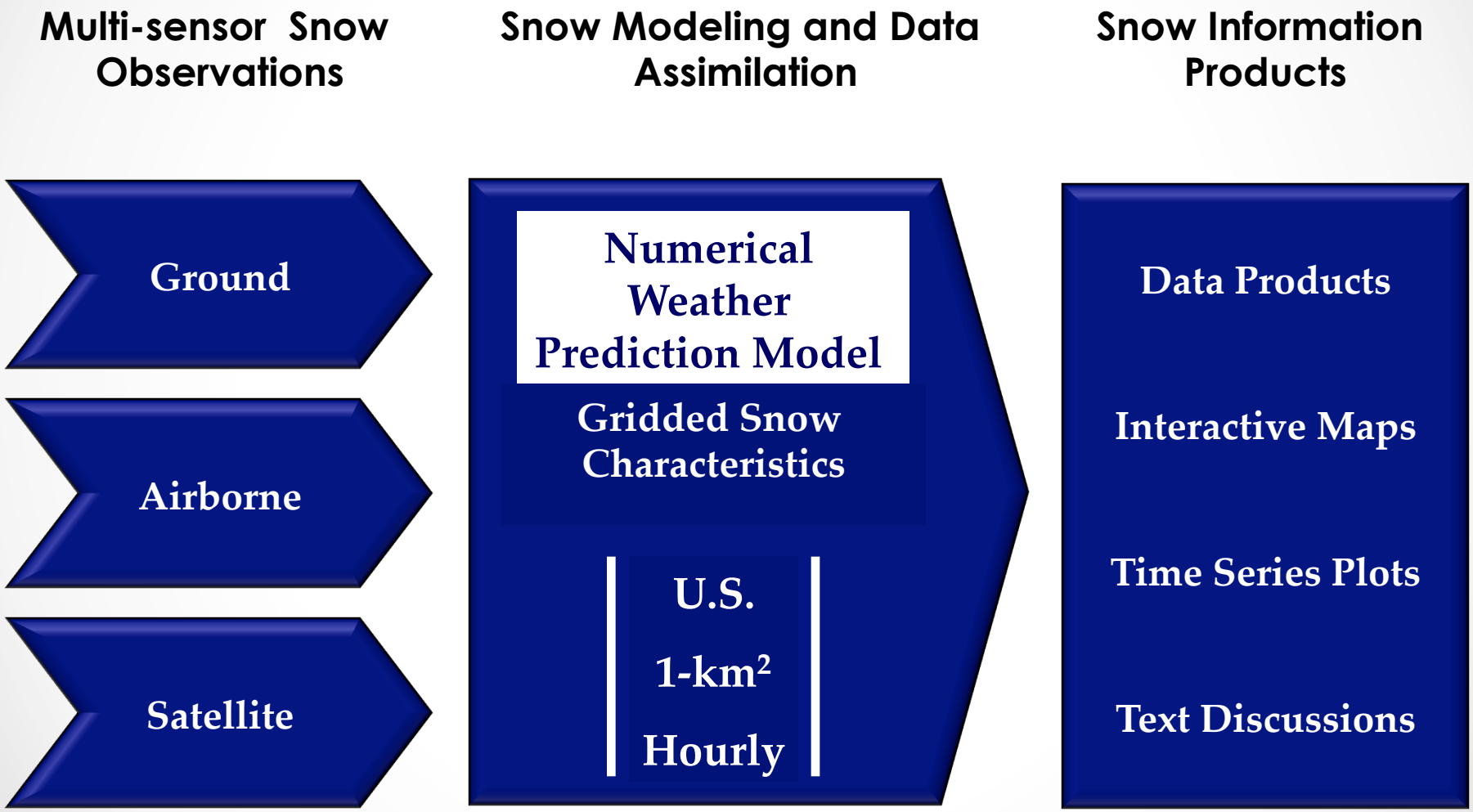






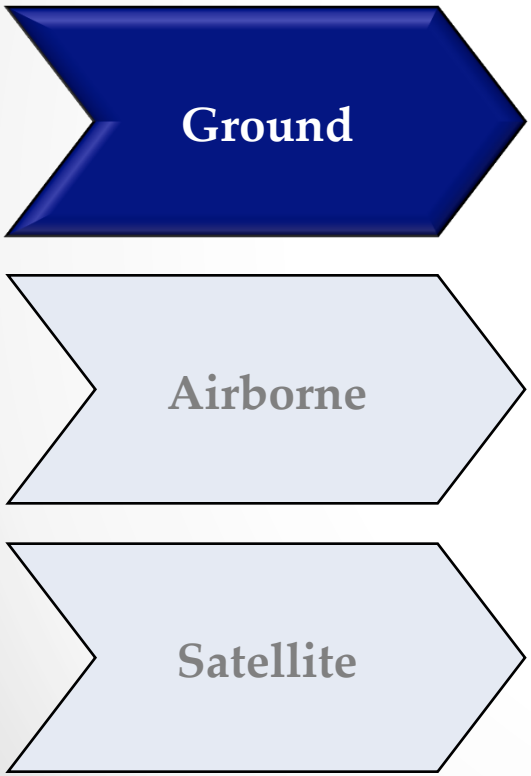
- **PRODUCTS**
  - Hourly and Daily
  - 1 km^2 Resolution
- **INTERNET**
  - Interactive Maps
  - 3D Visualization
    - e.g. Google Earth
  - Time-series loops
  - National/Regional Discussions
  - Text summaries by watershed
  - Point Queries
- **DIRECT FEED**
  - Push or Pull
  - Gridded Data
  - Flat Binary or GIS-ready

National Snow Analysis



National Snow Analysis

Multi-sensor Snow Observations



- **National Weather Service**
  - First-order Stations
  - Cooperatives
- **Federal and State Agencies**
  - NRCS SNOTEL and Snow Courses
  - USACE New England District Snow Surveys
  - Federal Aviation Administration
  - California Dept. of Water Resources
- **Regional Mesonets and Surveys**
  - State Mesonets
  - CoCoRAHS
  - MesoWest (150 smaller mesonets)
- **International Agencies**
  - St. John River Basin
  - Environment Canada
  - BC Hydro

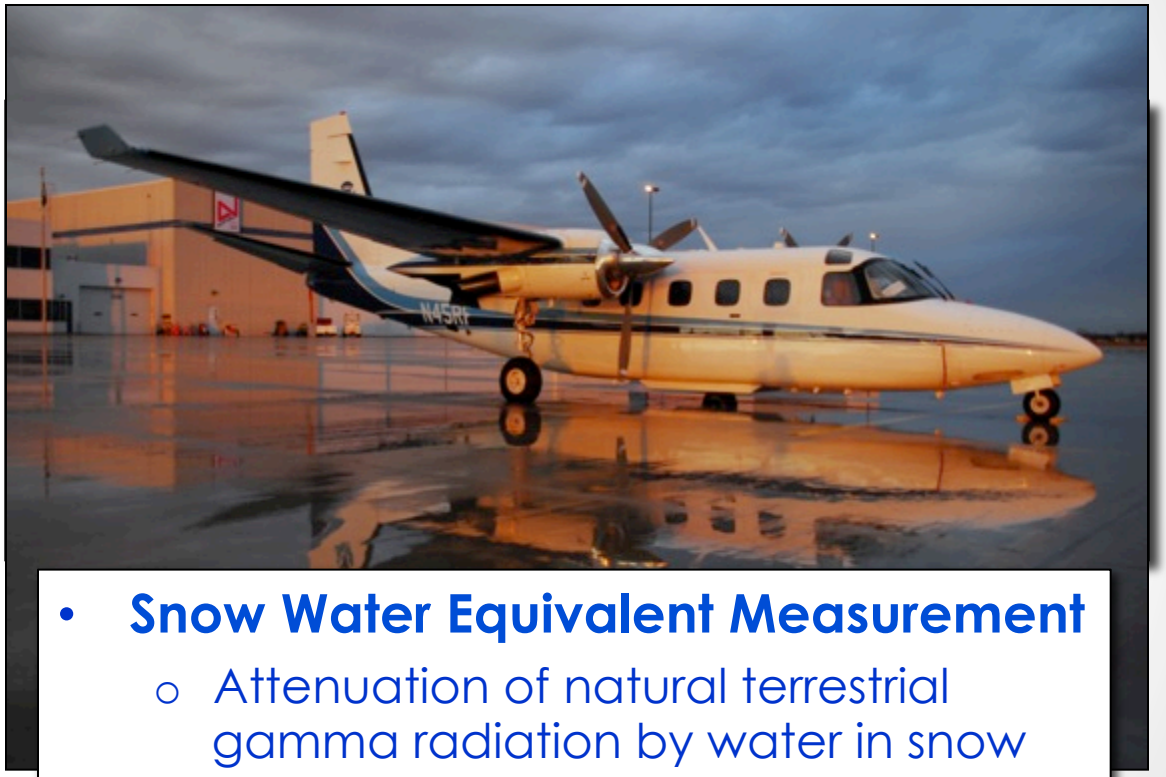
Over 58,000 Current Reporting Stations / over 145,000 in NOHRSC database

National Snow Analysis

Multi-sensor Snow Observations

- Ground
- **Airborne**
- Satellite

NWS Airborne Snow Survey Program



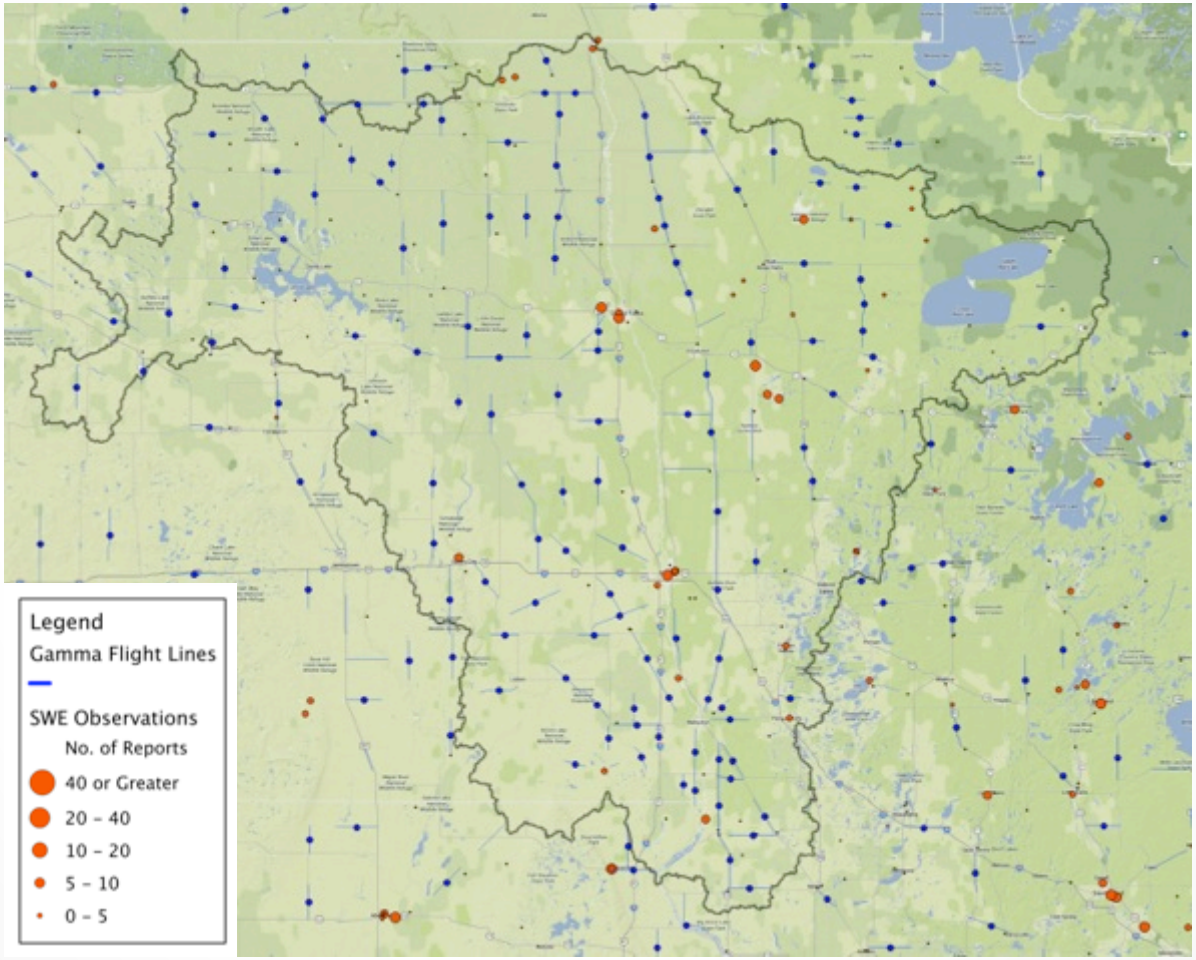
- **Snow Water Equivalent Measurement**
  - Attenuation of natural terrestrial gamma radiation by water in snow

NOHRSC Airborne Mission

- Collect airborne gamma snow water equivalent and soil moisture data
  - Where no other data are available
  - To augment existing low density ground observation networks
- Critical to the NWS water program
  - Spring snowmelt-driven flood forecasts and water supply outlooks
  - Assimilated into NOHRSC snow model
  - Used qualitatively and quantitatively by River Forecast Center flood forecast models
  - USACE, New York City Department of Environmental Protection, and other Federal, State, and Local river forecasting and water resource decision support systems are dependent upon these data
- Supports NOAA and NWS Strategic Plan water resources objectives

Airborne Data Fills Data Voids

Red River Basin of the North Snow Water Equivalent Observations
Snow Season 2012-2013



Real Time Soil Moisture Observations

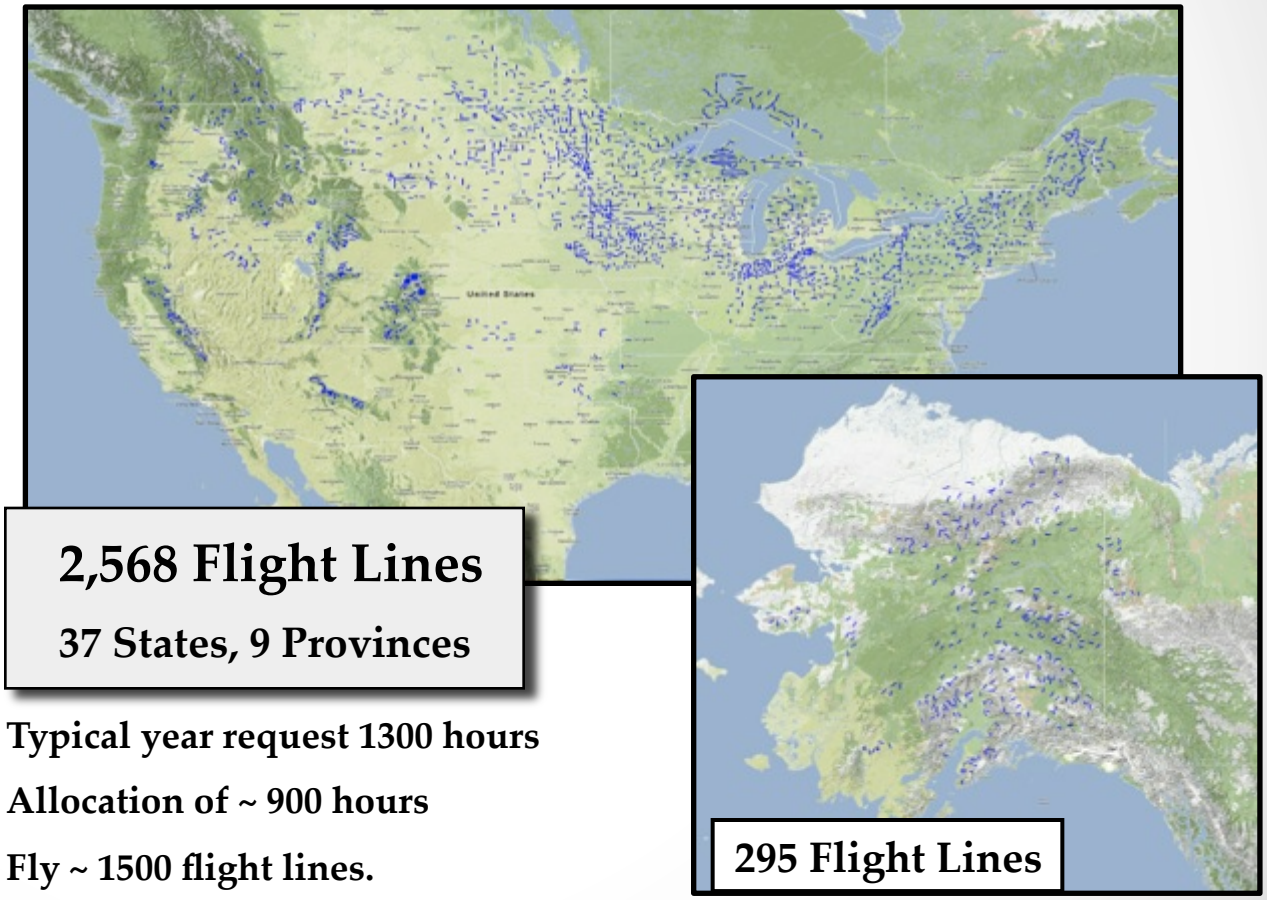
Limited Soil Moisture Information

National Snow Analysis

Multi-sensor Snow Observations

- Ground
- **Airborne**
- Satellite

Airborne Snow Survey Program Flight Line Network



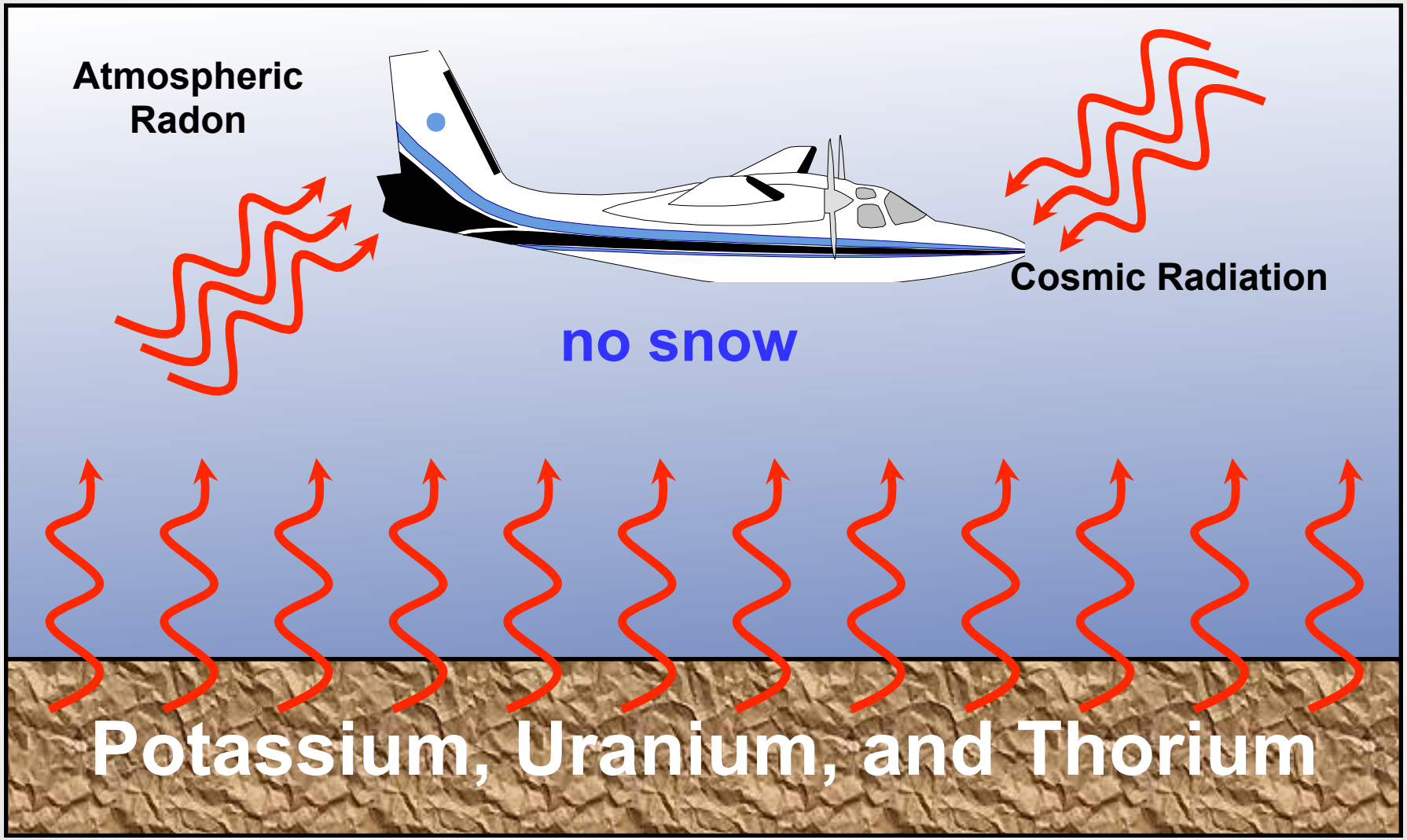
- **Typical year request 1300 hours**
- **Allocation of ~ 900 hours**
- **Fly ~ 1500 flight lines.**
- **Regions flown are based on risk of loss of life and property.**

Survey Aircraft

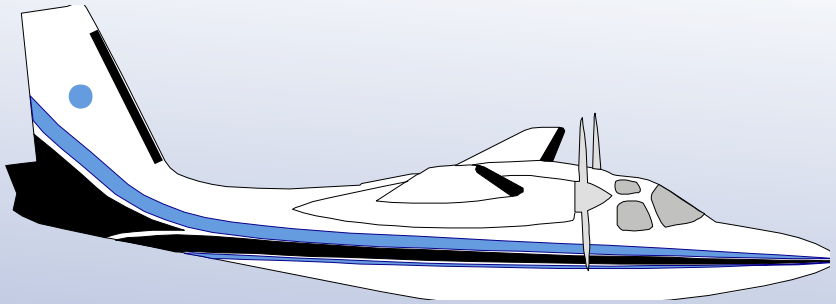
N45RF Jet Prop Commander	
Type:	1985 Jet Prop Commander AC-695A (#96089)
Engines:	Garrett TPE-331-10 (turboprop) 800 HP each
Crew:	2 pilots, co-pilot acts as snow system operator
Ceiling:	35,000 ft (pressurized)
Rate of Climb:	2,800 fpm
Operational Speeds:	120-250 kts (138-288 mph)
Max Gross Weight:	11,250 lbs
Dimensions:	Wing span (52'), length (43'), tail (14'11")
Fuel Load/Type:	482 gallons / Jet-A

N46RF and N48RF DeHavilland Twin Otter (DHC-6)	
Type:	De Havilland DHC-6 Twin Otter, Series 300
Engines:	United Aircraft of Canada Limited PT6A-27 (turboprop)
Crew:	2 pilots, co-pilot acts as snow system operator
Ceiling:	12,500 ft (w/o supplemental O_2) 25,000 ft (with O_2)
Rate of Climb:	1600 fpm
Operational Speeds:	80-160 kts (104-170 mph????)
Max Gross Weight:	12,500 lbs
Dimensions:	Wing span (65'), length (52"), tail (19'6")
Fuel Load/Type:	2500 gallons / Jet A

Natural Terrestrial Gamma Radiation



Natural Terrestrial Gamma Radiation



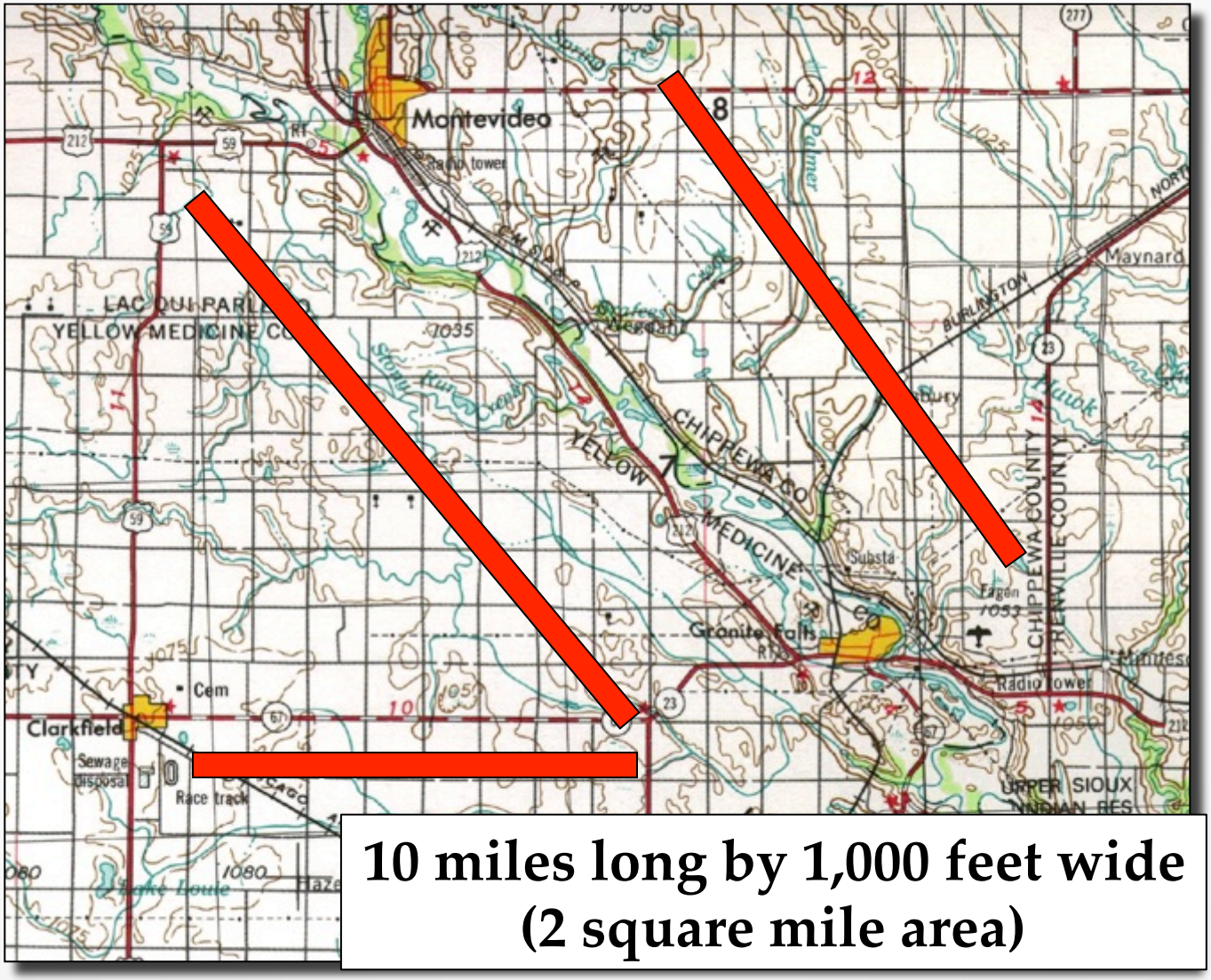
snow cover conditions

Pure, uncollided gamma radiation

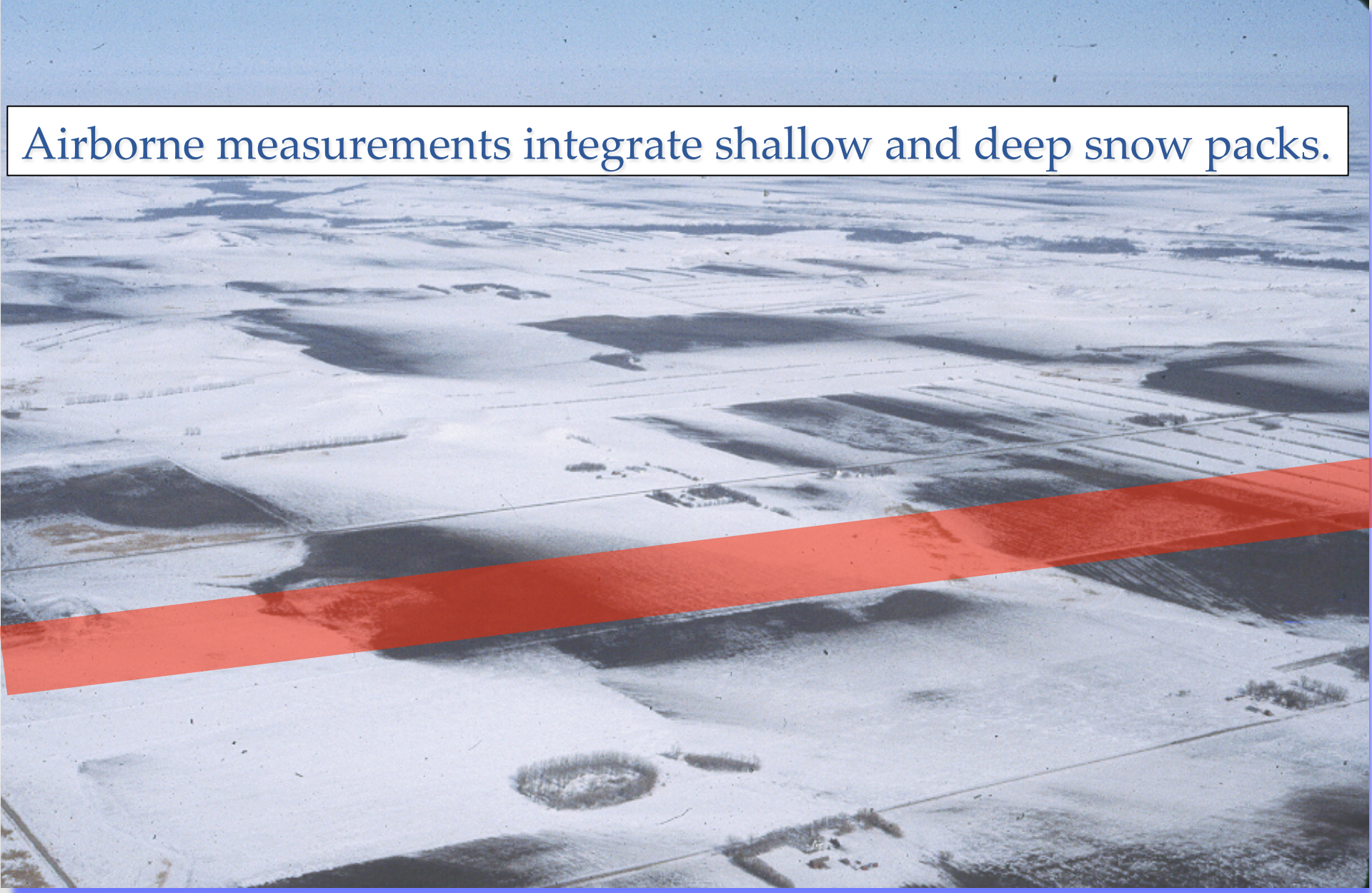
Radiation absorbed by water mass in snow pack

Potassium, Uranium, and Thorium

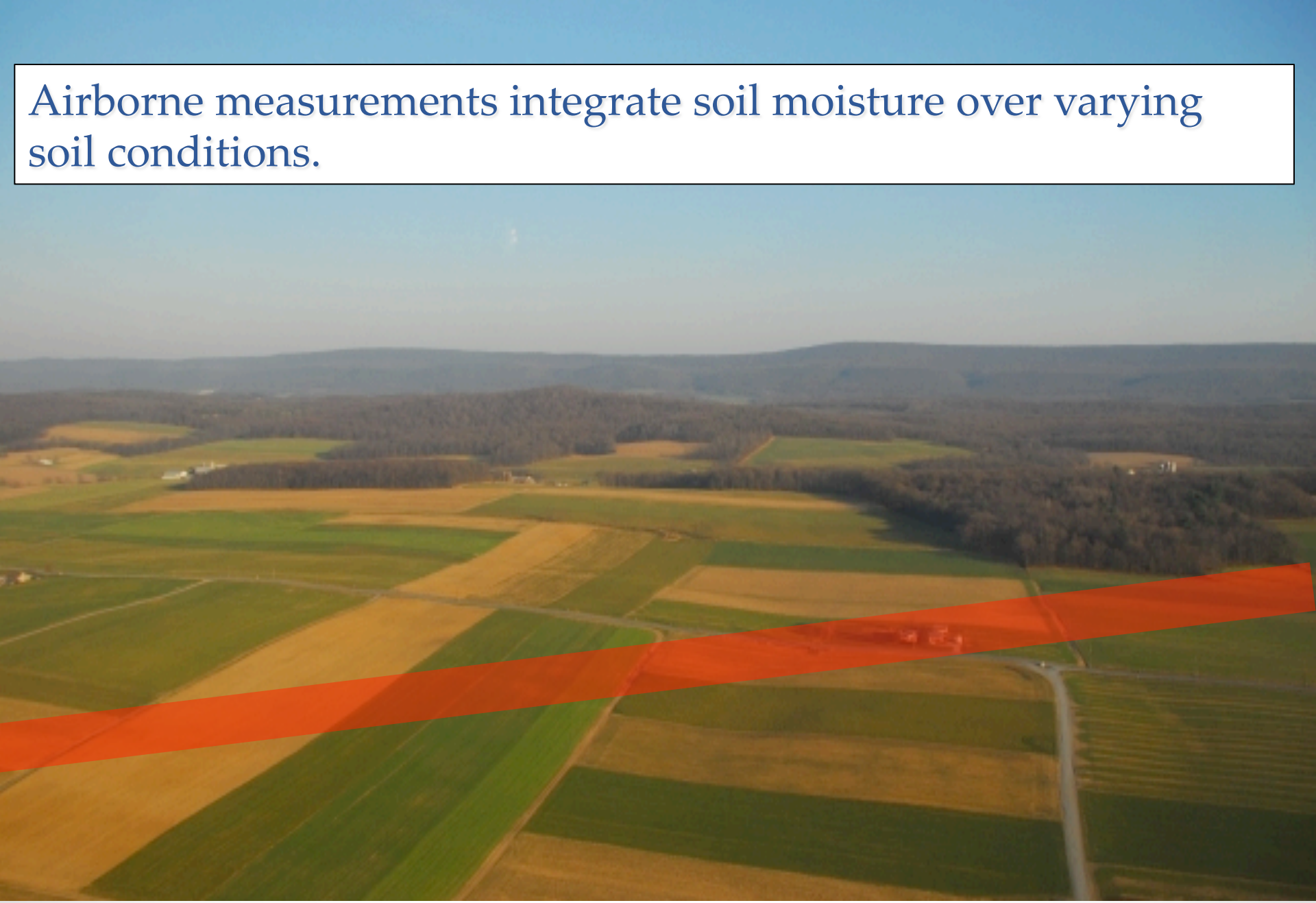
Typical Flight Line



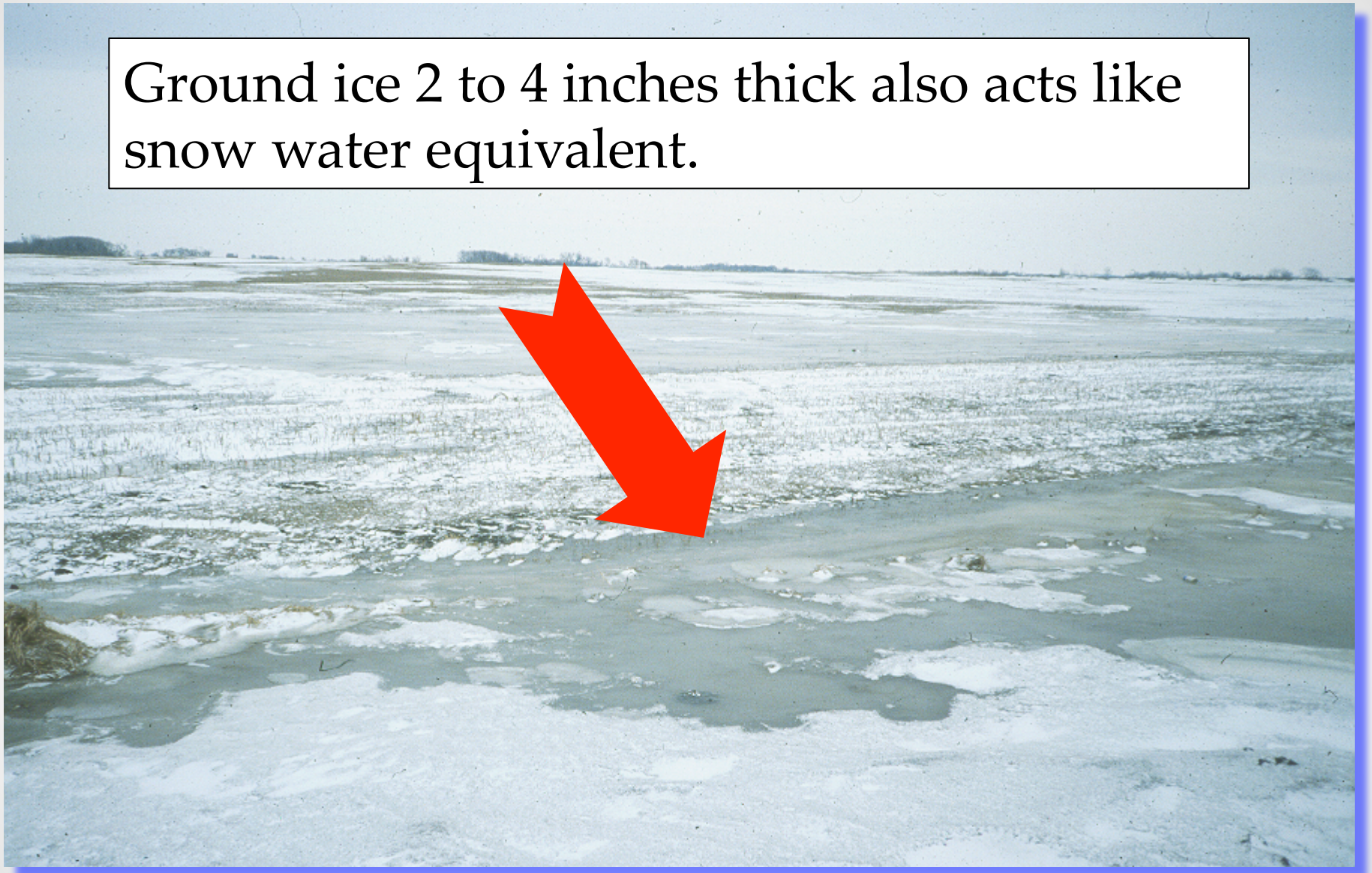
Airborne measurements integrate shallow and deep snow packs.



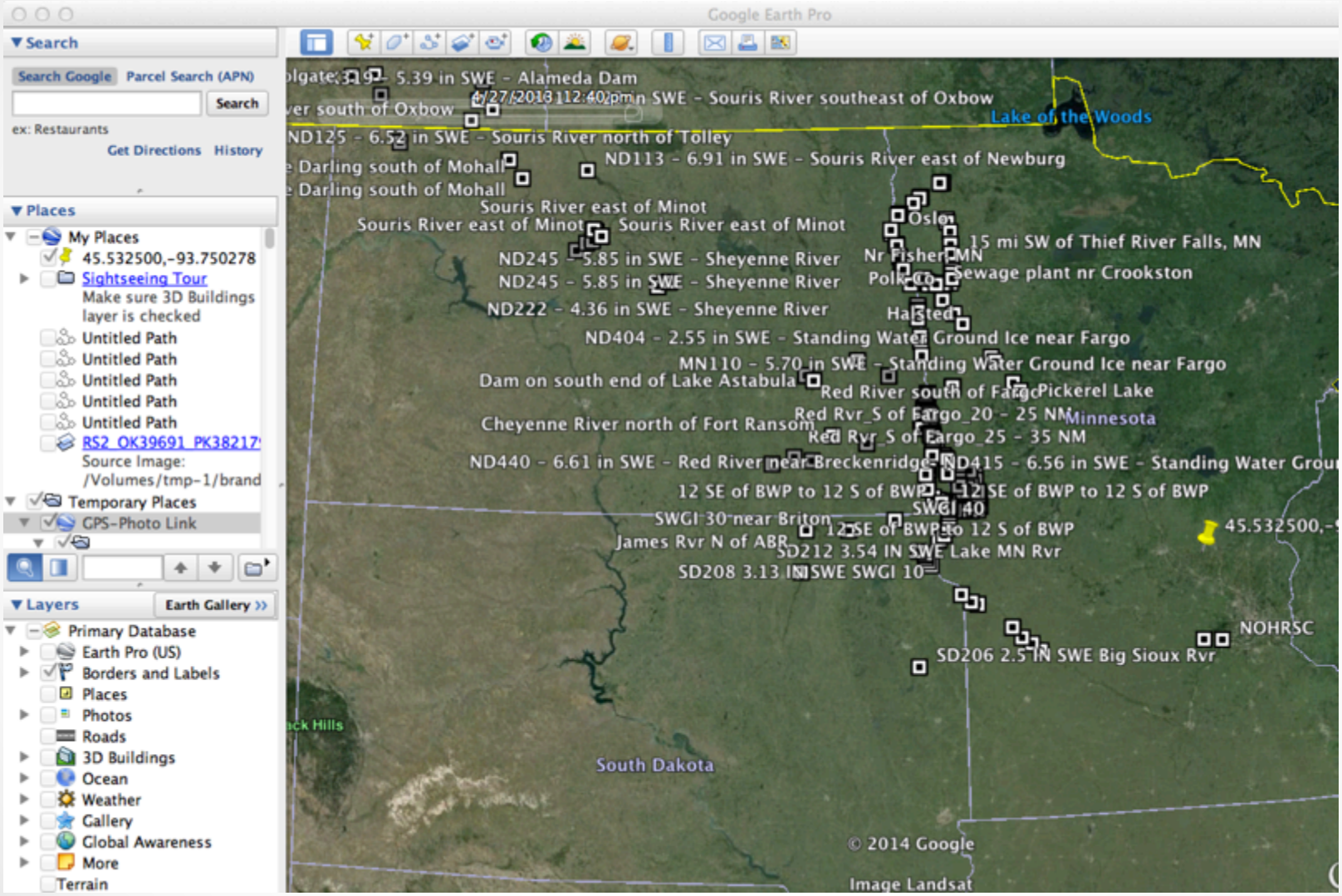
Airborne measurements integrate soil moisture over varying soil conditions.



Ground ice 2 to 4 inches thick also acts like snow water equivalent.

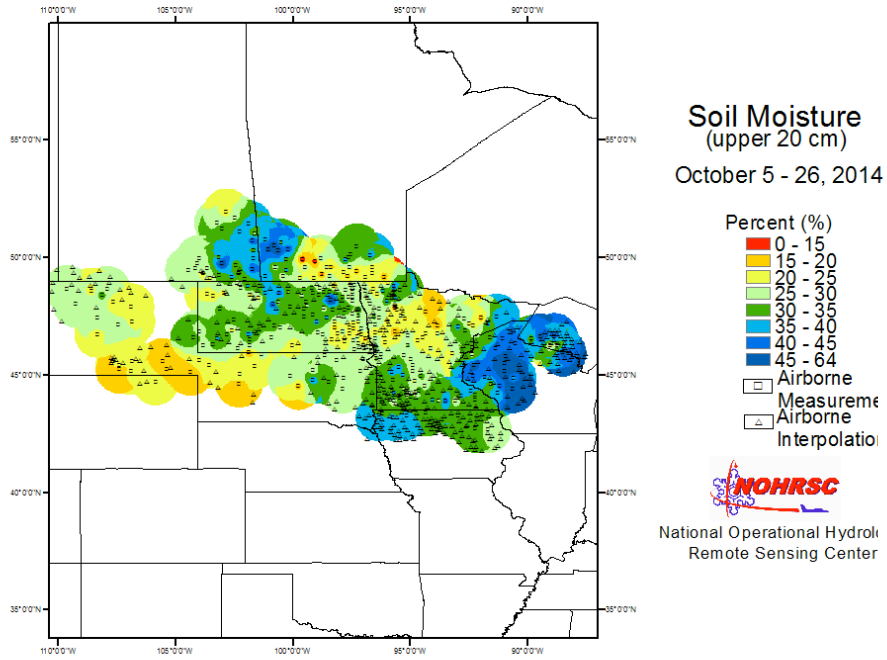


National Snow Analysis

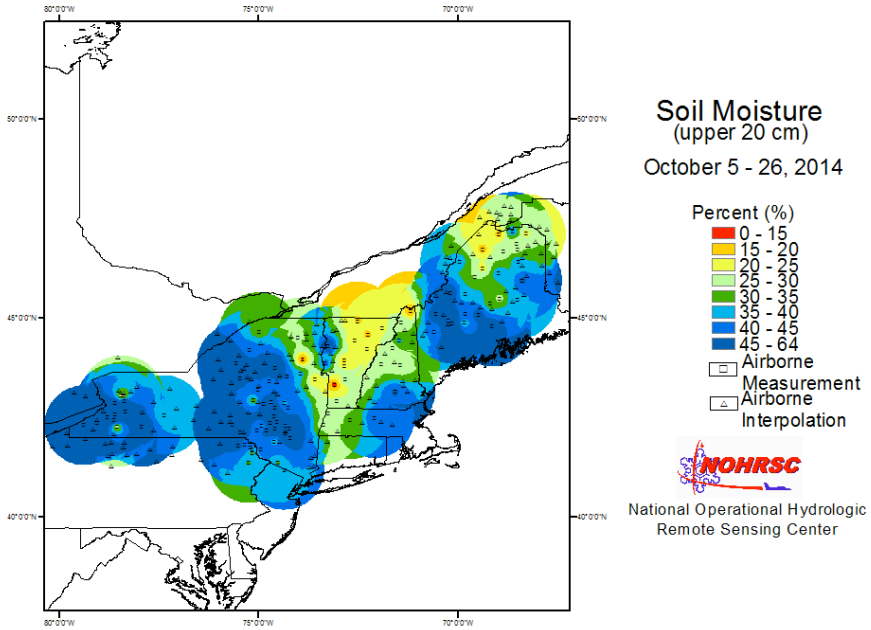



SD206 2.5 IN SWE Big Sioux Rvr
N 44° 44.55' W 96° 57.73'
04/23/13 UTC 19:04:36 UTC

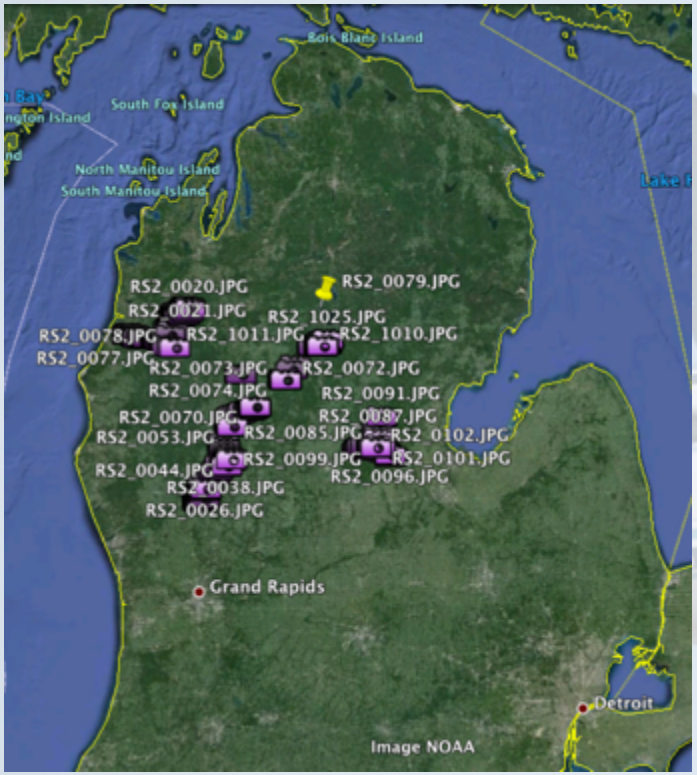
Soil Moisture Fall 2015



444 Line Flown
248 Hours Flown



Michigan Flood Recon



Record flooding occurred in Lower Michigan during the month of April 2014

The Muskegon River at Evart, Michigan reached record crest

The Muskegon River at Croton, Michigan reached second highest crest feet

The flooding along the Muskegon River impacted over 410 properties and caused over 1 million dollars in flood damages.

No fatalities and only 5 injuries were reported for this event. Over 280 households had to be evacuated and over 100 roads closed due to flooding.


Croton Dam 4
N 43° 25.88' W 85° 39.49'
04/15/14 UTC 19:55:10 UTC


Croton Dam 6
N 43° 26.05' W 85° 40.25'
04/15/14 UTC 19:55:32 UTC


Hardy Dam 1
N 43° 28.94' W 85° 38.62'
04/15/14 UTC 19:59:25 UTC


Hodenpyle Dam 4
N 44° 21.32' W 85° 49.59'
04/16/14 UTC 13:39:04 UTC

MBRFC New Line Install

Upper Missouri Basin:
Proposal for Enhanced Monitoring for Floods and Drought

February 2013 – Prepared by an inter-agency team of monitoring, forecasting and water management experts.

Summary: This proposal identifies critical investments in soil moisture and snowpack monitoring in the Upper Missouri River Basin and plains, in order to reduce flood risk and improve river and water resource management in the Basin. This enhanced monitoring network will require a $6.25 million capital investment and approximately $1.5 million in annual operations. Decision makers will take the next step by determining funding sources and implementation priorities for the enhanced monitoring network.

Background: In the spring and summer of 2011, unprecedented flooding in the Upper Missouri River Basin caused over $2 billion in direct damages and led to FEMA disaster declarations in all states along the river. The events of 2011 continued a pattern of significant flooding that has emerged over the past two decades, including The Great Flood of 1993 and another significant plains snow flood events in 1995 and 1997. In addition, the basin endured an 8-year drought ending in 2007 and is currently in the midst of another drought.

In September 2011, the Corps commissioned an independent expert review panel to examine the causes and response to the flooding. As one of its six primary recommendations, the panel identified the need for better monitoring information across the Great Plains, particularly regarding snow water equivalent (SWE) and soil moisture.

Technical Review: Pursuant to the independent review, from September to December of 2012, a team of monitoring experts from across the region developed a technical report titled *Snow Sampling and Instrumentation Recommendations.*[1] The report is built around three components:

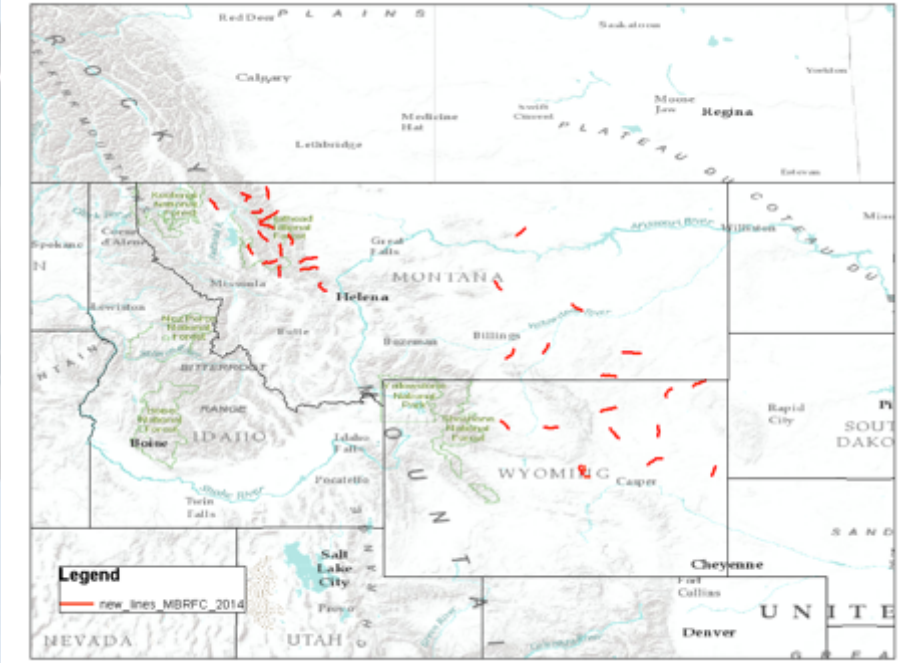
1) *Inventory:* The team conducted an inventory of existing federal, state, and volunteer networks to measure weather, snowpack and soil moisture (Figure 1);
2) *Gap Assessment:* The team identified gaps in monitoring, including gaps in geographic coverage and monitoring capabilities for key parameters; and
3) *Monitoring Recommendations:* The team sought to identify what will be needed to meet forecasting and monitoring goals for the Upper Missouri River Basin. They considered how to maximize the use of existing resources to develop the pragmatic solution described here.

Monitoring Proposal: The proposal endorses three approaches to enhance data collection: 1) automated measurements; 2) manual snow sampling; and 3) aerial snow surveys. The proposed network would consist of both new and retrofitted weather stations managed by a combination of state and federal entities.

- Automated Measurements: Existing automated monitoring networks include the NRCS Soil Climate Analysis Network (SCAN), the NRCS Snowpack Telemetry (SNOTEL) Network, and the states' Automated Weather Data Network (AWDN) sites. The proposal includes upgrades to 92 existing network sites as well as the addition of 29 new AWDN sites across South Dakota, Montana, and Wyoming. (See Figure 1.)
- Aerial Water Resource Surveys: The National Weather Service runs the Airborne Snow Survey Program, which can cover large regions and sample remote areas. Currently, the program runs just over 60 flight lines in the Upper

[1] Released February 1, 2013. The full proposal, including descriptions of the various existing and proposed monitoring platforms as well as detailed budgets, is available for review.

Photo: Missouri River Flood, 2011, Bismarck-Mandan.



38 new flight lines added summer 2014

Buffalo, NY Nov. 2014

US National Weather Service Northeast River Forecast Center
20 hours ago

Yesterday, NOAA pilots detailed to the National Operational Hydrologic Remote Sensing Center performed an airborne survey of the snow over western New York. They measured up to 6 inches of water contained within the snow. They also provided the photos below.

The US National Weather Service Buffalo NY has issued flood statements for the possible melting of some of this snow pack in the next couple of days.

We are grateful for NOHRSC's support this weekend as they typically do not fly snow surveys this early in the season.

Info on NOHRSC Snow Surveys can be found at http://www.nohrsc.noaa.gov/snowsurvey/

Information on flood statements can be found at http://www.weather.gov/nerfc/flood

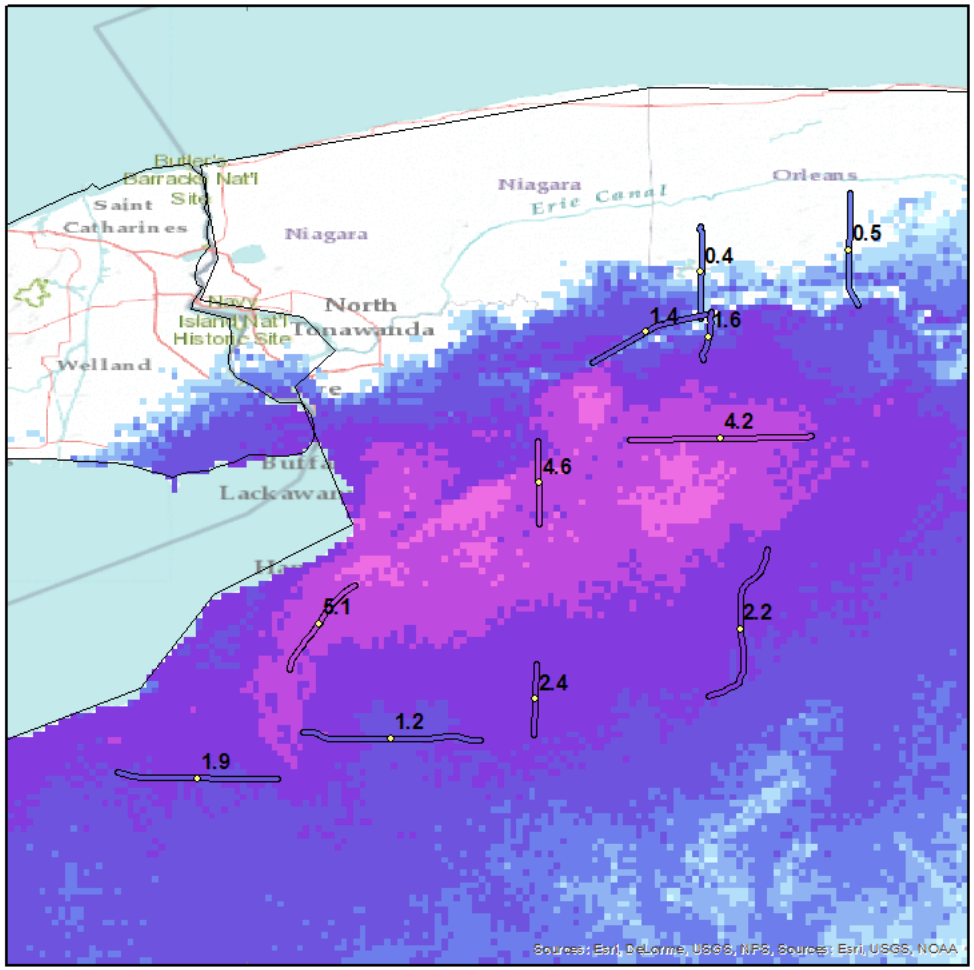
Latest forecasts are available at http://water.weather.gov/ (4 photos)

Buffalo, NY Lake Effect Snow Event Nov. 2014

Buffalo, NY Nov. 2014

Buffalo, NY Nov. 2014

Gamma Flight Survey #07 11/22/2014



National Operational Hydrologic Remote Sensing Center

Office of Hydrology
National Weather Service, NOAA
Chanhassen, MN

SNODAS SWE (in)

- 0
- 0 - 0.0039
- 0.0039 - 0.039
- 0.039 - 0.1968
- 0.1968 - 0.393
- 0.393 - 0.984
- 0.984 - 1.96
- 1.96 - 3.93
- 3.93 - 5.9
- 5.9 - 9.84
- 9.84 - 19.68
- 19.68 - 29.52
- 29.52 - 39.37
- 39.37 - 78.74

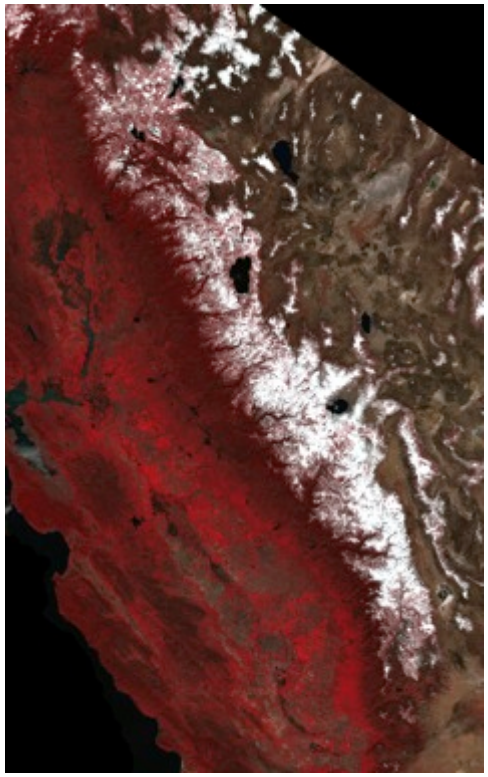
N

National Snow Analysis

Multi-sensor Snow Observations

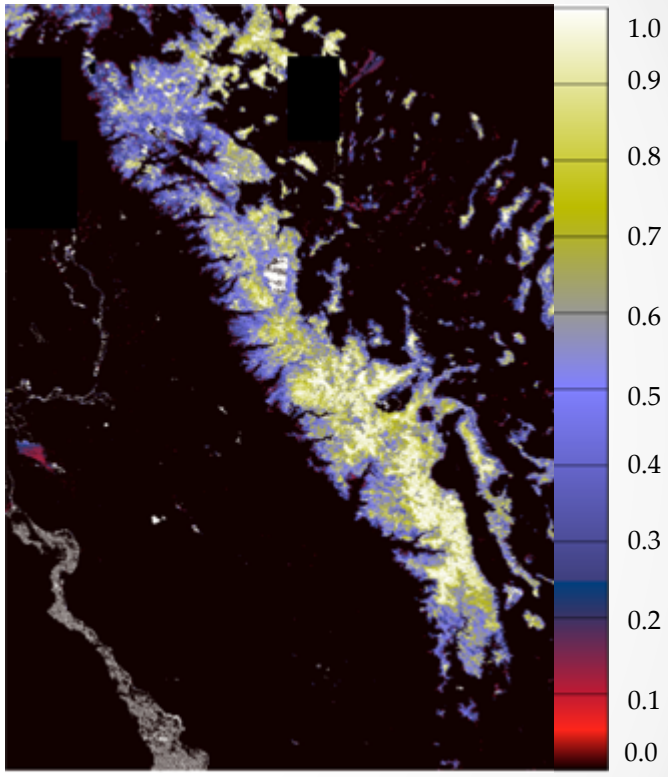
- Ground
- Airborne
- **Satellite**

MODSCAG Algorithm, images courtesy of T. Painter, U. Utah

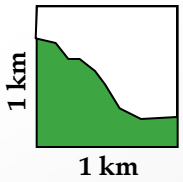


EOS Terra MODIS

Sierra Nevada, Mar 7 2004



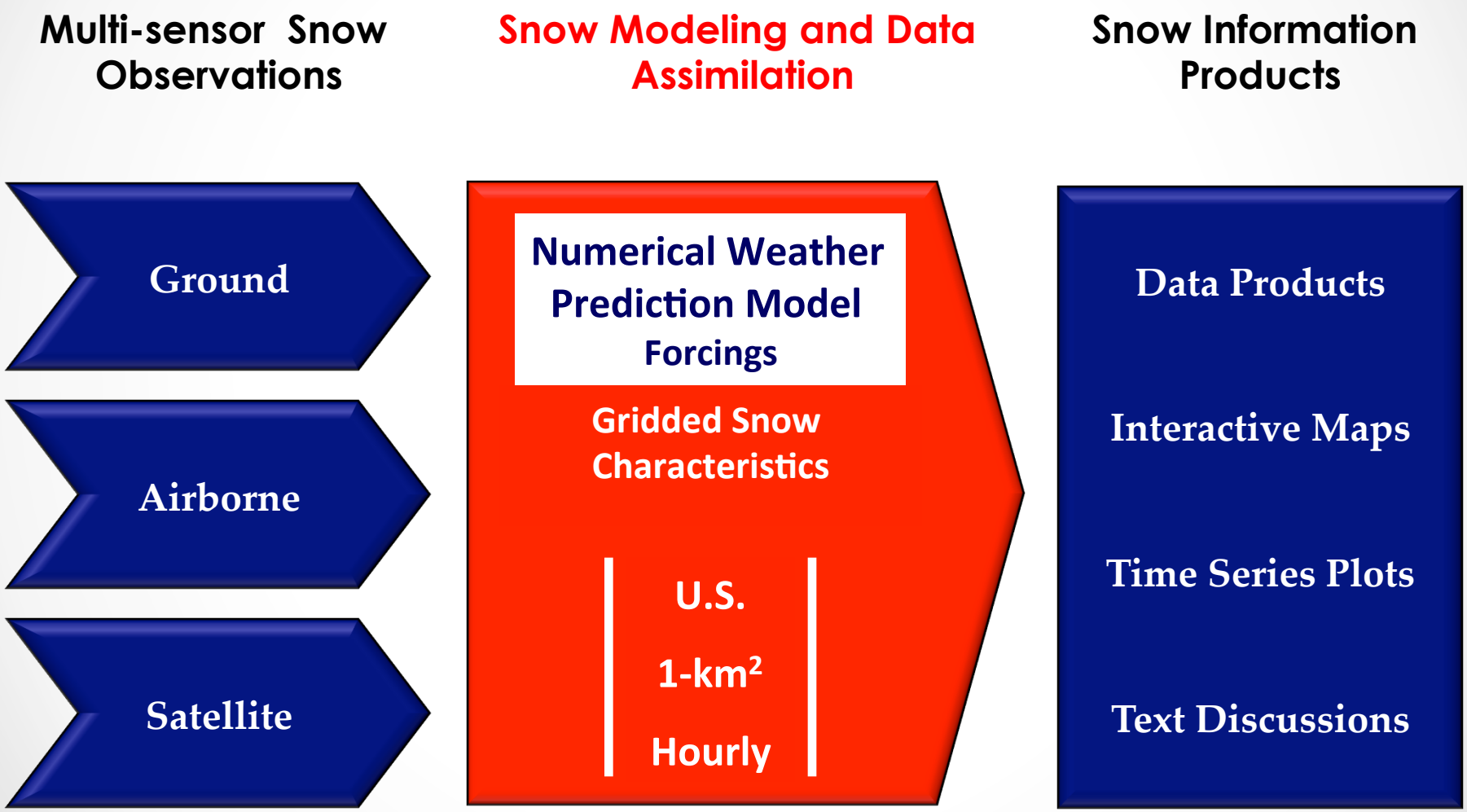
Fractional Snow Cover



$SCA_{frac} = 0.5$

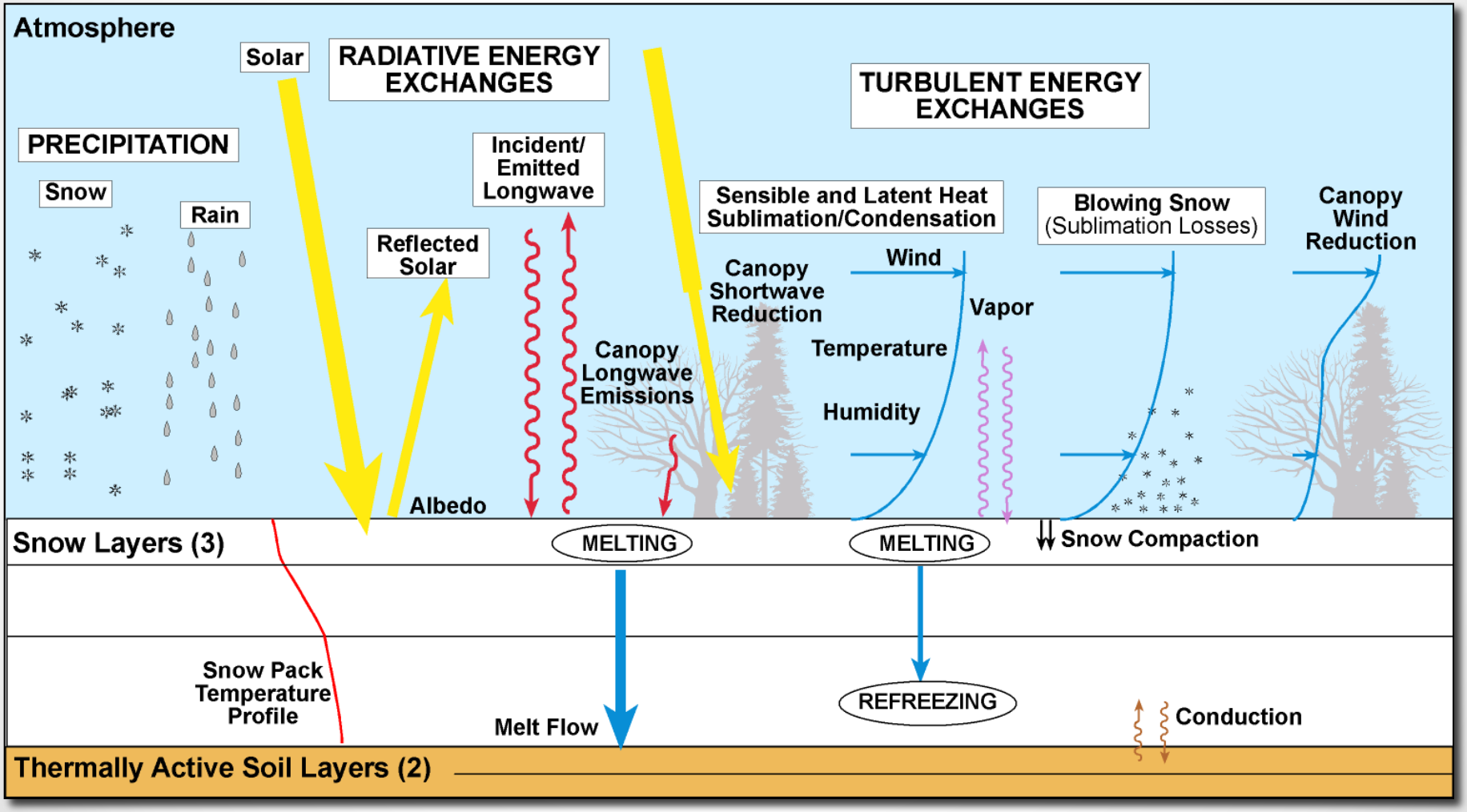
Observations alone are not enough !

National Snow Analysis

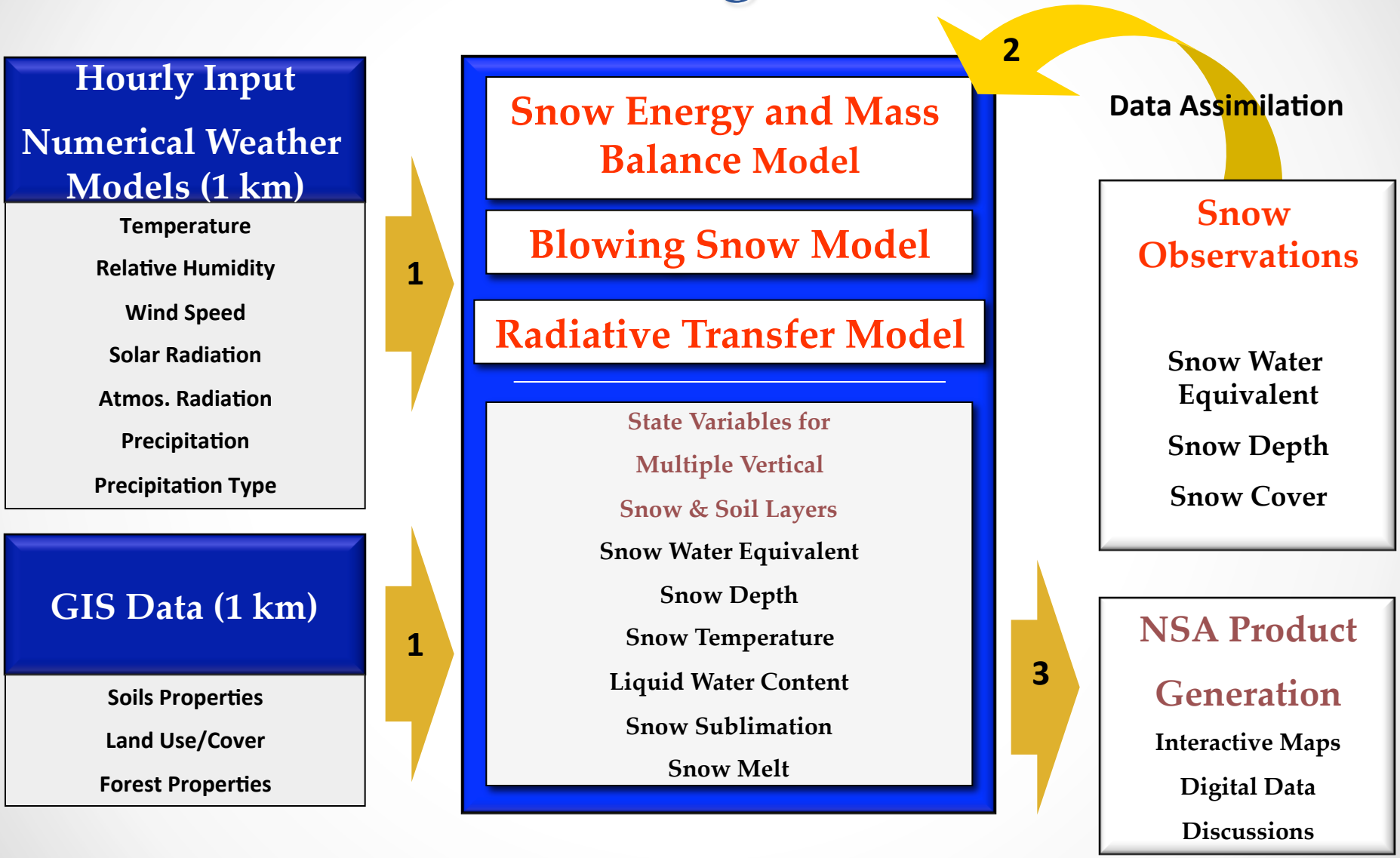


NOHRSC Snow Model Physics

$$(K\downarrow - K\uparrow) + (L\downarrow - L\uparrow) + Q_e + Q_h + Q_g + Q_p = \Delta Q$$



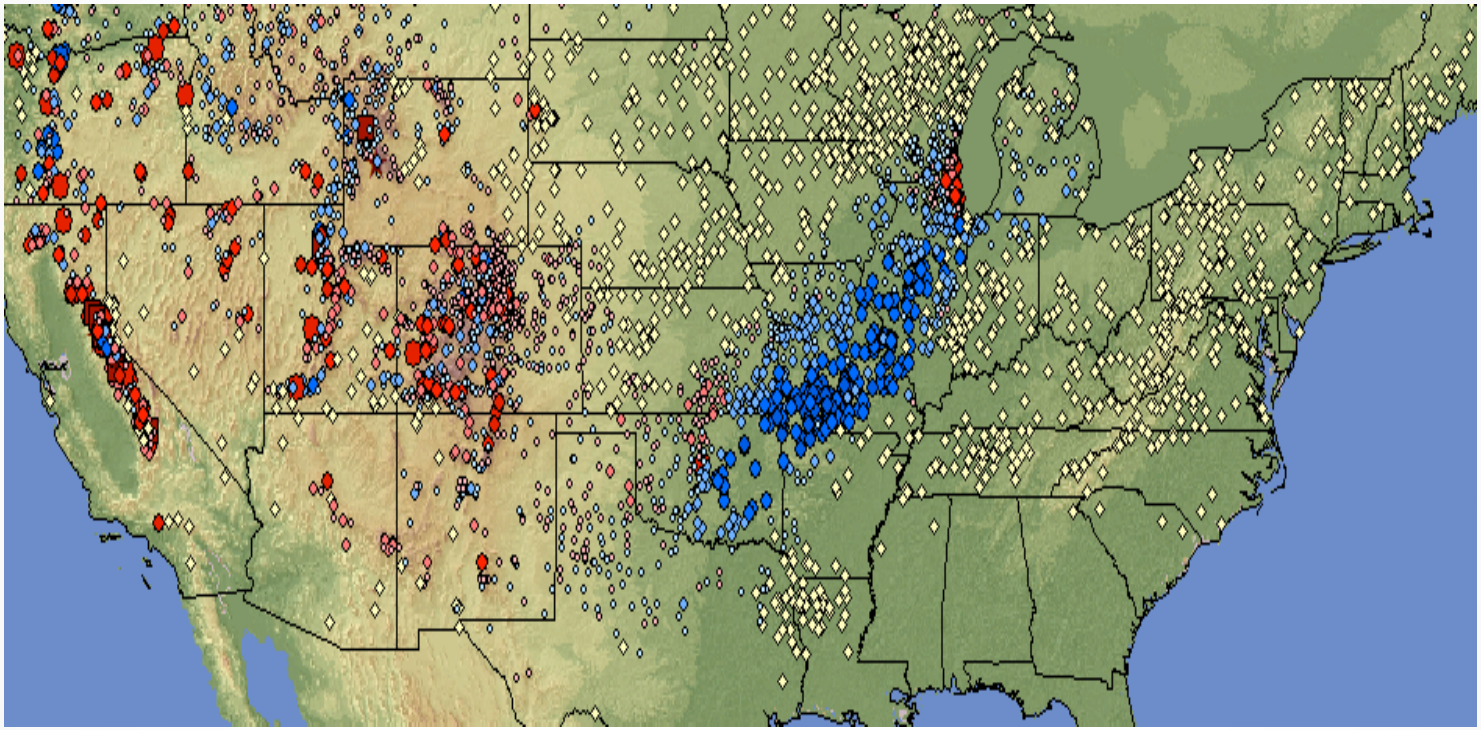
Snow Modeling Framework



Snow Observational Assimilation

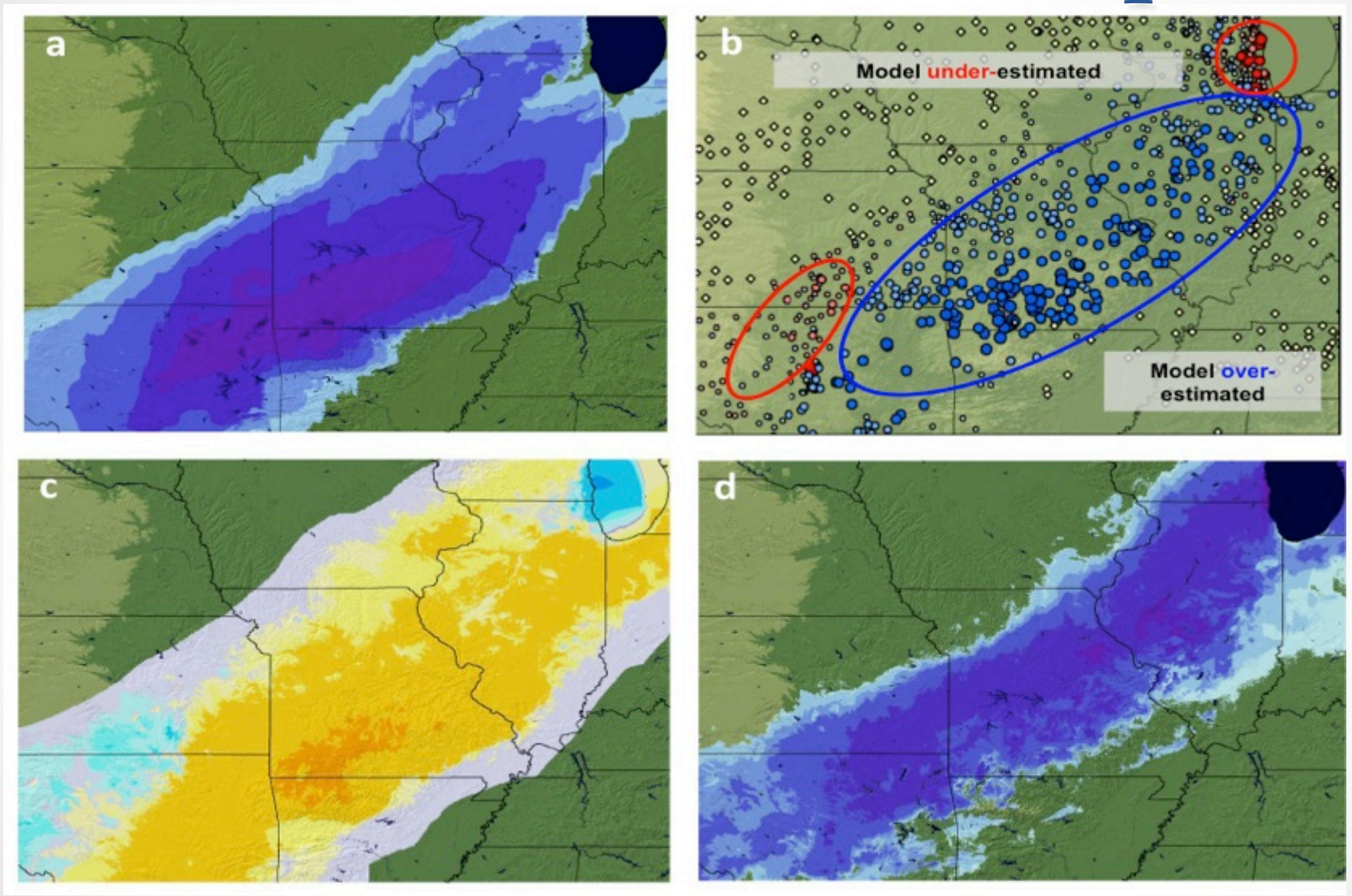
Daily SWE and Snow Depth Observations are used to update the model

If pattern of differences is explainable, an update field is generated and used to nudge the model toward observed states

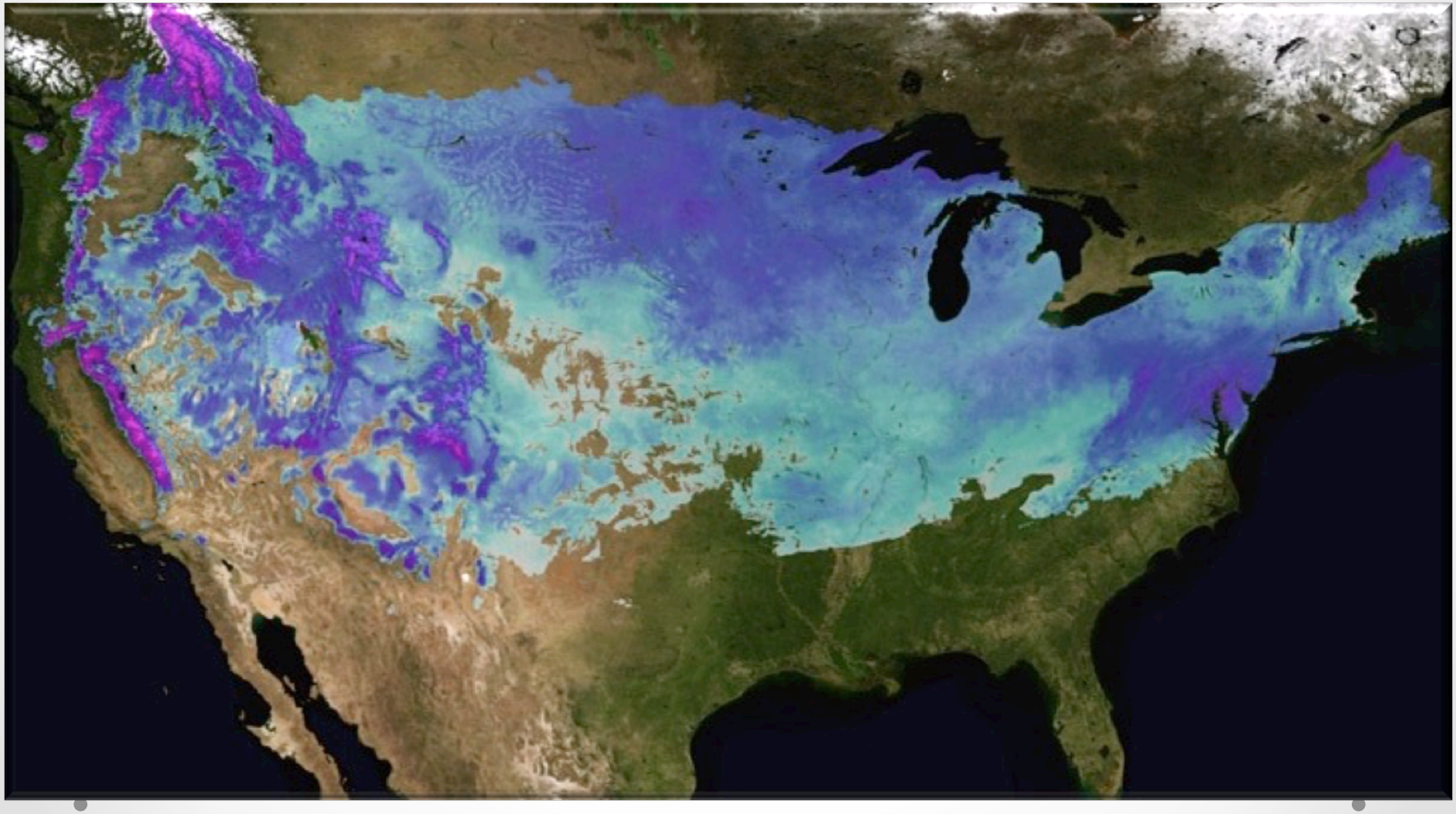


- Uncertainties in driving data
  - RUC2 precipitation under/over estimation
  - Typing issue; rain/ snow
  - Placement of storm track
- Uncertainties due to model physics
  - Melt problems due to temperature bias
  - Sublimation rates

Assimilation Example



Best Estimate of SWE



Airborne Snow Water Equivalent

```
SRUS43 KMSR 231924
SWE

.BR MSP 010223 DM022323/DC02231924 /SWIPZ
:-------------------------------------------------------
:NATIONAL WEATHER SERVICE - OFFICE OF SERVICES
:NATIONAL OPERATIONAL HYDROLOGIC REMOTE SENSING CENTER
:CHANHASSEN MINNESOTA                    (952) 361-6610
:-------------------------------------------------------
:ESTIMATED SNOW    R EQUIVALENT (INCHES)
:COMPOSITE AN      S 01021401 - 01022323
:
:BASIN              NAME
1604                ATLANTIC
1605                LEWIS EAST
1630          3.8   EWIS WEST
2601          3.4 : PIPESTEM RES LWR
2605          3.1 : PIPES
2606          3.3 : LAMO
2607          3.9 : WAST
2609          3.0 : COLUMBIA
2610          4.6 : STRATFORD WEST
2611          4.4 : STRATFORD EAST
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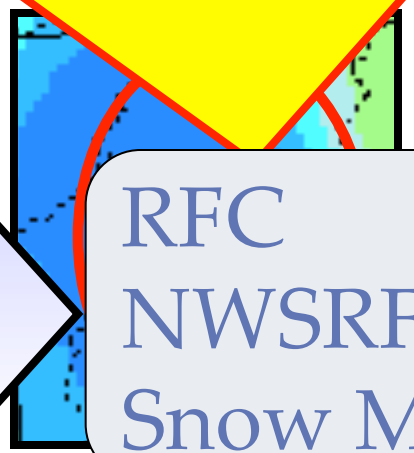


Imported

RFC
NWSRFS
Snow Model

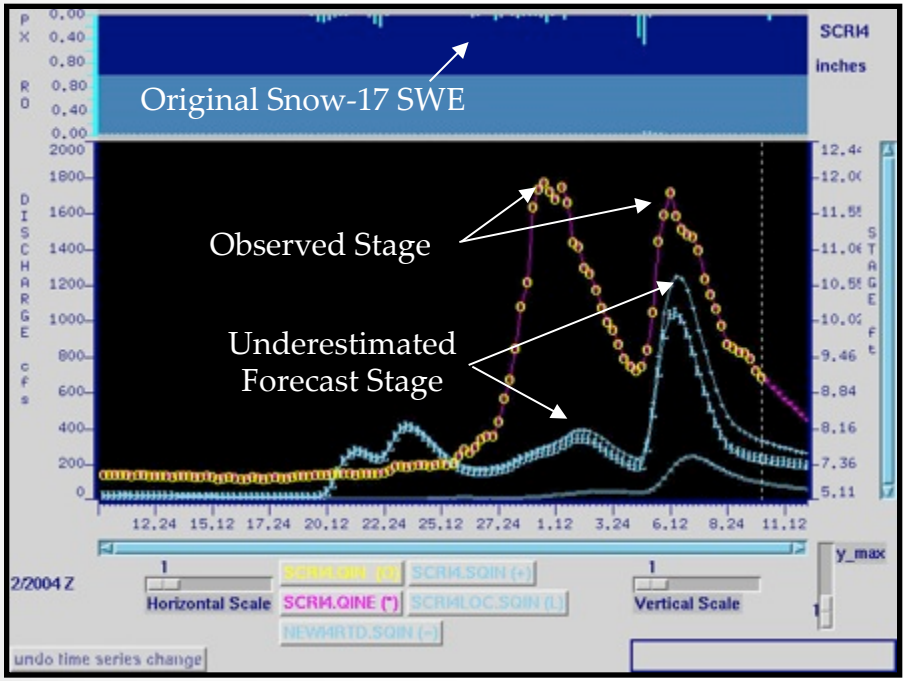
Benefits of NSA Products

Use of NSA Information Products at NCRFC

NWS River Forecast System

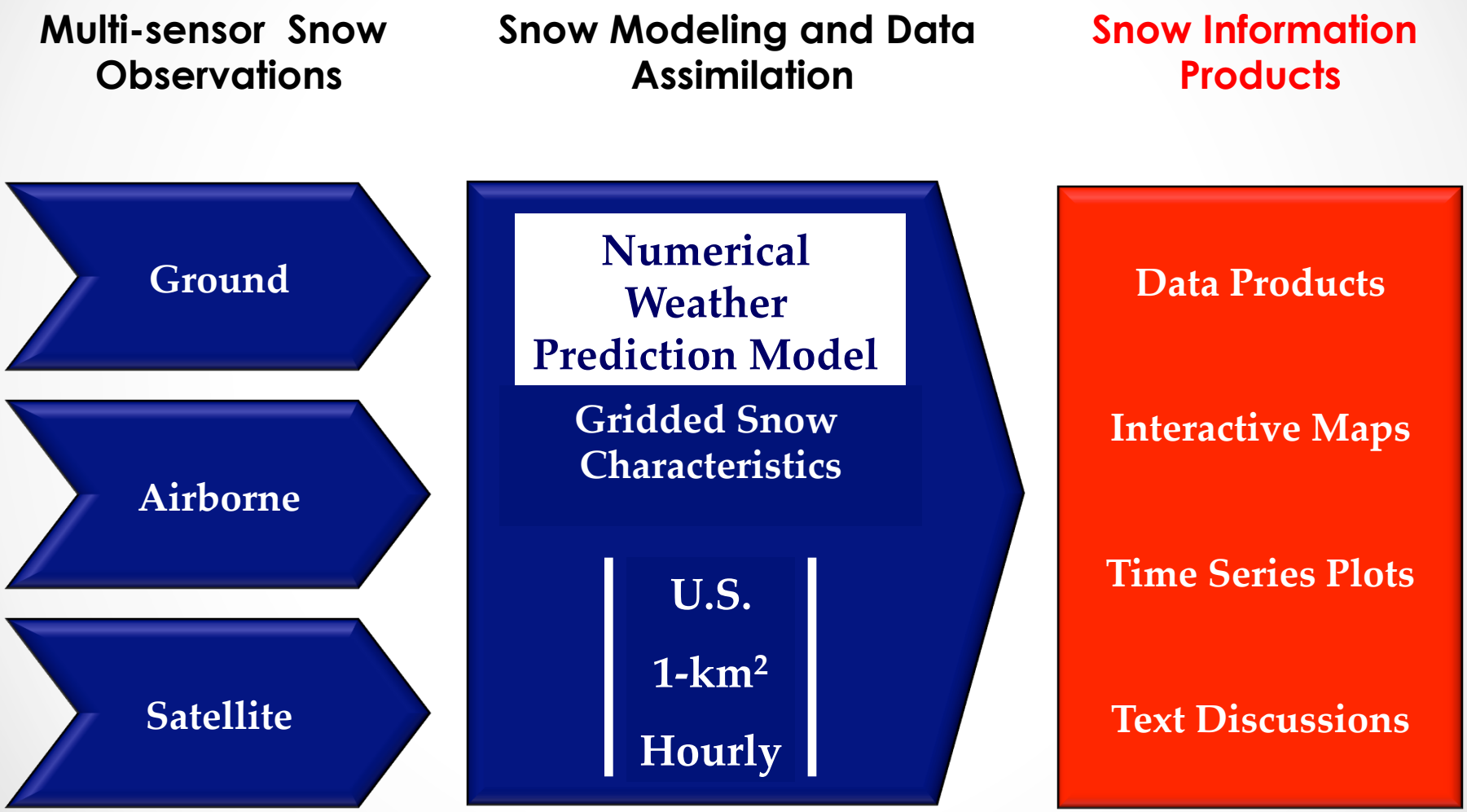
N. Raccoon River, Des Moines River Basin 2004 February 12 - March 11

NWSRFS without NOHRSC NSA data



Example: Two river discharge peaks were observed but underestimated by NWSRFS

National Snow Analysis



National Operational Hydrologic Remote Sensing Center - The ultimate source for snow information - Mozilla

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National Operational Hydrologic Remote Sensing Center

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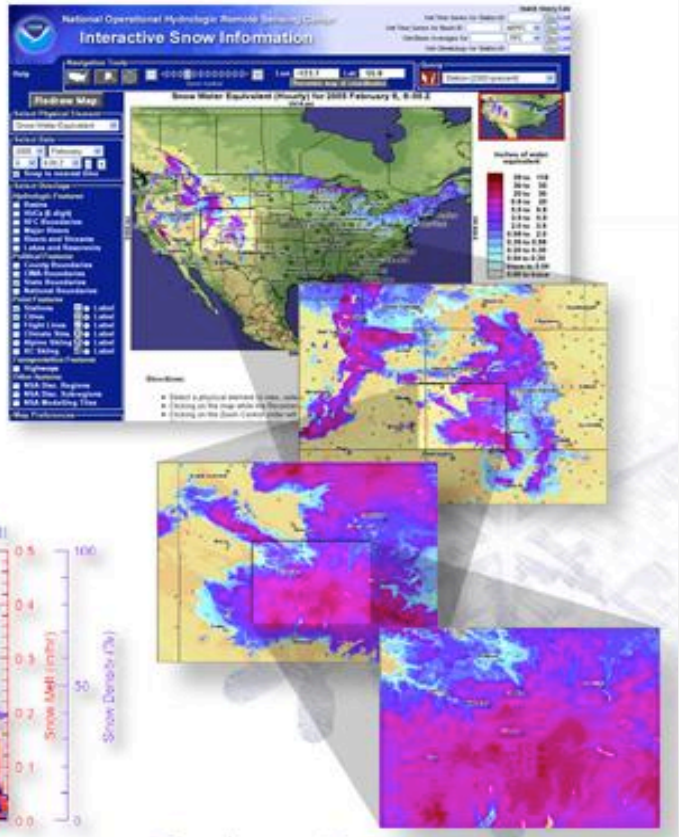
INTERACTIVE SNOW MAPS

Explore our online GIS for comprehensive snow information.

- Build custom maps for your region of interest
- Choose from over 40 snow themes
- Overlay roads, cities, rivers, etc.
- Query detailed conditions at over 20,000 locations



Get detailed snowpack conditions at over 4000 stations nationwide using the query tool.

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools

22.70 N, 70.08 W Zoom

Query

Station (2002-present)

Redraw Map

Select Physical Element

Snow Water Equivalent

Select Date

2014 November

11 12:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features

- RFC Basins Label
- Other Basins Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features

- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features

- Stations Label
- Cities Label
- Flight Lines Label
- Climate Stns. Label
- Skiing Label

Transportation Features

- Roads and Highways

Other features

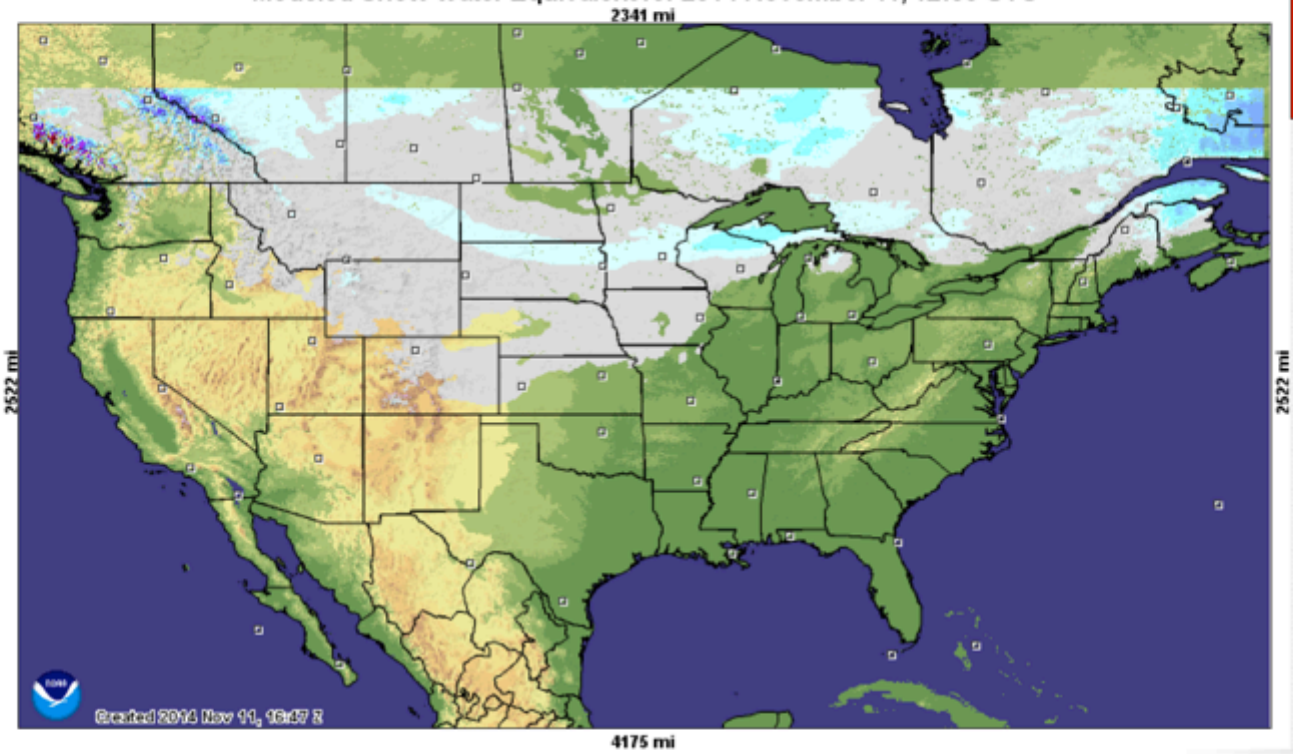
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

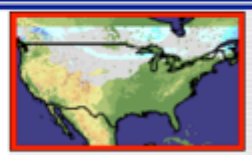
Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Modeled Snow Water Equivalent for 2014 November 11, 12:00 UTC





Inches of water equivalent

	>		30
20	to		30
18	to		20
16	to		18
14	to		16
12	to		14
10	to		12
8	to		10
6	to		8
4	to		6
2	to		4
1	to		2
trace	to		1

Not Estimated

Elevation in feet

	>		13124
8203	to		13124
3281	to		8203
3	to		3281
	<		3

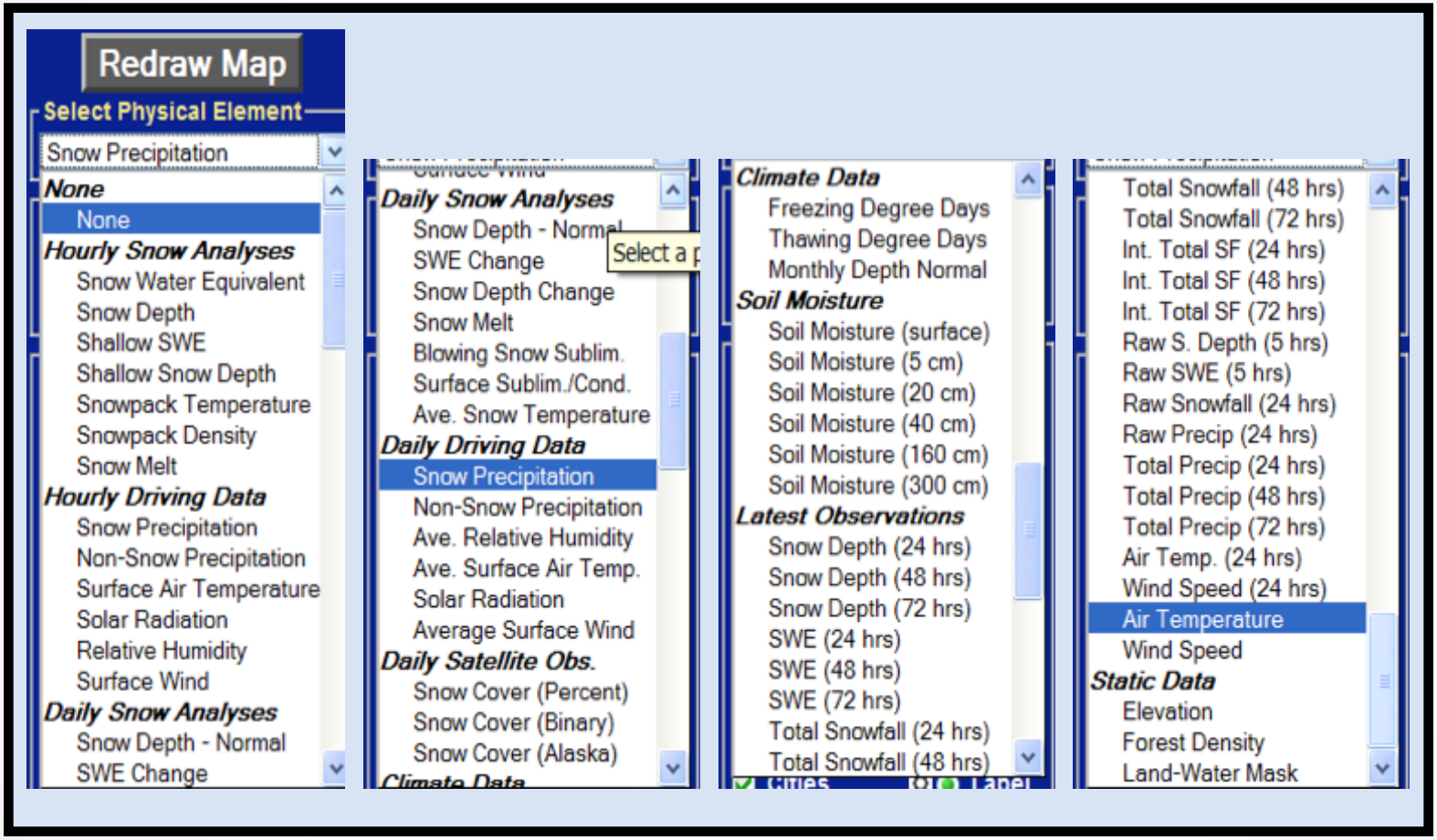
Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
- Clicking on the Zoom Control slider will zoom into or out of the map.
- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
- Stations and regions can be queried using the Query button and menu.

Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

Physical Element Map Options



Questions?

Carrie Olheiser
Carrie.olheiser@noaa.gov
NOHRSC
1735 Lake Drive West
Chanhassen, MN
952-368-2503

www.nohrsc.noaa.gov

Technology – NOHRSC – The ultimate source for snow information

NOHRSC In... | PGPW1 – N... | Inbox (5,61... | Technol... | NOHRSC In... | gamma_sw... | Inbox (16,7... | HPC Quant... | Snow Surv... | Help Page ...

www.nohrsc.noaa.gov/technology/

Google

National Weather Service
National Operational Hydrologic Remote Sensing Center

weather.gov

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  - Interactive Maps
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  - GIS Data Sets
  - Special Purpose Imagery
- **About The NOHRSC**
  - Staff
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  - Related Links
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  - Site Map
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  - Please Send Us Comments!

USA.gov

NOHRSC Science and Technology

Mission Statement

The National Operational Hydrologic
modeled hydrology products for the
the enhancement of the national eco

NOHRSC airborne, satellite, and mo
agencies, the private sector, and the
the nation. The NOHRSC produces
equivalent, snow depth, snow pack t
snow, modeled and observed snow i
and time-series for selected modelec

Overview

The National Operational Hydrologic
airborne, and satellite snow observa
data are used along with estimates c
to generate the operational, daily NO
NOHRSC snow model is an energy-
snow model run operationally at 1-kr
Ground-based and remotely-sensed
state variables. NOHRSC NSA outpu
alphanumeric, time-series, and gridd
maps for nine snowpack characterist
snowpack characteristics, (3) text su
and (5) selected gridded snow produ
equivalent, snow depth, surface and
sublimation, snow-surface energy ex

NWS NOHRSC Policy and Snov

- NOHRSC Abbreviations and
- NOAA's Hydrology Program
- NWS Instruction 10-931: Nat
  Sensing Center; 2005 March
- Requirements for snow data,
  hydrologic services program,
- Recommendations For Makir
- Recommendations For Makir

NOAA's National Snow Analyse

- NOAA's National Snow Analy

snow_data_assimilation.pdf (page 1 of 4) — Locked

.pdf

SNOW BOARD

A look at the importance of snow information

Under the umbrella of the NWS, the National Snow Analysis (NSA) provides valuable snow accumulation information

Water from melting seasonal snowpacks is a critical water resource in many mid-latitude regions of the world. In western USA, snowmelt from mountain basins has historically provided 70-90% of the annual run-off, and the winter snowpack acts as a reservoir to store water for spring and summer delivery to soils and streams. Studies have estimated the economic impact of snow in the USA at several hundred billion dollars per year. The value of water from spring snowmelt can exceed US$348 billion per year. The value of snow-related tourism in the USA exceeds US$7.9 billion per year, and snow removal from streets and highways in the USA exceeds US$2 billion annually.

Given the significant impact that snow can have on our lives and communities, there is an obvious need to monitor the snowpack accurately and consistently to meet a broad range of user interests and requirements. The National Weather Service (NWS), which issues river and flood forecasts, and provides hydrometeorological data and products to support the nation's water resource managers, established the National Operational Hydrologic Remote Sensing Center (NOHRSC) in Chanhassen, Minnesota, as its center of expertise in satellite and airborne remote sensing and geospatial data analysis.

Find: gamma | Next | Previou

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools — 21.40 N, 76.34 W — Zoom

Query — Station (2002-present)

Redraw Map

Select Physical Element: SWE Change

Select Date: 2014 November 11 06:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features
- RFC Basins — Label
- Other Basins — Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features
- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features
- Stations — Label
- Cities — Label
- Flight Lines — Label
- Climate Stns. — Label
- Skiing — Label

Transportation Features
- Roads and Highways

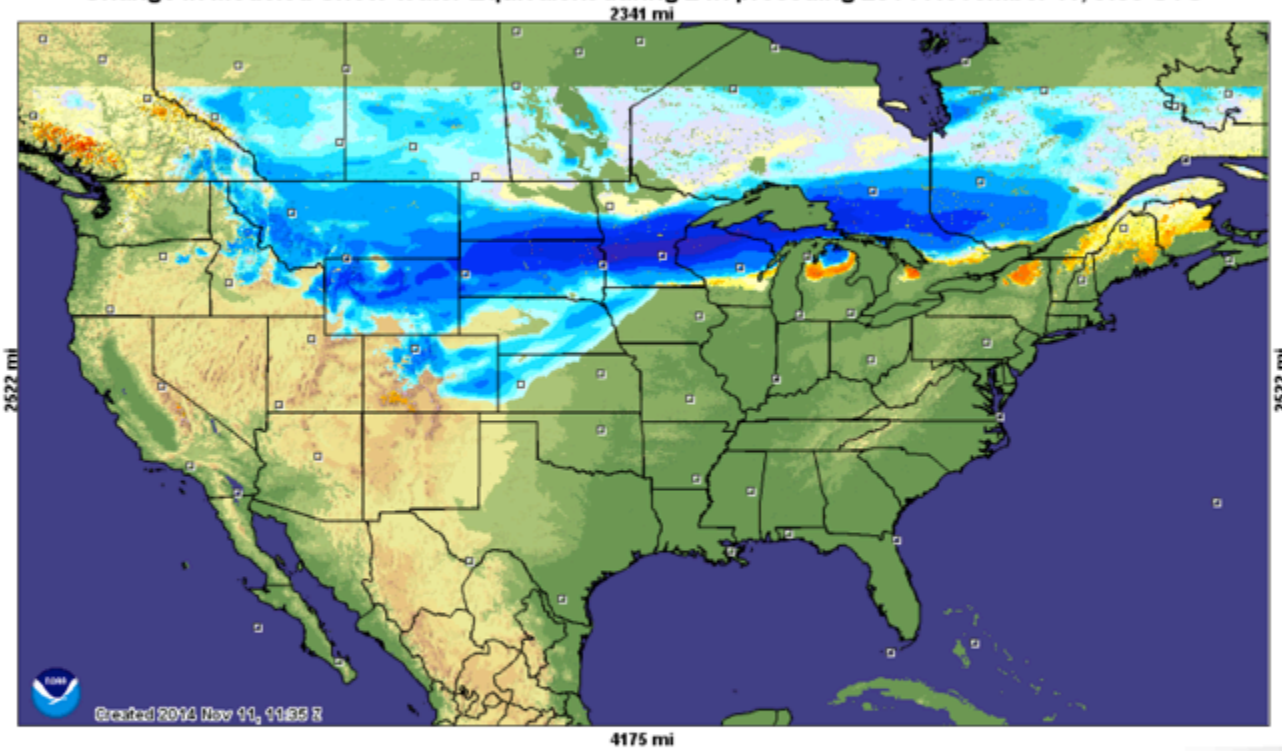
Other features
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

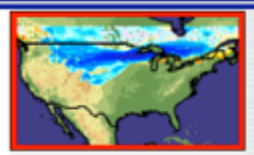
Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Change in Modeled Snow Water Equivalent during 24h preceding 2014 November 11, 6:00 UTC





Inches of water equivalent

	>		2.0
1.2	to		2.0
0.79	to		1.2
0.39	to		0.79
0.20	to		0.39
0.08	to		0.20
0.04	to		0.08
0.02	to		0.04
trace	to		0.02
-trace	to		trace
-0.02	to		-trace
-0.04	to		-0.02
-0.08	to		-0.04
-0.20	to		-0.08
-0.39	to		-0.20
-0.79	to		-0.39
-1.2	to		-0.79
-2.0	to		-1.2
	<		-2.0

Not Estimated

Elevation in feet

	>		13124
8203	to		13124
3281	to		8203
3	to		3281
	<		3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
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- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
- Stations and regions can be queried using the Query button and menu.

Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools

22.13 N, 78.20 W Zoom

Query

Station (2002-present)

Redraw Map

Select Physical Element

Snow Temperature

Select Date

2014 November

11 06:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features

- RFC Basins Label
- Other Basins Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features

- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features

- Stations Label
- Cities Label
- Flight Lines Label
- Climate Stns. Label
- Skiing Label

Transportation Features

- Roads and Highways

Other features

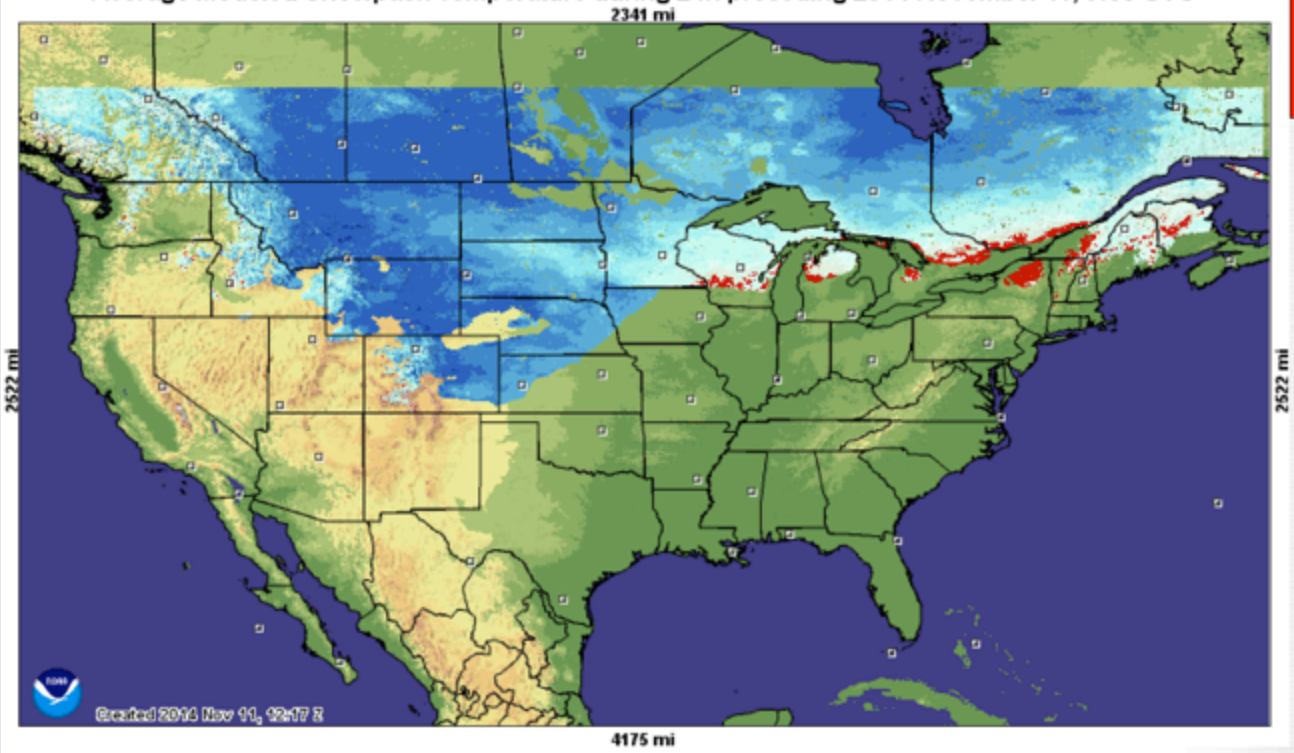
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

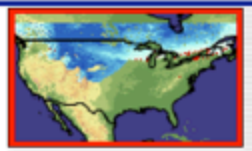
Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Average Modeled Snowpack Temperature during 24h preceding 2014 November 11, 6:00 UTC





Degrees Fahrenheit

31.9 to	32.0
31.8 to	31.9
31.1 to	31.8
30.2 to	31.1
26.6 to	30.2
24.8 to	26.6
23.0 to	24.8
21.2 to	23.0
17.6 to	21.2
14.0 to	17.6
5.0 to	14.0
-4.0 to	5.0
-22.0 to	-4.0
<	-22.0

Not Estimated

Elevation in feet

>	13124
8203 to	13124
3281 to	8203
3 to	3281
<	3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
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Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

24 hour Total Melt

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools

26.68 N, 96.57 W Zoom

Query

Station (2002-present)

Redraw Map

Select Physical Element

Snow Melt (24 hrs)

Select Date

2014 November

11 05:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features

- RFC Basins Label
- Other Basins Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features

- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features

- Stations Label
- Cities Label
- Flight Lines Label
- Climate Stns. Label
- Skiing Label

Transportation Features

- Roads and Highways

Other features

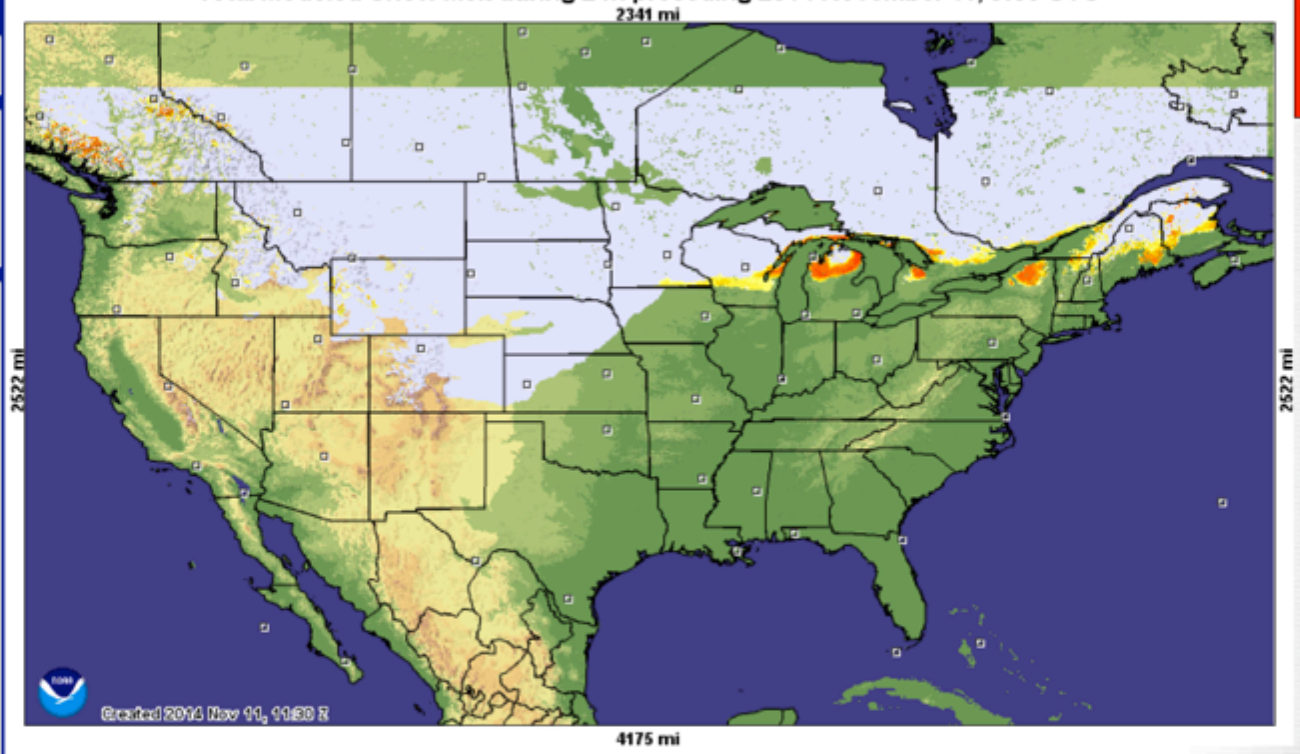
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Total Modeled Snow Melt during 24h preceding 2014 November 11, 5:00 UTC



Inches of water equivalent

> 2.0
1.4 to 2.0
0.98 to 1.4
0.79 to 0.98
0.59 to 0.79
0.39 to 0.59
0.20 to 0.39
0.16 to 0.20
0.12 to 0.16
0.08 to 0.12
0.04 to 0.08
0.02 to 0.04
trace to 0.02
0.00 to trace
Not Estimated

Elevation in feet

> 13124
8203 to 13124
3281 to 8203
3 to 3281
< 3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
- Clicking on the Zoom Control slider will zoom into or out of the map.
- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
- Stations and regions can be queried using the Query button and menu.

Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Forecasted Snow Precipitation

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools — 33.27 N, 74.14 W — Zoom

Query — Station (2002-present)

Redraw Map

Select Physical Element: Snow Precipitation

Select Date: 2014 November 13 06:00 UTC (-- - + ++)

Snap to nearest time

Select Overlays

Hydrologic Features
- RFC Basins — Label
- Other Basins — Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features
- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features
- Stations — Label
- Cities — Label
- Flight Lines — Label
- Climate Stns. — Label
- Skiing — Label

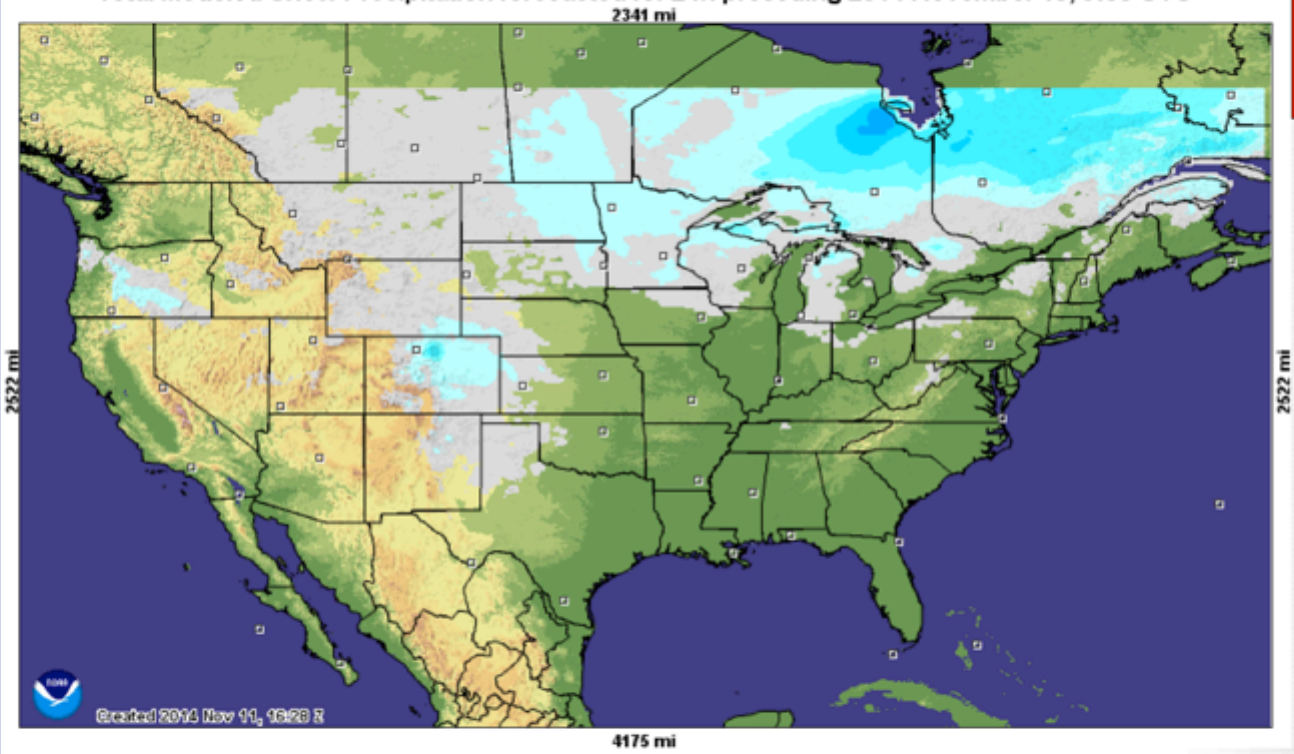
Transportation Features
- Roads and Highways

Other features
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

Map Preferences: English units

- Legend below map
- Background image
- Hill shading

Total Modeled Snow Precipitation forecasted for 24h preceding 2014 November 13, 6:00 UTC



Inches of water equivalent

>	20
14 to	20
9.8 to	14
7.9 to	9.8
5.9 to	7.9
3.9 to	5.9
2.0 to	3.9
1.6 to	2.0
1.2 to	1.6
0.79 to	1.2
0.39 to	0.79
0.20 to	0.39
0.04 to	0.20
trace to	0.04

Not Estimated

Elevation in feet

>	13124
8203 to	13124
3281 to	8203
3 to	3281
<	3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
- Clicking on the Zoom Control slider will zoom into or out of the map.
- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
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Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools

30.18 N, 102.34 W Zoom

Query: Station (2002-present)

Redraw Map

Select Physical Element: Snow Depth (24 hrs)

Select Date: 2014 November 11 12:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features
- RFC Basins Label
- Other Basins Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features
- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features
- Stations Label
- Cities Label
- Flight Lines Label
- Climate Stns. Label
- Skiing Label

Transportation Features
- Roads and Highways

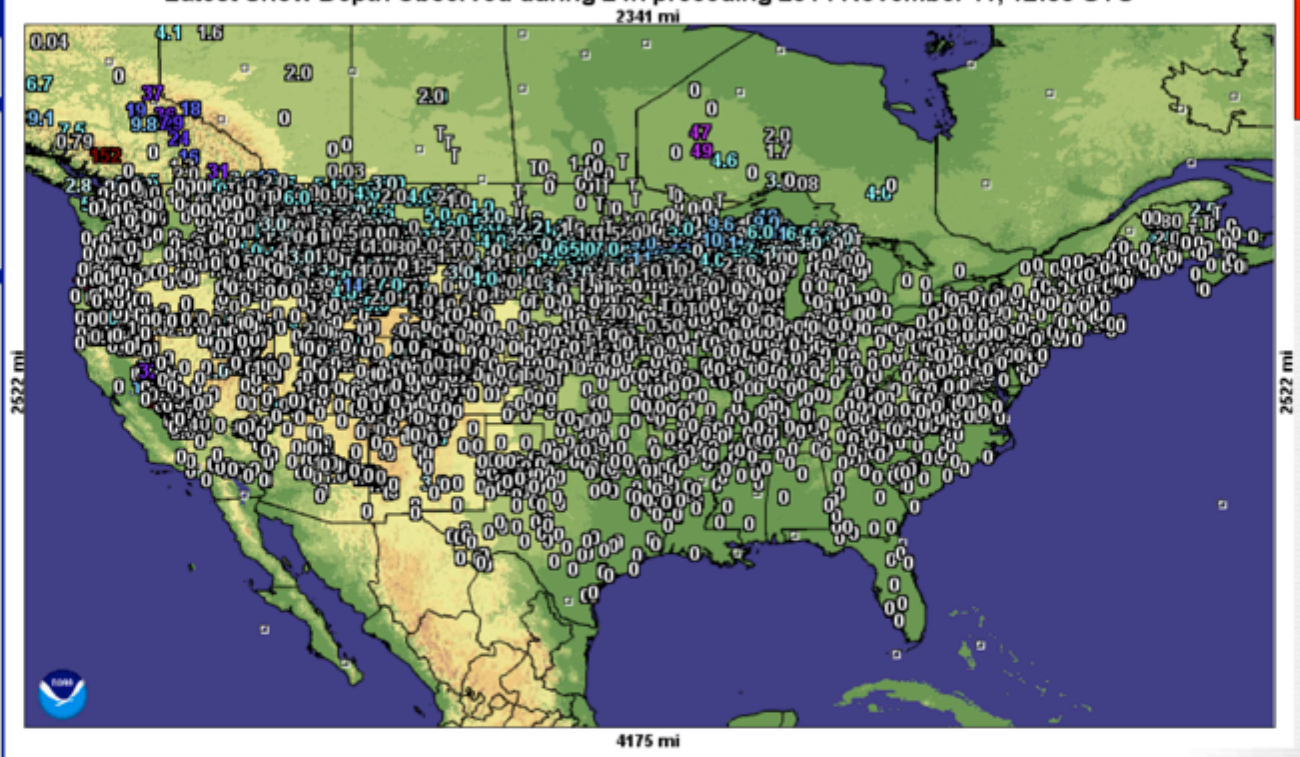
Other features
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Latest Snow Depth Observed during 24h preceding 2014 November 11, 12:00 UTC



Inches of depth

> 150
100 to 150
75 to 100
50 to 75
40 to 50
30 to 40
20 to 30
16 to 20
12 to 16
8.0 to 12
4.0 to 8.0
2.0 to 4.0
0.00 to 2.0
Not Estimated

Elevation in feet

> 13124
8203 to 13124
3281 to 8203
3 to 3281
< 3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
- Clicking on the Zoom Control slider will zoom into or out of the map.
- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
- Stations and regions can be queried using the Query button and menu.

Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools

46.29 N, 94.53 W Zoom

Query: Station (2002-present)

Redraw Map

Select Physical Element: Shallow SWE

Select Date: 2014 November 11 12:00 UTC

-- - + ++

Snap to nearest time

Select Overlays

Hydrologic Features
- RFC Basins Label
- Other Basins Label
- HUCs (6-digit)
- RFC Boundaries
- Rivers and Streams
- Lakes and Reservoirs

Political Features
- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

Point Features
- Stations Label
- Cities Label
- Flight Lines Label
- Climate Stns. Label
- Skiing Label

Transportation Features
- Roads and Highways

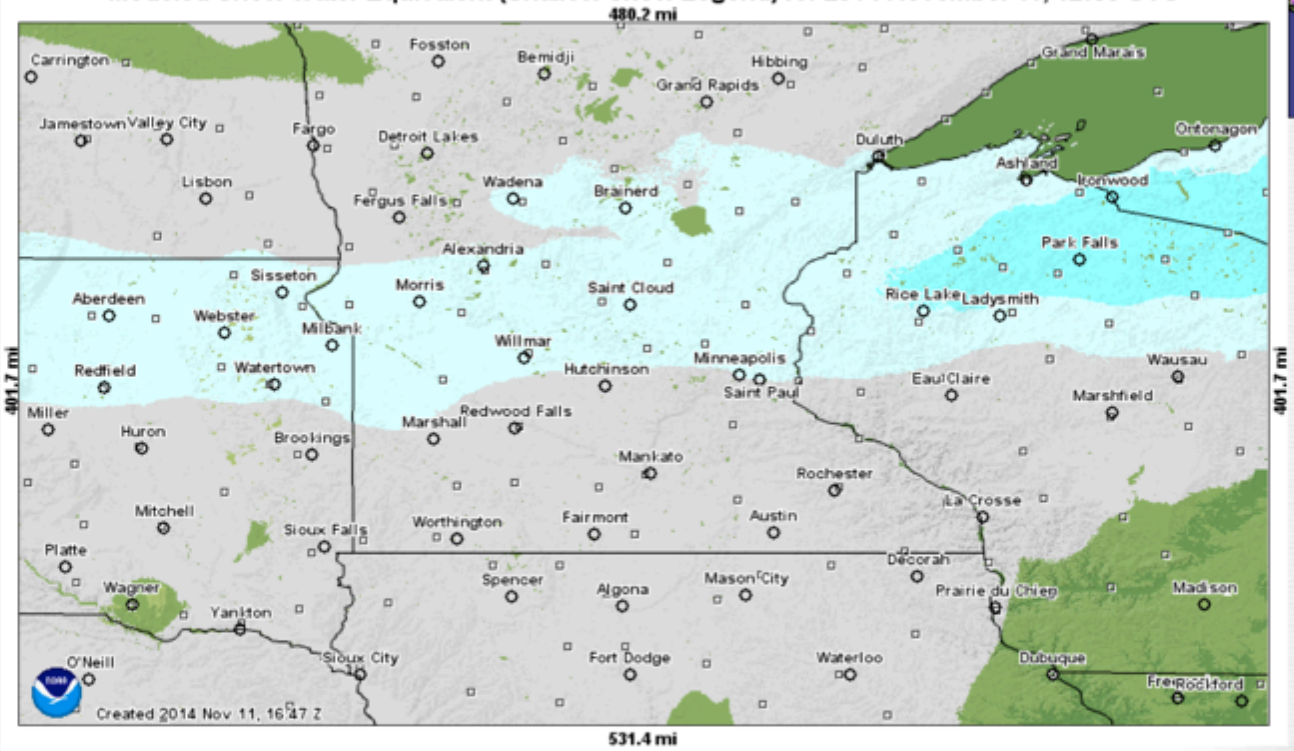
Other features
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

Map Preferences

English units

- Legend below map
- Background image
- Hill shading

Modeled Snow Water Equivalent (Shallow-snow Legend) for 2014 November 11, 12:00 UTC



Inches of water equivalent

	>		18
	16	to	18
	14	to	16
	12	to	14
	10	to	12
	8	to	10
	6	to	8
	5	to	6
	4	to	5
	3	to	4
	2	to	3
	1	to	2
	trace	to	1
	Not Estimated		

Elevation in feet

	>		13124
	8203	to	13124
	3281	to	8203
	3	to	3281
	<		3

Directions:

- Select a physical element to view, select a date, select overlays, and click "Redraw Map."
- Clicking on the map while the Recenter button is selected (red) will recenter the map on that point.
- Clicking on the Zoom Control slider will zoom into or out of the map.
- Clicking on the map and dragging with the button held down while the Recenter button is selected (red) will zoom to a rectangle when the button is released.
- Stations and regions can be queried using the Query button and menu.

Vector GIS Datasets used by this page

Raster GIS Datasets used by this page

Query Station Time Series

Station SHEF ID: KMSP

600 px width

400 px height

Submit

Reference Map

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Start Date: 2014 January 9 6:00 Z to Stop Date: 2014 February 1 6:00 Z

All Graphs | Metric Units | Refresh screen | More information on station KMSP

Snow Water Equivalent, Snow Depth, and Snow Melt

Modeled and Observed

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

(Modeled) (Observed)
Snow Water Equivalent
Snow Depth
Snow Density
Snow Melt
Assimilation

Snow Depth (cm) | Snow Water Equivalent (cm) | Snow Melt (mm/hr) | Snow Density (kg/m3)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

1

Precipitation, Snow Water Equivalent, and Snow Depth

Modeled and Observed

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

Snow Precipitation
Non-Snow Precipitation
Unknown Precipitation
Snow Water Equivalent (Modeled)
Snow Depth (Modeled)
Present Weather (Observed)
Rain
Rain (Not Freezing)
Freezing Drizzle/Rain
Sleet Rain/Snow
Snow

Modeled Precipitation (mm of water) | Snow Water Equivalent (cm)

Observed Precipitation (mm of water) | Snow Depth (cm)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

2

Time Window Cumulative Precipitation

Modeled and Observed

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

Snow Precipitation
Non-Snow Precipitation
Unknown Precipitation
Total Precipitation
Observed Depth of Snowfall

Cumulative Modeled Precipitation (mm of water)

Cumulative Observed Depth of Snowfall (cm) | Cumulative Observed Precipitation (mm of water)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

3

Snow Pack Temperature and Density by Layer

Modeled

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

Layer Separator

Snow Depth (cm) | Snow Temperature (°C)

Snow Depth (cm) | Snow Density (kg/m3)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

4

Snow Surface, Mean Snow Pack, and Air Temperatures

Modeled and Observed

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

Snow Surface Temperature
Mean Snow Pack Temperature
Air Temperature Forcing, 2-m
Observed Air Temperature
Observed Dew Point Temperature

Snow Temperature (°C) | Snow Temperature (°C)

Air Temperature (°C) | Air Temperature (°C)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

5

Snow Melt, Sublimation, and Weather Forcing

Modeled and Observed

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL
Latitude: 44.866667 N
Longitude: 93.216667 W
Elevation: 248 Meters
Start Date: 2014-01-09 06 UTC
Stop Date: 2014-02-01 06 UTC
Forest Density: 9%
Land Use: Conifer Boreal Forest

Sublimation from Snow Surface
Sublimation from Blowing Snow
Observed Blowing Snow
Snow Melt Rate
Relative Humidity 2-m
Wind Speed, 10-m (Observed)
Wind Speed, 10-m (Modeled)

Snow Sublimation (mm/hr) | Snow Melt (mm/hr)

Relative Humidity (%) | Wind Speed (m/s)

2014-01-15 00 2014-01-22 00 2014-01-29 00

Date (UTC)

6

Snow Surface Energy Exchanges

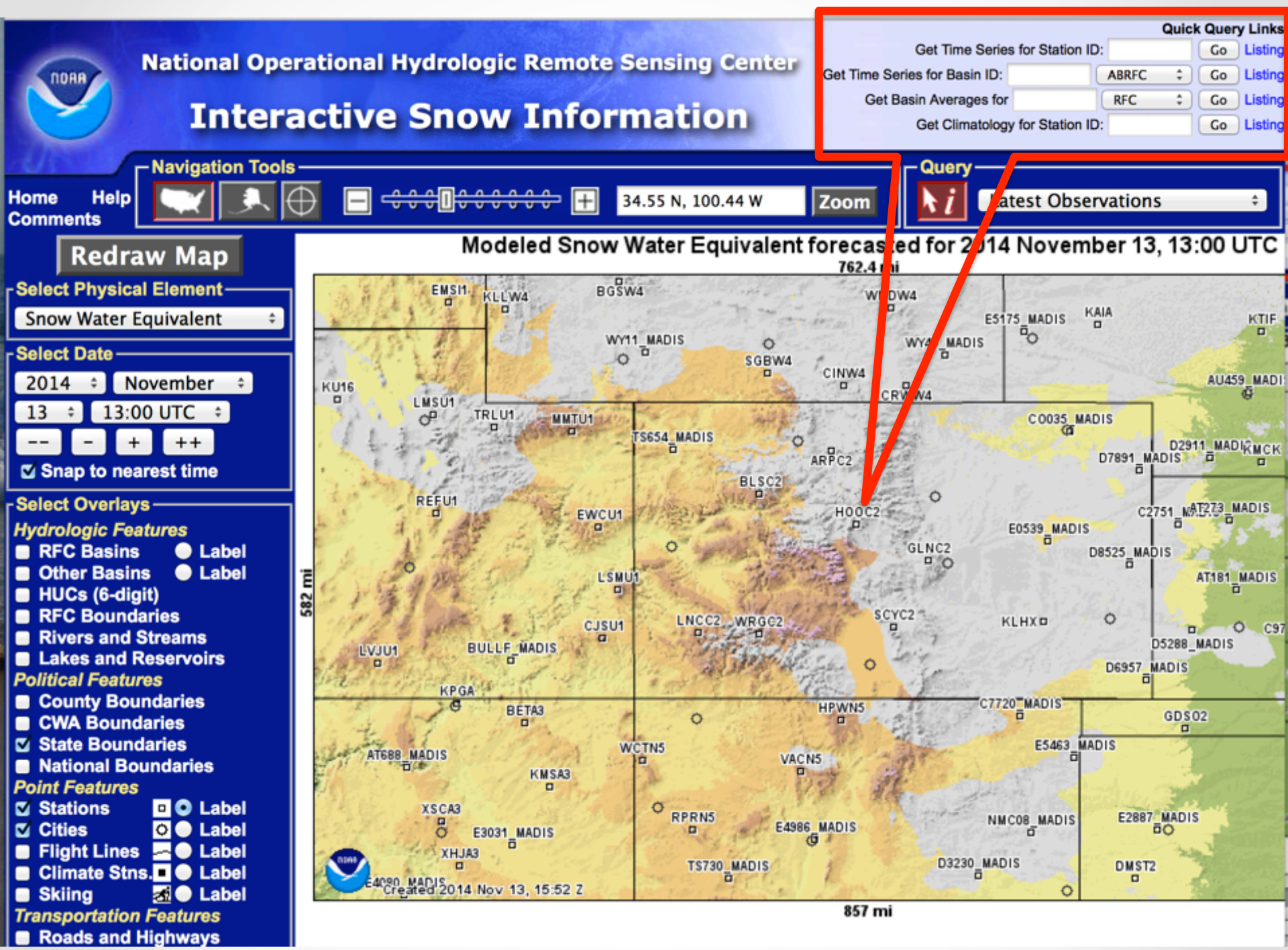
Modeled

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL

Snow Surface Radiation Fluxes

Modeled

Station: KMSP - MINNEAPOLIS-ST PAUL INTERNATIONAL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Get Time Series for Basin ID:
ABRFC
Get Basin Averages for
RFC
Get Climatology for Station ID:
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34.55 N, 100.44 W
Zoom
Query
Latest Observations
Redraw Map
Select Physical Element
Snow Water Equivalent
Select Date
2014
November
13
13:00 UTC
--
-
+
++
Snap to nearest time
Select Overlays
Hydrologic Features
RFC Basins
Label
Other Basins
Label
HUCs (6-digit)
RFC Boundaries
Rivers and Streams
Lakes and Reservoirs
Political Features
County Boundaries
CWA Boundaries
State Boundaries
National Boundaries
Point Features
Stations
Label
Cities
Label
Flight Lines
Label
Climate Stns.
Label
Skiing
Label
Transportation Features
Roads and Highways
Modeled Snow Water Equivalent forecasted for 2014 November 13, 13:00 UTC
762.4 mi
582 mi
857 mi
EMSI1
KLLW4
BGSW4
WY11_MADIS
SGBW4
CINW4
E5175_MADIS
KAIA
KTIF
KU16
LMSU1
TRLU1
MMTU1
TS654_MADIS
ARPC2
BLSC2
REFU1
EWCU1
HOOC2
C0035_MADIS
D7891_MADIS
D2911_MADIS
KMCK
AU459_MADIS
E0539_MADIS
GLNC2
D8525_MADIS
AT273_MADIS
AT181_MADIS
LSMU1
CJSU1
LNCC2
WRGC2
SCYC2
KLHX
D5288_MADIS
D6957_MADIS
LVJU1
BULLF_MADIS
KPGA
BETA3
HPWN5
C7720_MADIS
GDSO2
E5463_MADIS
AT688_MADIS
WCTN5
VACN5
KMSA3
XSCA3
RPRN5
E4986_MADIS
NMC08_MADIS
E2887_MADIS
E3031_MADIS
XHJA3
TS730_MADIS
D3230_MADIS
DMST2
Created 2014 Nov 13, 15:52 Z

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

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Query Station Time Series

Station SHEF ID: CO-AR-273

600 px width

400 px height

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Reference Map

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Start Date: 2014 | November | 9 | 15:00 Z — to — Stop Date: 2014 | November | 13 | 0:00 Z

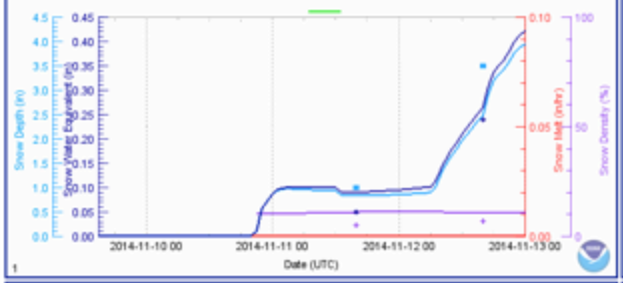
All Graphs | English Units | Refresh screen

Snow Water Equivalent, Snow Depth, and Snow Melt

Modeled and Observed

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Snow Water Equivalent (Modeled) (Observed)
Snow Depth
Snow Density
Snow Melt
Assimilation



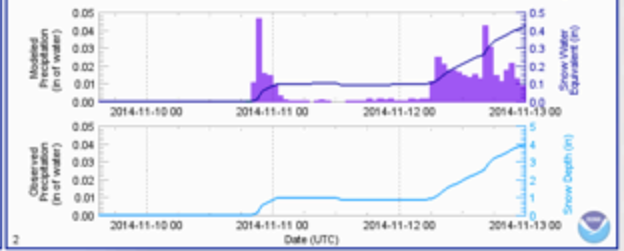
1

Precipitation, Snow Water Equivalent, and Snow Depth

Modeled and Observed

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Snow Precipitation
Non-Snow Precipitation
Unknown Precipitation
Snow Water Equivalent (Modeled)
Snow Depth (Modeled)
Present Weather (Observed)
No Precipitation
Rain (Not Freezing)
Freezing Drizzle/Rain
Mixed Rain/Snow
Snow



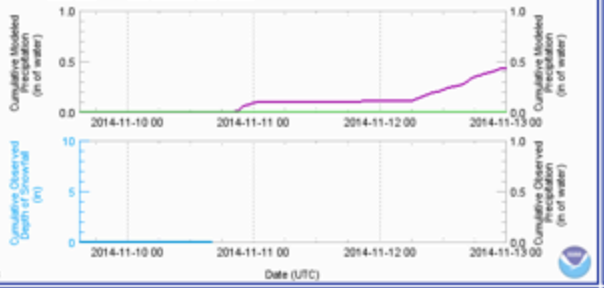
2

Time Window Cumulative Precipitation

Modeled and Observed

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Snow Precipitation
Non-Snow Precipitation
Unknown Precipitation
Total Precipitation
Observed Depth of Snowfall



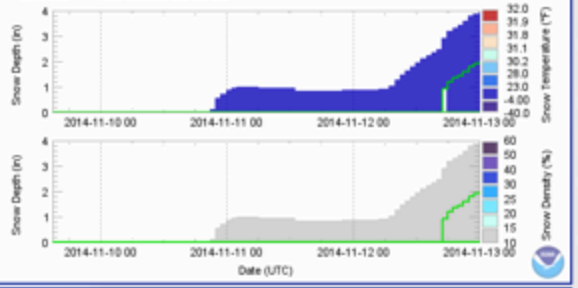
3

Snow Pack Temperature and Density by Layer

Modeled

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Layer Separator



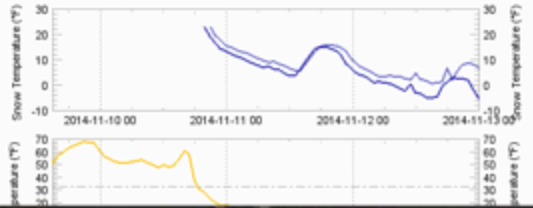
4

Snow Surface, Mean Snow Pack, and Air Temperatures

Modeled and Observed

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Snow Surface Temperature
Mean Snow Pack Temperature
Air Temperature Forcing, 6-ft
Observed Air Temperature
Observed Dew Point Temperature



Snow Melt, Sublimation, and Weather Forcing

Modeled and Observed

Station: CO-AR-273 - AURORA 3.3 S, CO
Latitude: 39.65262 N
Longitude: 104.8237 W
Elevation: 5712 Feet
Start Date: 2014-11-09 15 UTC
Stop Date: 2014-11-13 00 UTC
Forest Density: 8%
Land Use: Cool Grasses and Shrubs

Sublimation from Snow Surface
Sublimation from Blowing Snow
Observed Blowing Snow
Snow Melt Rate
Relative Humidity 6-ft
Wind Speed, 33-ft (Observed)
Wind Speed, 33-ft (Modeled)

PGPW1 - NOHRSC Graph plot

NOHRSC In... | PGPW1 ... | Inbox (5,61... | National Sn... | NOHRSC In... | gamma_sw... | Inbox (16,7... | HPC Quant... | NOHRSC In... | National Sn...

www.nohrsc.nws.gov/interactive/html/graph.html?station=PGPW1&w=600&h=400&o=a&uc=0&by=2012&bm=12&bd=14&

Google

Time Series

Station SHEF ID: PGPW1

600 px width

400 px height

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2012 | December | 14 | 6:00 Z to 2012 | December | 21 | 6:00 Z

All Images | English Units | Refresh screen | More information on station PGPW1

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Plot 1 Data
Plot 2 Data
Plot 3 Data
Plot 4 Data
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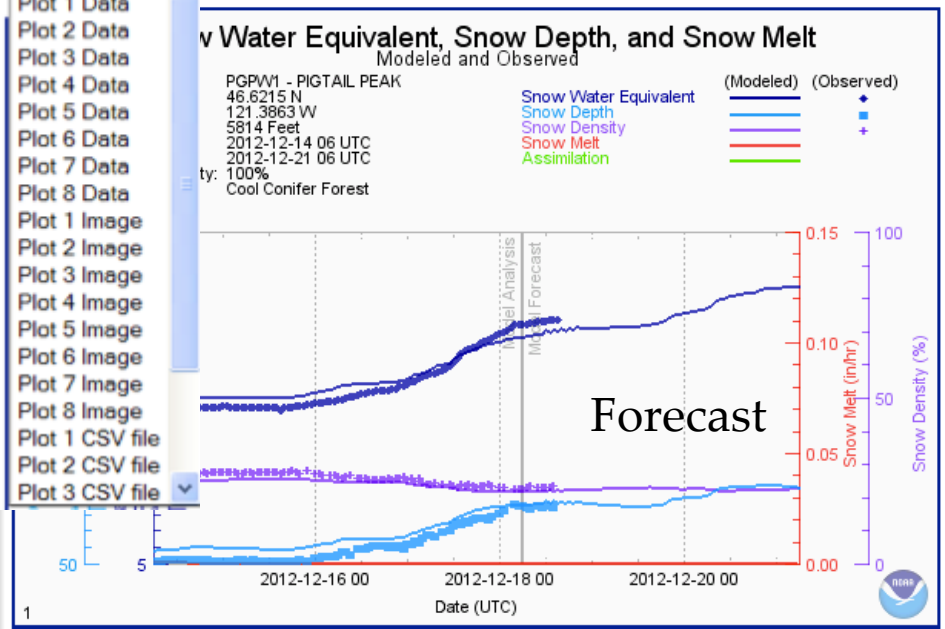
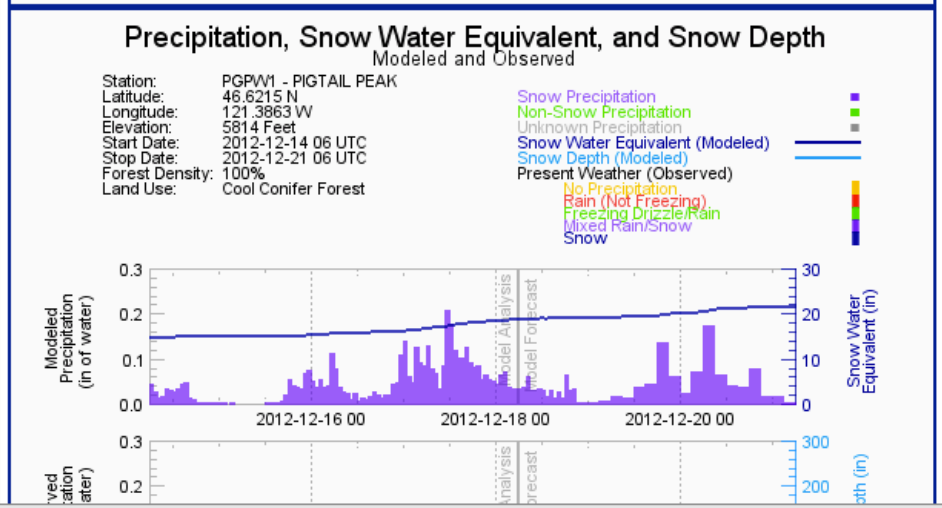
Plot 6 Data
Plot 7 Data
Plot 8 Data
Plot 1 Image
Plot 2 Image
Plot 3 Image
Plot 4 Image
Plot 5 Image
Plot 6 Image
Plot 7 Image
Plot 8 Image
Plot 1 CSV file
Plot 2 CSV file
Plot 3 CSV file



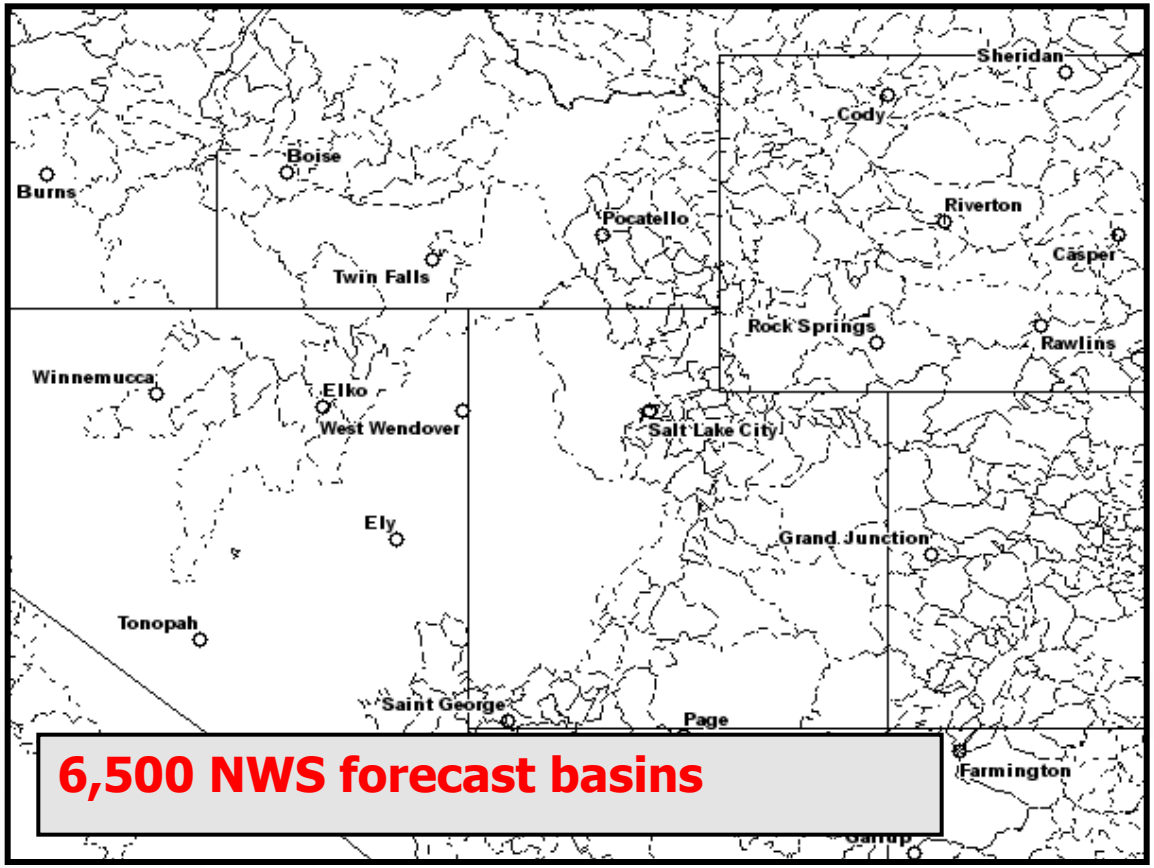


Find: gamma | Next | Previous | Highlight all | Match case

National Snow Analysis

Integrated Modeled / Observed Snowpack State Variables

Daily Basin-by-Basin NSA Products Shipped to Web



2010 | February | 9 | 2:00 Z | - | + | Snow Water Equivalent

Text | Metric Units | Refresh screen | Show only non-zero values

BASIN-BY-BASIN SNOW SUMMARY FOR MBRFC

SNOW WATER EQUIVALENT ANALYSIS (MODEL + OBSERVATIONS)

February 9, 2010 02 Z

NATIONAL OPERATIONAL HYDROLOGIC REMOTE SENSING CENTER
Office of Climate, Water, and Weather Services
NATIONAL WEATHER SERVICE, NOAA
CHANHASSEN, MN 55317

URL: www.nohrsc.noaa.gov Phone: 952-361-6610 Fax: 952-361-6634

LEGEND VARIABLE	HEADER	UNITS
Basin Identifier	(Basin)	n/a
Sub-basin Number	(Sub)	1,2,3...6 if applicable, or TTL for total basin
Date of Model Analysis	(Date)	YYMMDD.HH (UTC)
Min Elevation	(Min E)	Meters - Only applicable to NWS-subdivided basins
Max Elevation	(Max E)	Meters - Only applicable to NWS-subdivided basins
Basin Description	(Description)	n/a
Snow Water Equivalent		
Basin/Sub-basin Mean	(Mean)	Meters
Basin/Sub-basin Std. Dev	(StDev)	Meters
Basin/Sub-basin Minimum	(Min)	Meters
Basin/Sub-basin Maximum	(Max)	Meters
Basin/Sub-basin Volume	(Volume)	Cubic meters
Basin/Sub-basin Volume	(Volume(2))	Billion liters

Basin	Sub	Date	Min E	Max E	Description	Mean	StDev	Min	Max	Volume
101	TTL	100209.02	582	686	REPUBLICAN R. NR BLOOMINGTON, NE	0.0187	0.0006	0.0169	0.0196	542900
102	TTL	100209.02	548	725	THOMPSON CREEK AT RIVERTON, NE	0.0206	0.0058	0.0146	0.0550	1791000
103	TTL	100209.02	543	659	REPUBLICAN RIVER AT RIVERTON, NE	0.0206	0.0012	0.0177	0.0233	864000
104	TTL	100209.02	508	642	REPUBLICAN RIVER AT GUIDE ROCK NE	0.0307	0.0103	0.0197	0.0737	3084000
105	TTL	100209.02	466	602	REPUBLICAN RIVER NR HARDY NE	0.0274	0.0041	0.0182	0.0510	2201000
106	TTL	100209.02	483	567	LOVEWELL RES. KS	0.0283	0.0010	0.0256	0.0313	774200
107	TTL	100209.02	444	545	REPUBLICAN RIVER NR SCANDIA KS	0.0260	0.0011	0.0237	0.0290	1377000
108	TTL	100209.02	424	565	BUFFALO CR NR JAMESTON KS	0.0280	0.0015	0.0253	0.0320	2417000
109	TTL	100209.02	407	503	REPUBLICAN RIVER AT CONCORDIA KS	0.0286	0.0020	0.0253	0.0342	2079000
110	TTL	100209.02	381	507	REPUBLICAN RIVER NR CLIFTON KS	0.0305	0.0016	0.0278	0.0357	4225000
111	TTL	100209.02	362	496	REPUBLICAN RIVER AT CLAY CENTER KS	0.0302	0.0015	0.0264	0.0358	2991000
112	TTL	100209.02	337	442	MILFORD LAKE NR JUNCTION CITY KS	0.0318	0.0015	0.0285	0.0366	2516000
117	TTL	100209.02	398	499	ELK CR. AT CLYDE KS	0.0307	0.0009	0.0292	0.0333	574700
118	TTL	100209.02	498	631	WHITE ROCK CRK NR BURR OAK KS	0.0262	0.0026	0.0218	0.0319	1532000
119	TTL	100209.02	602	733	TURKEY CREEK AT NAPONEE, NE.	0.0184	0.0010	0.0153	0.0197	673200
120	TTL	100209.02	576	703	CENTER CREEK AT FRANKLIN, NE	0.0190	0.0009	0.0165	0.0208	455800

Done

National Operational Hydrologic Remote Sensing Center

Interactive Snow Information

Quick Query Links

Get Time Series for Station ID: Go Listing

Get Time Series for Basin ID: ABRFC Go Listing

Get Basin Averages for RFC Go Listing

Get Climatology for Station ID: Go Listing

Home Help Comments

Navigation Tools — Zoom Control — Lon: -96.68 Lat: 39.79 — Recenter map at coordinates

Query: Basin

Redraw Map

Select Physical Element: Snow Water Equivalent

Select Date: 2010 February 9 15:00 Z

Snap to nearest time

Select Overlays

Hydrologic Features
- Basins — Label
- HUCs (6-digit)
- RFC Boundaries
- Major Rivers
- Rivers and Streams
- Lakes and Reservoirs

Political Features
- County Boundaries
- CWA Boundaries
- State Boundaries
- National Boundaries

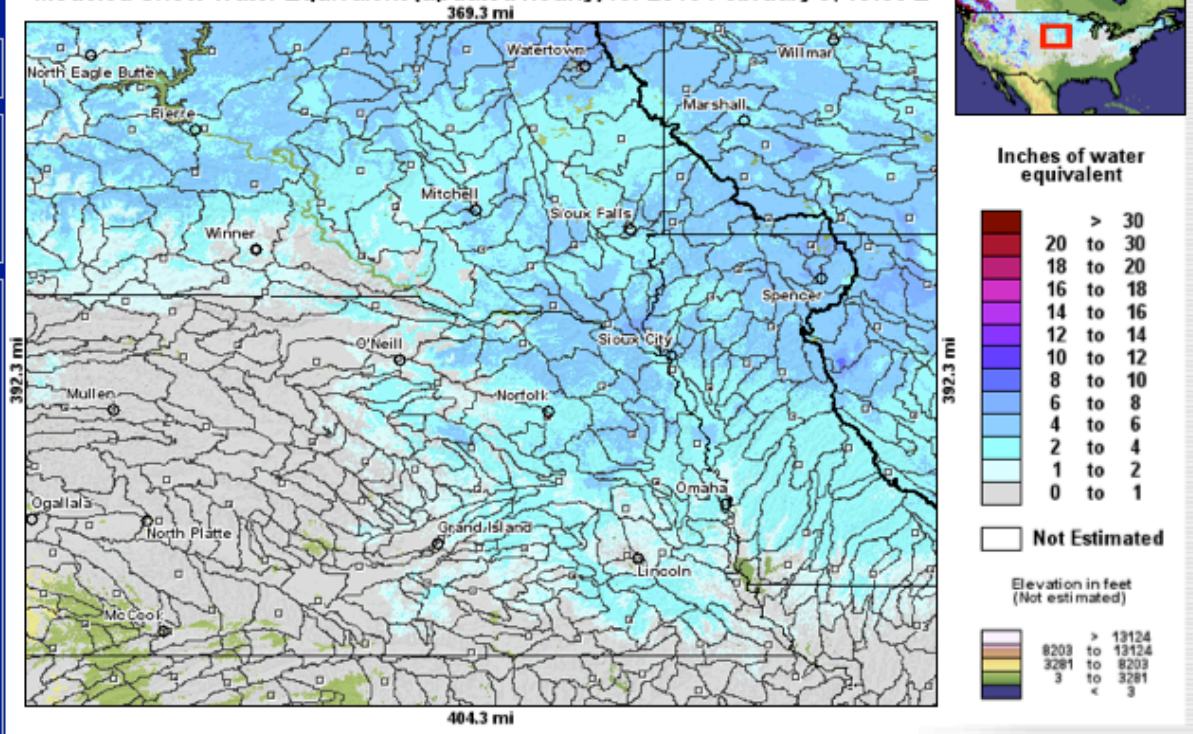
Point Features
- Stations — Label
- Cities — Label
- Flight Lines — Label
- Climate Stns. — Label
- Skiing — Label

Transportation Features
- Roads and Highways

Other features
- NSA Disc. Regions
- NSA Disc. Subregions
- NSA Modelling Tiles

Map Preferences: English units

Modeled Snow Water Equivalent (updated hourly) for 2010 February 9, 15:00 Z



Inches of water equivalent

>	30		
20	to	30	
18	to	20	
16	to	18	
14	to	16	
12	to	14	
10	to	12	
8	to	10	
6	to	8	
4	to	6	
2	to	4	
1	to	2	
0	to	1	

Not Estimated

Elevation in feet (Not estimated)

>	13124		
8203	to	13124	
3281	to	8203	
3	to	3281	
<	3		

Model Adjustments:

A data assimilation as done across the upper Rio Grande through the Plains to Tennessee River basin on December 9. Our model over-produced snowfall from the most recent storm in this region, and there was some mis-typing of precipitation. Three-quarters to 1 1/4 inches of water was removed from the modeled snowpack in Kansas through western Missouri. One-half to 3/4 inch of water was also removed from the Llano Estacado and Caprock. Up to an inch of water was removed from Arkansas through western Tennessee.

Done

Query Basin Time Series

River Forecast Center Region: MBRFC

Basin SHEF ID: 821

600 px width

400 px height

Submit

Reference Map

Links

This image

Preferences

Cookies off

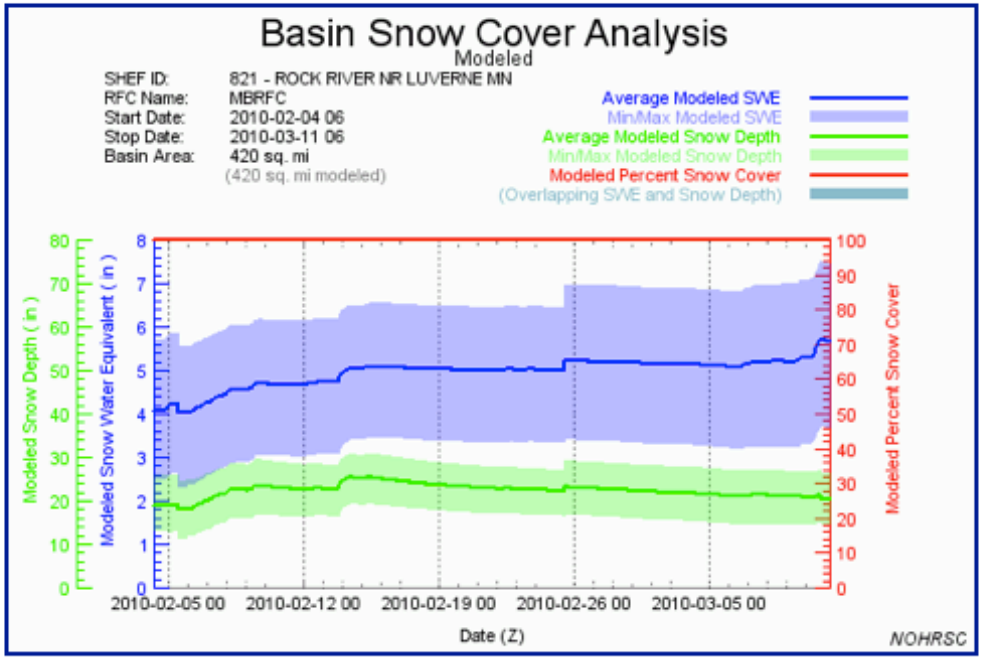
Start Date: 2010 | February | 4 | 6:00 Z

to

Stop Date: 2010 | March | 11 | 6:00 Z

Image | English Units | Refresh screen

Average of snow-covered area only



National Weather Service
National Operational Hydrologic Remote Sensing Center
1735 Lake Drive W.

National Weather Service

National Operational Hydrologic Remote Sensing Center

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NATIONAL SNOW ANALYSES

Get the latest in-depth analyses of national and regional snow conditions.

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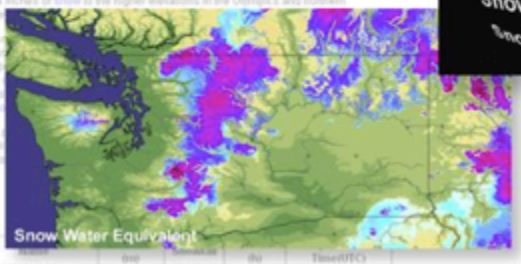
- Commentary and analysis
- Observations and statistics



Know Snow

Snow Analysis Highlights

Wednesday, November 12, 2014

Snow Model Status: The model analysis is out to Wednesday, 2014-11-12 1800 UTC. The daily model forecast is out to Saturday, 2014-11-15 0600 UTC.

more ...

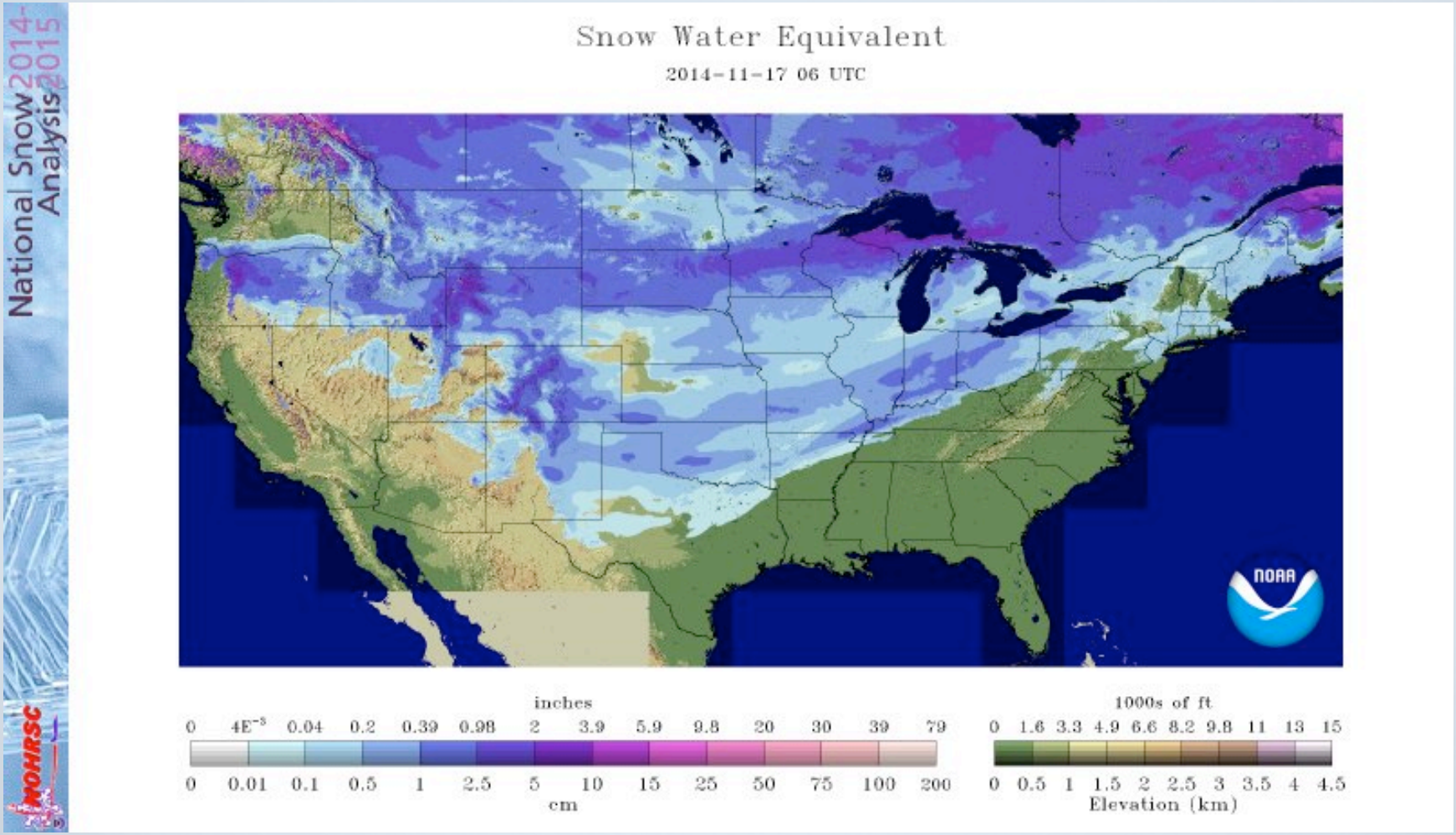
Website News

We have recently enabled native support for CoCoRaHS station identifiers. If you are looking for observations for a CoCoRaHS station, it will be listed and be accessible by its CoCoRaHS identifier, and no longer by its MADIS ID (i.e. #####_MADIS).

National Weather Service
National Operational Hydrologic Remote Sensing Center
1735 Lake Drive W.
Chanhassen, MN 55317

NOHRSC NSA

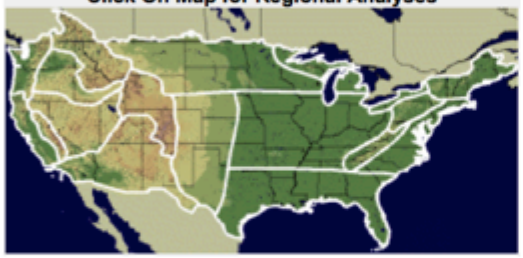
50.4 % of CONUS snow covered on November 17,2014.



National Snow Analyses

Snow Reports | Model Assimilation Schedule | Snow Survey Schedule

Click On Map for Regional Analyses



Automated Model Discussion:
November 12, 2014

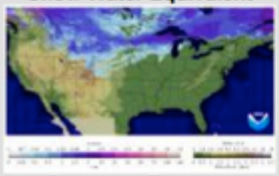
Area Covered By Snow:	18.7%
Area Covered Last Month:	0.3%
Snow Depth	
Average:	0.6 in
Minimum:	0.0 in
Maximum:	1298.8 in
Std. Dev.:	2.2 in
Snow Water Equivalent	
Average:	0.1 in
Minimum:	0.0 in
Maximum:	759.8 in
Std. Dev.:	0.6 in

more... Metric Units...

Select Region and Date

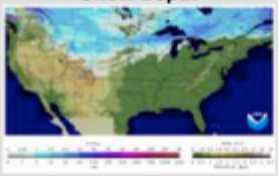
National | 2014 | November | 12 | - | + | Go

Snow Water Equivalent



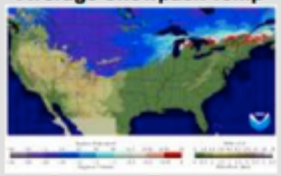
Animate: Season --- Two weeks --- One Day

Snow Depth



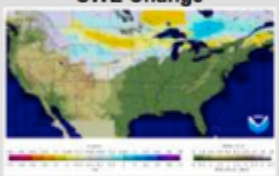
Animate: Season --- Two weeks --- One Day

Average Snowpack Temp



Animate: Season --- Two weeks --- One Day

SWE Change

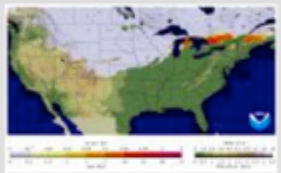


Animate: Season --- Two weeks --- One Day

Snow Precipitation

Animate: Season --- Two weeks --- One Day

Snow Melt

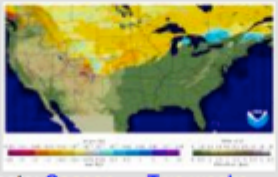


Animate: Season --- Two weeks --- One Day

Blowing Snow Sublimation

Animate: Season --- Two weeks --- One Day

Surface Sublimation



Animate: Season --- Two weeks --- One Day

Non-Snow Precipitation

Animate: Season --- Two weeks --- One Day

move toward the middle Atlantic coast. Four to 8 inches of snow are likely in the southern Great Lakes region, with up to a foot possible in northern Virginia through central Maryland. Light freezing rain is possible on the southern side of this snowband, roughly from western North Carolina through eastern Maryland.

Rapid deepening of the combined low will continue as the low moves offshore by Thursday. A foot of snowfall is likely over a small area of the East Coast, roughly from northern Virginia through eastern Massachusetts. At least 4 inches of snowfall is likely from Lake Erie through southern New Hampshire, south to eastern Virginia and in West Virginia. The system will be far enough to sea that little precipitation is expected on Thursday.

A weak surface low will move into the Southwest from the Pacific today and bring up to a half-foot of snowfall to the southern Sierra Nevada. Widespread light precipitation is expected across the Southwest tomorrow. By Thursday, the low and its associated upper trough will move into the southern Plains, and a surface low is expected to spin up in the northwestern Gulf Coast. Sufficiently-cold air will be in place over the southern Plains to cause up to 1/2 foot of snowfall along the lower Red River on Thursday, with 1/2 to 1 inch of rainfall possible farther south from eastern Texas through Mississippi. This system will move eastward across the northern Gulf during the rest of the week and is expected to hook northeastward to the East Coast by the weekend.

Snow Reports

Top Ten: Metric Units...

Station ID	Name	Elevation (feet)	Snowfall (in)	Duration (hours)	Report Date / Time(UTC)
LCVP1	LAUREL CAVERNS	2717	34.000	48	2010-02-08 12
0620H_MADIS	ANGEL FIRE 0.2 SSE, NM	8530	13.000	24	2010-02-08 14
AGFN5	ANGEL FIRE - INACT	8648	12.000	24	2010-02-08 22
1539C_MADIS	OURAY .23 NNW, CO	7740	10.100	24	2010-02-08 15
URYC2	QURAY SPOTTER	7733	10.100	24	2010-02-08 15
7066A_MADIS	CRIPPLE CREEK 5.1 NW, CO	8533	10.000	24	2010-02-08 15
EADC2	EADS,CO	4226	10.000	24	2010-02-08 14
GARO1	UNKNOWN	1030	10.000	24	2010-02-08 12
WSAC2	SKI AREA	11345	10.000	24	2010-02-08 14
MSCI4	MASON CITY #1	1132	5.000	12	2010-02-09 05

Note: these data are unofficial and provisional.
Zip codes (where available) of observations will be included in text files after October 7, 2006.

Station Snowfall Reports
Station Snow Water Equivalent Reports
Station Snowdepth Reports

Model Assimilation

A data assimilation as done across the upper Rio Grande through the Plains to Tennessee River basin on December 9. Our model over-produced snowfall from the most recent storm in this region, and there was some mis-typing of precipitation. Three-quarters to 1 1/4 inches of water was removed from the modeled snowpack in Kansas through western Missouri. One-half to 3/4 inch of water was also removed from the Llano Estacado and Caprock. Up to an inch of water was removed from Arkansas through western Tennessee.

NOHRSC Airborne Snow Survey Program

The Airborne program has no scheduled flights in this region for the week of February 08, 2010.

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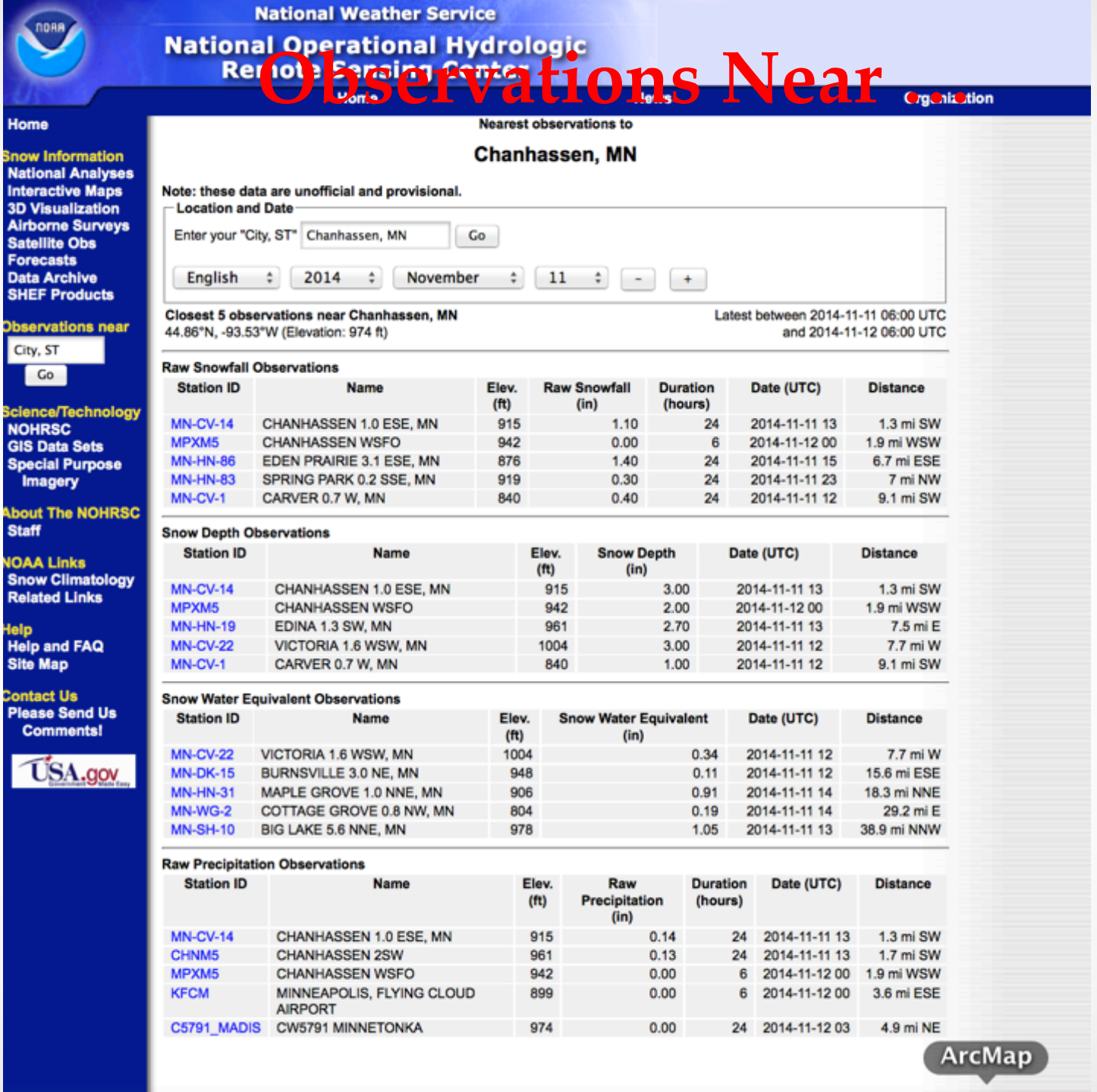
Back to Snow Analyses | Observation Search

National Snow Water Equivalent Observations from 2010-02-08 07:00 Z to 2010-02-09 06:00 Z

Note: these data are unofficial and provisional.
Latitude and longitude of observations will be included in text files after December 1, 2006.

Text file with Metric units | Text file with English units | Table with Metric Units

Station ID	Date (UTC)	Value (in)	Elevation (feet)	Station Description
LLPC1	2010-02-09 06	72.340	8248	LOWER LASSEN PEAK SNOW COURSE
EPSW1	2010-02-09 06	65.500	5249	21A07 - EASY PASS AM
SLTC1	2010-02-08 12	53.900	5712	SLATE CREEK
RRMC1	2010-02-08 12	47.100	6260	RED ROCK MOUNTAIN
SHMC1	2010-02-08 12	46.800	6411	SHIMMY LAKE GOES
HIGC1	2010-02-08 12	45.200	5922	HIGHLANDS LAKES GOES
BKHW1	2010-02-09 06	44.800	4633	BUCKINGHORSE
SDFC1	2010-02-08 12	44.100	6827	SAND FLAT
SWCW1	2010-02-09 06	42.400	4491	SWIFT CREEK
BNKC1	2010-02-08 12	41.000	5848	BONANZA KING
BKLC1	2010-02-09 06	40.800	5771	BUCKS LAKE
HRKC1	2010-02-09 06	40.700	4534	HARKNESS FLAT
STMC1	2010-02-08 12	40.300	5299	STOUTS MEADOW GOES
TAHC2	2010-02-09 06	38.770	5184	TAHTSA LAKE WEST SNOW PILLOW
AFSW1	2010-02-09 06	38.300	5151	PARADISE
MTCQ2	2010-02-09 06	37.800	5180	MOUNT COOK
SZKQ2	2010-02-09 06	37.200	3583	SPUZZUM CREEK SNOW PILLOW
CWRQ2	2010-02-09 06	36.930	5141	CHILLIWACK RIVER SNOW PILLOW
LLSC1	2010-02-09 06	36.820	8274	LAKE LOIS
MRSW1	2010-02-09 06	36.500	5413	MORSE LAKE
TENQ2	2010-02-09 06	36.500	5482	TENQUILLE LAKE
LYLW1	2010-02-09 06	35.800	6516	LYMAN LAKE
AZUQ2	2010-02-09 06	35.750	5331	AZURE RIVER
LELC1	2010-02-09 06	34.600	9606	LEAVITT LAKE
REDQ2	2010-02-09 06	34.200	6818	REDFISH CREEK
HRSC1	2010-02-08 12	34.100	8609	HORSE MEADOWS
MOLQ2	2010-02-09 06	33.620	4941	MOLSON CREEK SNOW PILLOW
TSAQ2	2010-02-09 06	33.460	4482	TSAI CREEK
MDBC1	2010-02-08 12	33.100	6703	MIDDLE BOULDER 1 SNOW COURSE
PCRW1	2010-02-09 06	31.900	4629	PARK CREEK RIDGE
CAYW1	2010-02-09 06	31.800	5364	CAYUSE PASS
MRTW1	2010-02-09 06	31.000	3550	MARTEN RIDGE
VNVC1	2010-02-08 12	31.000	6752	VAN VLECKV_REMARKS=
WHSW1	2010-02-09 06	30.800	5007	WATERHOLE
MELC1	2010-02-08 12	30.300	7513	MEADOW LK SNOW COURSE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Chanhassen, MN
Note: these data are unofficial and provisional.
Location and Date
Enter your "City, ST"
Chanhassen, MN
Go
English
2014
November
11
-
+
Closest 5 observations near Chanhassen, MN
44.86°N, -93.53°W (Elevation: 974 ft)
Latest between 2014-11-11 06:00 UTC
and 2014-11-12 06:00 UTC
Raw Snowfall Observations
Station ID | Name | Elev. (ft) | Raw Snowfall (in) | Duration (hours) | Date (UTC) | Distance
MN-CV-14 | CHANHASSEN 1.0 ESE, MN | 915 | 1.10 | 24 | 2014-11-11 13 | 1.3 mi SW
MPXM5 | CHANHASSEN WSFO | 942 | 0.00 | 6 | 2014-11-12 00 | 1.9 mi WSW
MN-HN-86 | EDEN PRAIRIE 3.1 ESE, MN | 876 | 1.40 | 24 | 2014-11-11 15 | 6.7 mi ESE
MN-HN-83 | SPRING PARK 0.2 SSE, MN | 919 | 0.30 | 24 | 2014-11-11 23 | 7 mi NW
MN-CV-1 | CARVER 0.7 W, MN | 840 | 0.40 | 24 | 2014-11-11 12 | 9.1 mi SW
Snow Depth Observations
Station ID | Name | Elev. (ft) | Snow Depth (in) | Date (UTC) | Distance
MN-CV-14 | CHANHASSEN 1.0 ESE, MN | 915 | 3.00 | 2014-11-11 13 | 1.3 mi SW
MPXM5 | CHANHASSEN WSFO | 942 | 2.00 | 2014-11-12 00 | 1.9 mi WSW
MN-HN-19 | EDINA 1.3 SW, MN | 961 | 2.70 | 2014-11-11 13 | 7.5 mi E
MN-CV-22 | VICTORIA 1.6 WSW, MN | 1004 | 3.00 | 2014-11-11 12 | 7.7 mi W
MN-CV-1 | CARVER 0.7 W, MN | 840 | 1.00 | 2014-11-11 12 | 9.1 mi SW
Snow Water Equivalent Observations
Station ID | Name | Elev. (ft) | Snow Water Equivalent (in) | Date (UTC) | Distance
MN-CV-22 | VICTORIA 1.6 WSW, MN | 1004 | 0.34 | 2014-11-11 12 | 7.7 mi W
MN-DK-15 | BURNSVILLE 3.0 NE, MN | 948 | 0.11 | 2014-11-11 12 | 15.6 mi ESE
MN-HN-31 | MAPLE GROVE 1.0 NNE, MN | 906 | 0.91 | 2014-11-11 14 | 18.3 mi NNE
MN-WG-2 | COTTAGE GROVE 0.8 NW, MN | 804 | 0.19 | 2014-11-11 14 | 29.2 mi E
MN-SH-10 | BIG LAKE 5.6 NNE, MN | 978 | 1.05 | 2014-11-11 13 | 38.9 mi NNW
Raw Precipitation Observations
Station ID | Name | Elev. (ft) | Raw Precipitation (in) | Duration (hours) | Date (UTC) | Distance
MN-CV-14 | CHANHASSEN 1.0 ESE, MN | 915 | 0.14 | 24 | 2014-11-11 13 | 1.3 mi SW
CHNM5 | CHANHASSEN 2SW | 961 | 0.13 | 24 | 2014-11-11 13 | 1.7 mi SW
MPXM5 | CHANHASSEN WSFO | 942 | 0.00 | 6 | 2014-11-12 00 | 1.9 mi WSW
KFCM | MINNEAPOLIS, FLYING CLOUD AIRPORT | 899 | 0.00 | 6 | 2014-11-12 00 | 3.6 mi ESE
C5791_MADIS | CW5791 MINNETONKA | 974 | 0.00 | 24 | 2014-11-12 03 | 4.9 mi NE
ArcMap

National Weather Service

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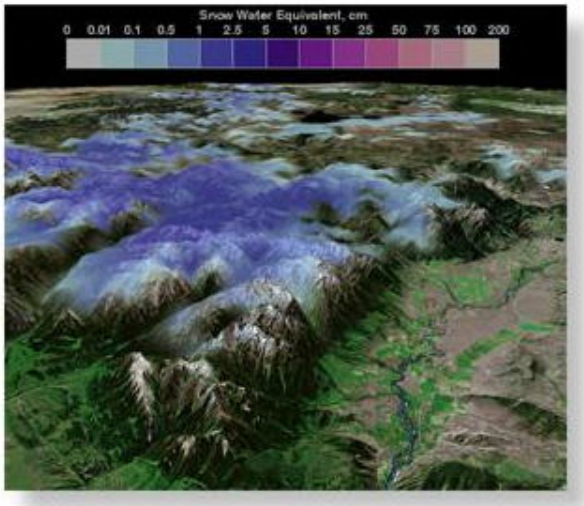
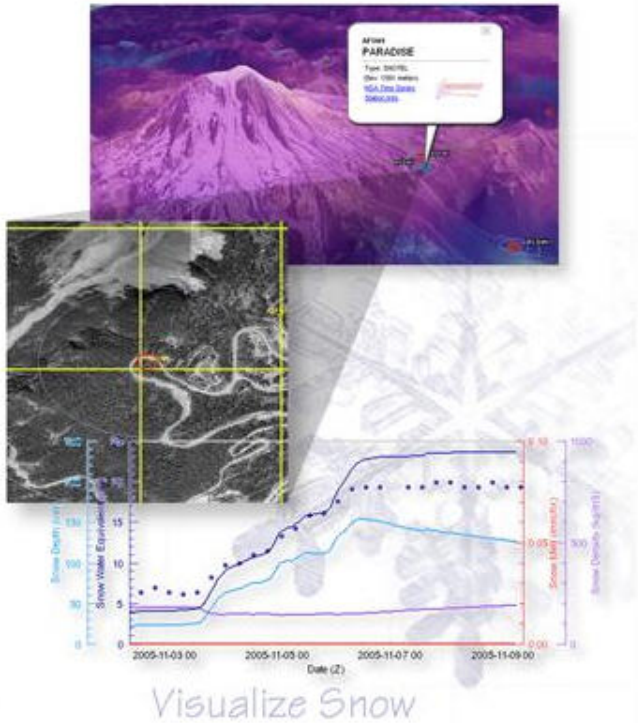
NATIONAL SNOW ANALYSES IN 3D

3D visualization - it's a key to understanding the National Snow Analyses.

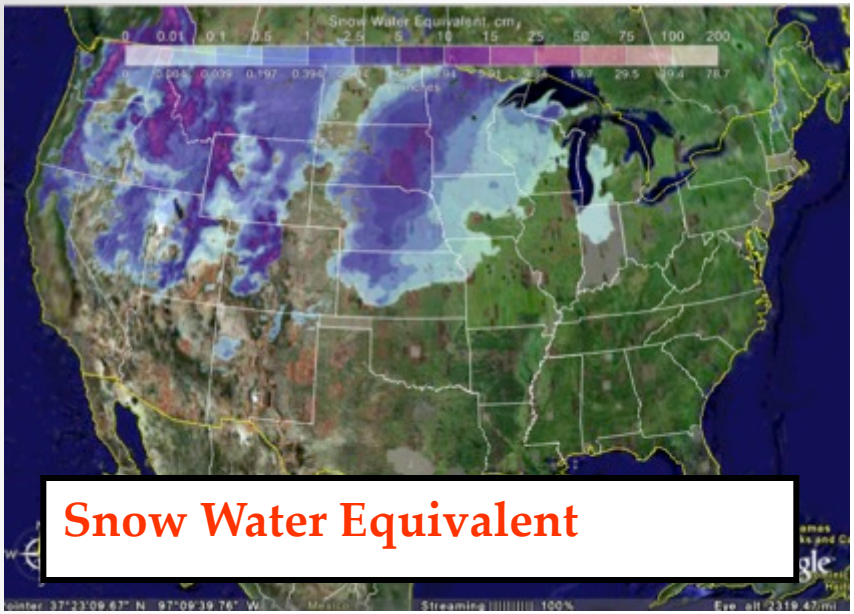
- Fly over terrain
- Explore snow reporting stations
- Get the latest snow observations

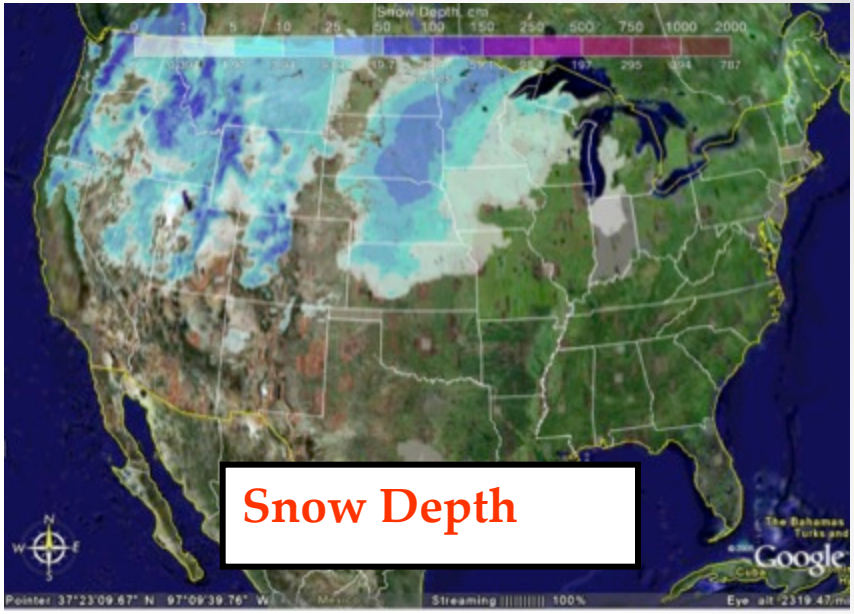


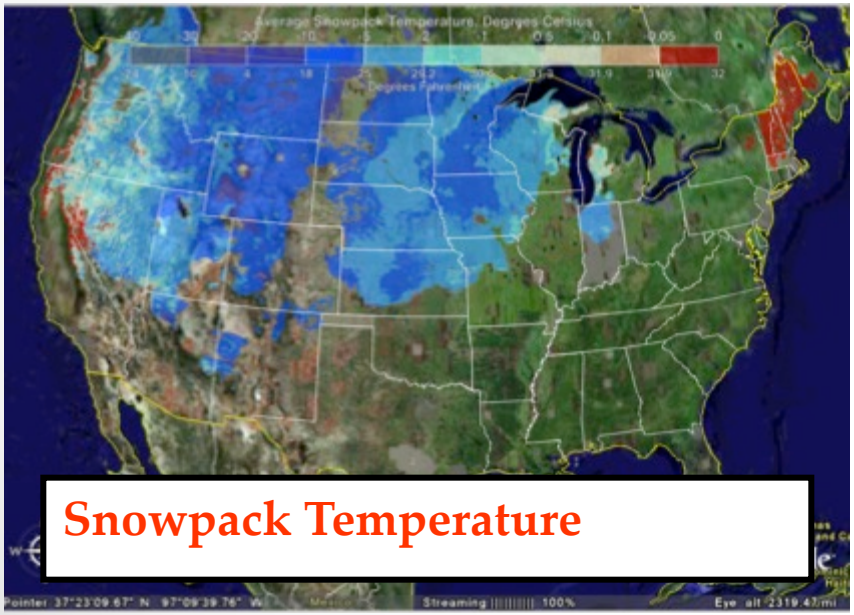


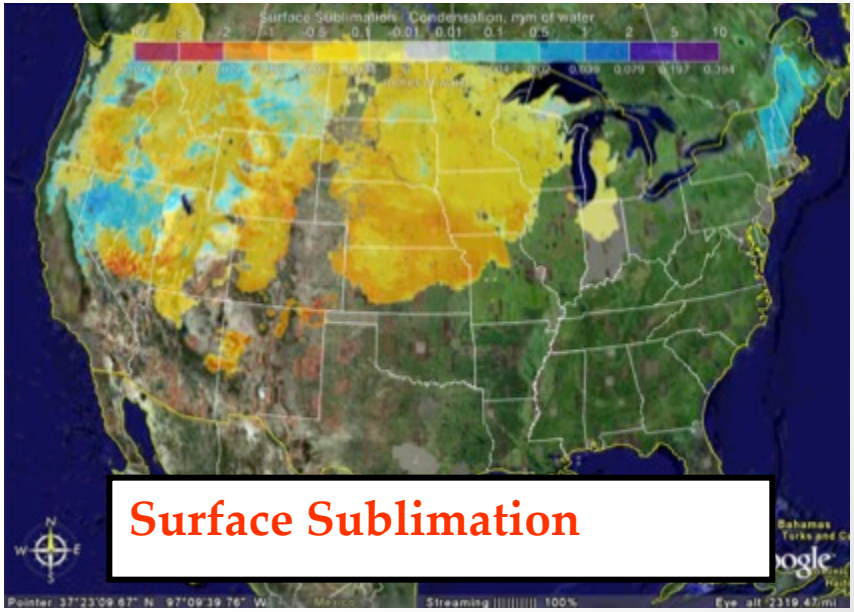
Visualize Snow

National Snow Headlines


Snow Water Equivalent, cm
Snow Water Equivalent


Snow Depth, cm
Snow Depth


Average Snowpack Temperature, Degrees Celsius
Snowpack Temperature


Surface Sublimation / Condensation, mm of water
Surface Sublimation

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NOHRSC Snow Model Snapshot
2011-01-12

- [x] Snow Water Equivalent
- [ ] Scaled Snow Precipitation
- [ ] Scaled Non-Snow Precipitation
- [ ] Average Snowpack Temperature
- [ ] Snow Melt
- [ ] Snow Cover
- [ ] Snow Depth
- [ ] Snow Density
- [ ] Snow Water Equivalent
- [ ] Surface Sublimation / Condensation
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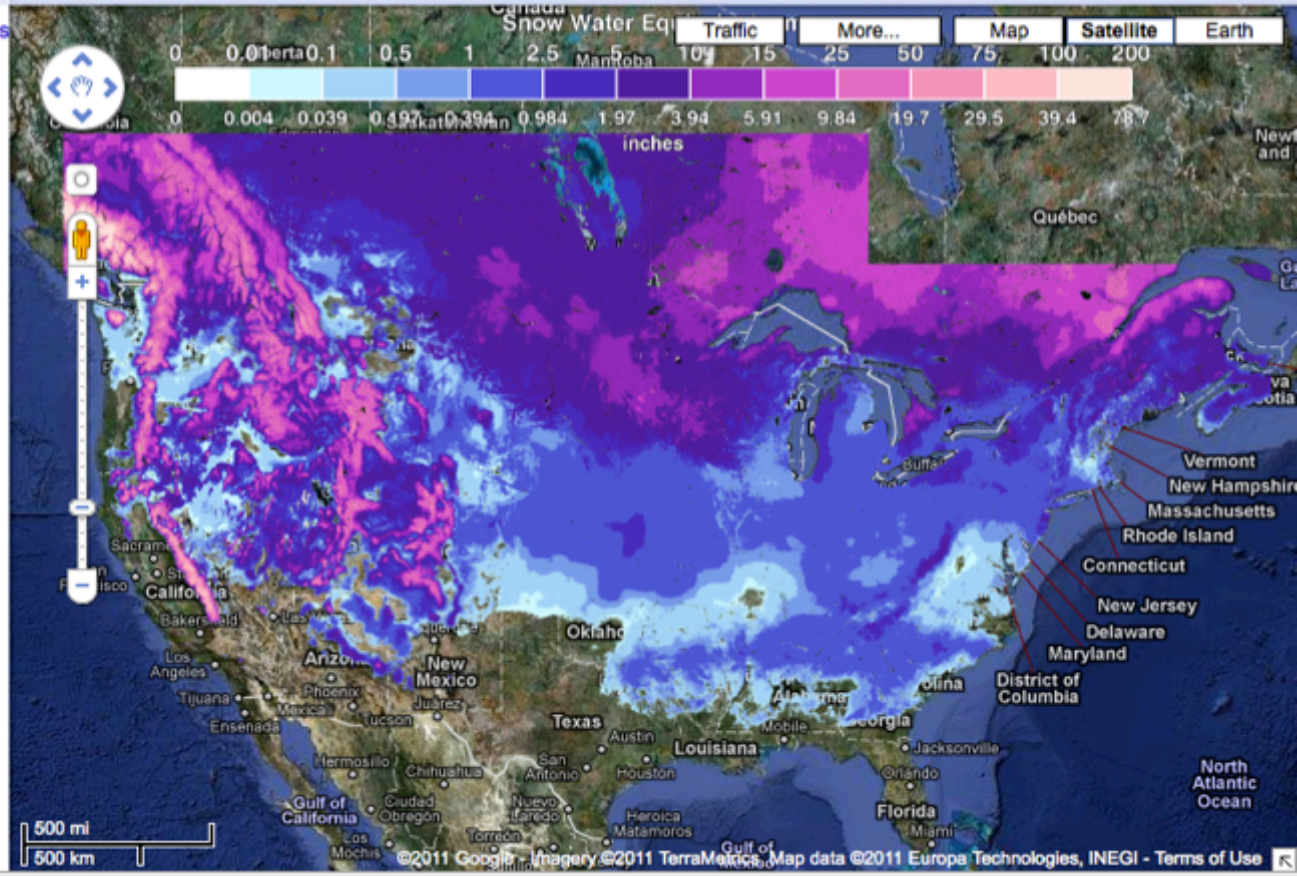

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