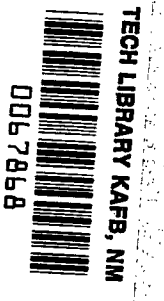


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# Applications Systems Verification and Transfer Project

## Volume VI: Operational Applications of Satellite Snow-Cover Observations - NOAA/NESS Support Study

Stanley R. Schneider



NASA

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# Applications Systems Verification and Transfer Project

## Volume VI: Operational Applications of Satellite Snow-Cover Observations - NOAA/NESS Support Study

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National Aeronautics and Space Administration

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## ABSTRACT

Geostationary and polar orbiting satellite data from the National Oceanic and Atmospheric Administration have been used to operationally provided field hydrologists with basin snowcover percentages for inclusion in runoff models. Data reduction is accomplished thru the use of optical rectification devices and electronic color density slicers. Over two thousand (2000) satellite-derived snow maps covering 30 different basins in the western United States were provided to users during the four-year period of the ASVT project. Plans for improving snowmapping techniques on computer interactive systems and by all-digital analysis are presented. A description of the newest generation of NOAA polar orbiters, TIROS-N, and its potential for snowmapping is reviewed. Snowcover percentages for all basins determined between November 1974 and July 1978 are presented in tabular format.

CONTENTS

## FIGURES



## TABLES

# OPERATIONAL APPLICATIONS OF SATELLITE SNOWCOVER OBSERVATIONS - NOAA/NESS SUPPORT STUDY

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## INTRODUCTION

This is the final report of the work performed by NOAA/NESS personnel under the ASVT program of Operational Applications of Satellite Snowcover Observations. The period covered in the report is January 1, 1975 to December 31, 1978.

## THE SNOW ASVT PROGRAM

According to Rango (1975) positive research results in both snowmapping and runoff correlations led to a decision at NASA in 1975 to operationally test the use of remotely sensed snowcovered area for improving runoff forecasts in a four-year duration Applications System Verification Test (ASVT). A contract was let that same year to NOAA/NESS to promote a study in support of the snow ASVT. Since that time data from NOAA/NESS have been regularly shipped on request to the ASVT test sites in Arizona, California, Colorado and the Pacific Northwest. These data have usually been in the form of satellite imagery, digital tapes and completed snow maps. Daily NOAA snowcover data have been used at the four test sites to fill in the gaps created by the less frequent coverage of Landsat-1 and 2.

As part of the ASVT Program a NESS representative was sent on a two week training mission to all the ASVT test sites in January 1977. Mini-snowmapping workshops were conducted in Portland, Denver and Placerville, California. A snow survey flight in Arizona was arranged by representatives of the U.S. Geological Survey and the Salt River Project to help the NESS analyst gain a "feel" for the appearance of snowcovered terrain in the Salt-Verde watershed.

Some of the NESS ASVT funds have been used to defray the cost of equipment purchased in support of the snowmapping study, i.e., Zoom Transfer Scopes and density slicer vidicons. However, as the ASVT program now comes to an end, it becomes obvious that its major benefit to operational snowmapping at NESS has been to make the user community aware of the availability and usefulness of satellite snowcover data. In fact, several of the basins (Rio Grande, Feather, Sacramento) originally targeted for limited-duration study in support of the ASVT have now been added to the ongoing Operational Snowmapping Program at NESS.

## SATELLITES AND SENSORS

### NOAA/VHRR

From 1973 to 1978, the primary sensor used to obtain data for the NESS Snowmapping Program was the Very High Resolution Radiometer (VHRR) onboard the NOAA series of polar-orbiting satellites. The VHRR is sensitive to two portions of the spectrum, a 0.6 to 0.7 um (visible) and a 10.5 to 12.5 um (thermal infrared) channel. Coverage over most basins is available once daily in the visible and twice each day in the thermal infrared portions of the spectrum. Data from the satellite are received through the High Resolution Picture Transmission (HRPT) system at three NESS receiving facilities; Wallops Island, Virginia, Redwood City, California, and Gilmore Creek, Alaska. The raw, ungridded unmapped image signals are displayed through a film recorder which produces a 25 cm by 25 cm film negative. Each negative covers an area approximately 2100 km square with 3 frames usually available per pass. Prints from the image negatives, at a normal scale of 1:10,000,000 and a resolution of 1 km (at nadir), are used in snowmapping. The VHRR achieves lateral coverage through continuous horizon-to-horizon scanning by a mirror oriented perpendicular to the forward motion of the spacecraft. Since the mirror rotates at a constant angular rate, the geometric resolution on the ground changes as the distance from the satellite subpoint increases. The resulting image produced from these signals will appear foreshortened in the area of the horizons. This foreshortening or distortion in the image can be corrected either through optical rectification or by further computer processing utilizing an algorithm described by R. L. Legeckis and J. Pritchard (1976).

### SMS/GOES

Five satellites in the SMS/GOES series have been launched thus far. The first two Synchronous Meteorological Satellites, SMS-1 and SMS-2, were NASA sponsored prototypes. The most recent three, GOES-1, 2 and 3 were entirely NOAA funded (the acronym stands for Geostationary Operational Environmental Satellite). The satellites are dubbed geostationary because their position relative to the earth's surface remains fixed. The satellite in this series that can currently be used to monitor the east coast is GOES-2; it was launched on June 15, 1977 and is stationed over the equator at 75°W longitude at an altitude of 37,500 $Km^2$. GOES-3, which was launched on June 16, 1978, is stationed at 135°W and is currently the operational west coast satellite. The imaging sensor on board the SMS/GOES is the Visible and Infrared Spin Scan Radiometer (VISSR). The sensor can provide imagery in both the visible and the infrared portions of the spectrum (as its name implies) as often as every half-hour. Imagery from the VISSR can be obtained in a variety of resolutions. Raw data is received from the satellite at a resolution of 1 Km but can be averaged to produce images of larger spatial coverage at 2-, 4- or 8 Km resolution (thermal infrared VISSR data is available only at a resolution of 8 Km).

The 1 Km VISSR images have been the data source for many of the operational snow maps produced since 1975. No computer programs presently exist to geometrically correct the distortion inherant to this type of imagery. However, small areas on the image may be rectified on optical devices by stretching along the axis defined by the study area and the satellite subpoint.

## CURRENT METHODOLOGY

Snow maps are produced at NESS by first enlarging and rectifying a visible VHRR or VISSR image to overlay a hydrologic basin map. A Bausch and Lomb Zoom Transfer Scope (ZTS) is utilized for this purpose.

Registration of image to map on the ZTS involves aligning physiographic landmarks such as lakes, rivers and shorelines. After registration has been achieved the snow line on the image is traced onto the basin map and snow-covered areas are colored in. Percentage snowcover for the basin is then determined by using an electronic density slicer. The snow map is placed on the density slicer with a previously prepared opaque mask outlining the basin. The density slicer selectively color illuminates gray shades on the map. The colors are projected onto a display screen and percentage values for each color are read from a digital meter.

## THE NESS SNOWMAPPING PROGRAM

In late 1972, hydrologists at NESS determined that NOAA-2 satellite imagery could be used to create timely maps depicting snowcover over river basins of varying size, location and topography (Wiesnet and McGinnis, 1973). Snowmapping was upgraded to the status of an operational program at NESS during 1974 (Schneider et. al., 1976) and has continued to expand in scope ever since. Indeed, areal snowcover measurements are now being routinely made at NESS for thirty critical basins in the United States and Canada. The data are disseminated to the user community by mail, teletype and telecopier.

The areal snowcover data and/or snow maps are provided to water resource managers in numerous federal, state and local agencies. A map of the western United States showing many of the operational basins is presented in figure 1. A list of primary users and information on the precise location and size of each basin is given in the accompanying Table 1. The basins are similarly numbered on table and map.

The areal snowcover percentages are dispatched over the RAWARC teletype circuit to National Weather Service River Forecast Centers (RFC) in Sacramento, Fort Worth, Salt Lake City, Kansas City and Portland and River District Offices in Great Falls, Phoenix and Albuquerque. Snowmaps are sent over telecopier or through the mail to other agencies including the U.S. Geological Survey, Bureau of Reclamation, Corps of Engineers, Soil Conservation Service and U.S. Forest Service.


Figure 1. Map showing location of operational basins

# Table 1

BASINS BEING MAPPED AS OF 1978

| River Basin | Drainage Area in $Km^2$ | Primary Users |
|---|---|---|
| American above Fair Oaks (15) | 5,601 | Sacramento RFC |
| Boise above Lucky Peak (11) | 6,941 | Portland RFC, Columbia Basin Network |
| Carson (18) | 8,864 | Soil Conservation Service, Sacramento RFC |
| Clearwater above Peck (7) | 20,824 | Portland RFC, Columbia Basin Network |
| Columbia River above Mica Dam (1) | 21,290 | Portland RFC, Columbia Basin Network, B.C. Hydro & Power Authority, Environment Canada |
| Deschutes (4) | 27,195 | Portland RFC, Columbia Basin Network |
| Feather above Oroville (14) | 9,386 | California State Dept. of Water Resources |
| Humboldt above Comus (20) | 31,339 | Salt Lake City RFC, Soil Conservation Service |
| John Day (5) | 19,632 | Portland RFC, Columbia Basin Network |
| Kootenay above Libby (2) | 23,277 | Portland RFC, Columbia Basin Network |
| Missouri River above Canyon Ferry Dam | 40,714 | Soil Conservation Service, Great Falls RDO |
| North Platte between Alcova and Guernsey (22) | 12,198 | Bureau of Reclamation, Kansas City RFC, Soil Conservation Service |
| North Platte above Seminoe (23) | 15,274 | Bureau of Reclamation, Kansas City RFC, Soil Conservation Service |
| Northeast U.S. Snow Map | | NE Regional Hydrologist NWS |
| Payette above Emmett (10) | 6,941 | Portland RFC, Columbia Basin Network |
| Rio Grande above Colo.-New Mexico State Line (26) | 19,900 | Soil Conservation Service, Fort Worth RFC |
| Rio Grande above Del Norte (25) | 3,419 | Soil Conservation Service, Fort Worth RFC |
| Sacramento above Shasta (13) | 16,630 | California State Dept. of Water Resources |
| Salmon above Whitebird (8) | 35,095 | Portland RFC, Columbia Basin Network |
| Salt (28) | 16,141 | Salt Lake City RFC, Phoenix RDO, Salt River Project, U.S. Geological Survey |

## Table 1 Continued

BASINS BEING MAPPED AS OF 1978

| River Basin | Drainage Area in $Km^2$ | Primary Users |
|---|---|---|
| San Juan (24) | 65,273 | Salt Lake City RFC |
| Snake above Palisades (12) | 13,340 | Portland RFC, Columbia Basin Network |
| St. John | 55,167 | Marine Bureau of Civil Emergency Preparedness, New Brunswick Dept. of Environment, Environment Canada, St. John Basin Task Force |
| Sweetwater above Pathfinder (21) | 6,027 | Bureau of Reclamation, Kansas City RFC, Soil Conservation Service |
| Tahoe-Truckee (16, 17) | 7,665 | Soil Conservation Service, Sacramento RFC |
| Umatilla (6) | 5,931 | Portland RFC, Columbia Basin Network |
| Verde (27) | 17,094 | Salt Lake City RFC, Phoenix RDO, Salt River Project, U.S. Geological Survey |
| Walker (19) | 9,241 | Soil Conservation Service, Sacramento RFC |
| Weiser (9) | 3,781 | Portland RFC, Columbia Basin Network |
| Willamette (3) | 26,159 | Portland RFC, Columbia Basin Network |

**********

Notes on Users:

1. The Columbia Basin Network includes the Soil Conservation Service, Bureau of Reclamation, U.S. Geological Survey, U.S. Army Corps of Engineers, National Weather Service, Bonneville Power Administration, B.C. Hydro and Power Authority, as weel as other state and local agencies.

2. Basins being done for the Bureau of Reclamation in Denver, Colorado, are retransmitted from the site to field offices in Caspar, Laramie, and Cheyenne, Wyoming.

3. The St. John Basin Task Force includes the National Weather Service, U.S. Army Corps of Engineers, U.S. Geological Survey, Environment Canada, and other state, provincial agencies.

4. Most basins are mapped twice weekly cloud cover permitting. The Salt, Verde and St. John basins are mapped daily cloud cover permitting. The Tahoe-Truckee, Carson and Walker basins are mapped only at the end of each month.

Not depicted in figure 1 but listed on the table are the St. John basin in Maine and New Brunswick, the Missouri River above Canyon Ferry Dam and the Northeast U.S. snow map. The Northeast analysis is first transmitted over telecopier to the Weather Service Eastern Regional Hydrologist in New York and is then rerouted to RFC's in Hartford, Harrisburg and Cincinnati. Snowmaps for the Missouri River above Canyon Ferry Dam were begun in November 1978, at the request of the Soil Conservation Service office in Bozeman, Montana.

Basin snow maps are made on an average of once a week beginning November 1st and terminating when the snowpack appears almost totally depleted on the imagery. The analyses can only be made when the basin is free of obscuring clouds. Accordingly, basins in the southwestern United States and California's Sierra Nevada are mapped more often than those in the less cloudfree Pacific Northwest.

Over six hundred snowcover measurements were made at NESS during the 1977-1978 snow season; a monthly breakdown is given in Table 2. Complete snowmapping data for each basin are provided in tabular form in Appendix B. Totals for the past four years are as follows:

| Snow Year | Number of Snow Maps |
|---|---|
| 1974-1975 | 441 |
| 1975-1976 | 520 |
| 1976-1977 | 494 |
| 1977-1978 | 606 |
| TOTAL | 2061 |

The snowcover data are generally provided to users within 30 hours of a satellite overpass so they can be incorporated into watershed runoff forecast models. Quality control techniques used are described in Schneider et al. (1976). They include checks of the operational snow maps with higher resolution Landsat satellite data, computer-enhanced imagery, ground-based snowpack measurements and aerial-survey maps. The data from aerial surveys are particularly useful for quality control purposes and are provided for basins in Arizona, Idaho, and British Columbia, respectively by the Salt River Project, Walla Walla District Corps of Engineers, and the British Columbia Hydro and Power Authority.

## USER EVALUATIONS

In an effort to streamline and improve snowmapping at NESS a detailed questionnaire was sent out to primary users of the snowcover data on October 24, 1978. The questions were directed towards user needs in terms of timeliness, frequency, accuracy and quality control. Of seventeen responses, three rated the snow maps as "excellent", fourteen rated them as "good: and two rated the maps as "fair" (in some cases more than one box was checked).

The following applications of the snowcover data were mentioned: runoff forecasting, flood prevention, water resource planning, research and development, reservoir/dam regulation, irrigation planning and inclusion in state bulletins.

# Table 2

NUMBER OF SNOWCOVER MEASUREMENTS

November 1, 1977 - July 31, 1978

| BASIN | NOVEMBER | DECEMBER | JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE | JULY | TOTALS |
|---|---|---|---|---|---|---|---|---|---|---|
| American | 2 | 4 | 4 | 3 | 2 | 4 | 7 | 3 | | 29 |
| Boise | 2 | 2 | 3 | 3 | 6 | 3 | 3 | 4 | 1 | 27 |
| Carson | | | 2 | 1 | 1 | 1 | 1 | 1 | | 7 |
| Clearwater | 1 | 1 | 1 | 2 | 6 | 1 | | 5 | 2 | 19 |
| Columbia | | | | | | | 3 | 4 | 3 | 10 |
| Deschutes | 2 | 1 | 1 | | 4 | 2 | 1 | | | 11 |
| Feather | 3 | 3 | 4 | 5 | 4 | 3 | 4 | 1 | | 27 |
| Great Lakes | | | | | 4 | 8 | | | | 12 |
| Humboldt | 4 | 2 | 6 | 7 | 4 | 3 | 2 | | | 30 |
| John Day | 2 | 3 | 2 | 2 | 4 | 2 | 1 | | | 16 |
| Kootenay above Libby | | | | | | | 2 | 5 | 3 | 10 |
| North Platte between Alocva & Guernsey | 3 | 2 | 3 | 5 | 6 | 2 | 4 | | | 25 |
| North Platte above Seminoe | 5 | 1 | 2 | 5 | 8 | 2 | 4 | 2 | | 29 |
| Northeast U.S. | 6 | 8 | 8 | 6 | 8 | 6 | | | | 42 |
| Payette | 2 | 2 | 3 | 3 | 5 | 3 | 4 | 3 | | 25 |
| Rio Grande above Colo.-N. Mexico State Line | 4 | 5 | 5 | 5 | 7 | 5 | 5 | 1 | | 37 |
| Rio Grande above Del Norte | 2 | 4 | 1 | 1 | 2 | 5 | 5 | 3 | | 23 |
| Sacramento | 1 | 3 | 2 | 4 | 4 | 2 | 4 | 1 | | 21 |
| Salmon | 3 | 1 | | | 6 | 2 | | 5 | 1 | 18 |
| Salt | 1 | | 7 | 9 | 8 | 4 | 1 | | | 30 |
| San Juan | | | | 3 | 2 | 3 | 3 | | | 11 |
| Snake above Palisades | 1 | | | | 1 | 2 | 5 | 7 | 4 | 20 |
| St. John | | | | | 1 | 4 | 4 | | | 9 |
| Sweetwater | 4 | 2 | 3 | 5 | 6 | 2 | 4 | | | 26 |
| Tahoe-Truckee | | | 2 | 1 | 1 | 1 | 1 | 1 | | 7 |
| Umatilla | 1 | 2 | 1 | | 2 | 2 | | | | 8 |
| Verde | 2 | | 6 | 9 | 8 | 4 | 2 | | | 31 |
| Walker | | | 2 | 1 | 1 | 1 | 1 | 1 | | 7 |
| Weiser | 2 | 2 | 3 | 3 | 5 | 3 | 4 | 3 | | 25 |
| Willamette | 2 | 2 | 2 | 1 | 3 | 2 | 2 | | | 14 |
| TOTALS | 55 | 50 | 73 | 84 | 121 | 82 | 77 | 45 | 13 | 600 |

Users reported that they were checking the satellite snowcover accuracy by using runoff data, snow course data, hydromet networks, aerial surveys (both fixed and rotary wing) and mathematical models (SSAR and FLOCAST were mentioned).

Users requested coverage for over 30 additional basins. Several of the users requested that the data be transmitted to them in a more timely fashion, i.e., over telecopier rather than through the mail. A sample of the questionnaire is in Appendix A.

## DEVELOPMENT

### TIROS-N

The first of a new generation of polar orbiting satellite, TIROS-N was launched on October 13, 1978. A second satellite in this series, NOAA-A will be launched in early 1979. Together, the satellites will be able to provide coverage four times daily (0300, 0730, 1500, 1930 Local Standard Time) over most areas in the United States and Canada. Each satellite will have an Advanced Very High Resolution Radiometer (AVHRR) onboard which will be able to provide coverage in the following five channels:

| | |
|---|---|
| Channel 1 | .58-.68 um |
| Channel 2 | .725-1.0 um |
| Channel 3 | 3.55-3.93 um |
| Channel 4 | 10.5-11.5 um |
| Channel 5 | 11.5-12.5 um |

Several studies (Strong, et al., 1971; Wiesnet et al., 1975; and O'Brien and Munis, 1975) have shown that it is often possible to detect metamorphosed (or melting) snow and ice by comparisons of simultaneous Landsat visible (MSS-5) and near infrared (MSS-7) imagery. These studies indicate that the reflectance of metamorphosed snow and ice is less in the near infrared than that of fresh nonmelting snow. The availability of simultaneous AVHRR visible (Channel 1) and near infrared (Channel 2) imagery may thus allow NESS investigators to give operational reports on the age and condition of river basin snowcover as well as its areal extent.

### High Resolution Film Loops

One-kilometer-resolution GOES images can be generated every half-hour and strung together to make a film loop. The loop can then be run continuously through a projector, displaying the same sequence of images over and over. These loops have been found helpful in discriminating between cloud and snow, and in monitoring shadow effects on snow fields, fog dissipation, cumulus buildups and snow melt.

### Interactive Snowmapping

Two new interactive computer systems named VIRGS (VISSR Interactive Registration and Gridding System) were delivered to NESS in June 1978. A feasibility study concerning use of the VIRGS for operational snowmapping has already been carried out at the Madison campus of the University of Wisconsin (Gird, 1979). To use the system for snowmapping, basin perimeters drawn on standard aeronautical charts are first converted into grid points through the use of an electronic digitizing board, and are then read into the VIRGS. The basin outlines can then be displayed on the system video screen at any time by typing a single command on the keyboard. A joy-stick cursor is used to outline snowcover on the video screen; area statistics software on the VIRGS are invoked to calculate and print out the basin snowcover percentages. Advantages of this system overpure photointerpretation include ease of basin registration and measurement of areal snowcover as well as the ability to display time-sequenced sets of images. Present disadvantages include lengthly set-up time, lack of hard-copy output and "jumpiness" of the joy-stick cursor.

### All Digital Snowmapping

A project is underway at NESS to check the feasibility of doing all digital snowmapping using 4 km visible GOES data. The test area includes nine contiguous basins in the Sierra Nevada. These basins offer a wide variety of terrain characteristics and ground cover for control purposes; they are also of ideal size and location as viewed from the westcoast geostationary satellite. Data used in this experiment are stored on computer disk packs for 24 hours. Snow maps for all nine basins can be done as often as five times daily: 1645Z, 1745Z, 2045Z, 2145Z and 0045Z. The model involves the thresholding of each individual basin pixel for snowcover and takes into account solar illumination angles as well as the nature of ground cover. Detailed descriptions of this snowmapping model as well as preliminary results for the 1978-1979 snow season are presented in Tarpley, et. al. (1979).

## FINAL COMMENTS

An operational satellite snowmapping program for selected river basins is now in place at the National Environmental Satellite Service. Owing to the combined success of this program and the NASA Snow ASVT, a larger number of requests for support have been received than can be handled given present manpower and fiscal restraints. Expansion of the program can therefore only come about through the development of more efficient (i.e., automated) techniques for snowmapping. This is the goal towards which satellite snow specialists must now direct their efforts.

## ACKNOWLEDGEMENTS

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Appendix A

Satellite Snowmapping Questionnaire

1. General Information

Respondent
Name_____
Affiliation_____
_____
Address_____
_____
_____
_____
Phone (commercial)_____FTS (if available_____

2. How are NESS satellite snow maps transmitted to you?

Teletype_____

Telecopier_____

Mail_____

3. For what purposes are the snowcover data used now?_____

runoff forecasting____ reservoir/dam regulation____
flood prevention____ snow survey cross check_____
water resource planning____ hydroelectric power generation____
Research & Development ____ irrigation planning____
inclusion in state/regional bulletins ____

other_____
_____
_____
_____

4. How do you plan to use the snowcover data in the future?_____
_____
_____
_____
_____

5. Are you satisfied with the timeliness with which you receive the snowcover data?_____
_____
_____
_____

6. Are you satisfied with the frequency with which you are receiving snowcover data? (check one)

Frequency about right_____ How often do you receive snowmaps now in an average week?_____

Need more frequently (if so, how frequent)_____

Need less frequently (if so, how frequent)_____

7. Are there additional river basins in your geographic area of responsibility you wish to have covered? Please identify._____

8. Are there additional institutions/agencies in your area that might wish to receive satellite snow maps? Please identify.___

9. How would you rate the accuracy of the satellite snow maps?

Poor_____ Fair_____ Good_____ Excellent_____

10. How do you check the accuracy of the snow cover data?

runoff data_____
snow course data_____
hydromet network_____
aerial surveys_____
mathematical model (i.e., SSARR)_____

other_____

11. General Recommendations_____

Appendix B

AMERICAN

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 23 | 44 | April 2 | 39 |
| November 30 | 33 | April 9 | 38 |
| December 5 | 16 | April 12 | 28 |
| December 12 | 21 | April 21 | 49 |
| December 18 | 44 | May 3 | 28 |
| December 24 | 33 | May 7 | 29 |
| January 7 | 48 | May 11 | 27 |
| January 20 | 44 | May 17 | 24 |
| January 23 | 62 | May 22 | 22 |
| January 26 | 45 | May 25 | 19 |
| February 1 | 42 | May 30 | 16 |
| February 14 | 47 | June 4 | 14 |
| February 22 | 46 | June 11 | 9 |
| March 24 | 40 | June 21 | 7 |
| March 27 | 35 | | |

AMERICAN

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 17 | 13 | February 25 | 50 |
| November 23 | 9 | March 5 | 42 |
| December 31 | 10 | March 10 | 40 |
| January 4 | 64 | March 19 | 38 |
| January 8 | 53 | March 28 | 33 |
| January 17 | 42 | April 4 | 25 |
| January 27 | 29 | April 14 | 18 |
| February 1 | 23 | April 20 | 13 |
| February 9 | 41 | May 19 | 22 |
| February 15 | 29 | | |

AMERICAN

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 3 | 19 | March 9 | 46 |
| December 7 | 19 | March 10 | 45 |
| December 28 | 14 | March 17 | 36 |
| January 2 | 10 | March 20 | 45 |
| January 15 | 9 | March 25 | 41 |
| January 19 | 15 | March 29 | 35 |
| January 20 | 14 | April 19 | 27 |
| January 26 | 26 | April 23 | 23 |
| February 2 | 17 | April 30 | 15 |
| February 10 | 31 | May 3 | 16 |
| February 20 | 55 | May 11 | 12 |
| February 24 | 49 | May 13 | 12 |
| March 4 | 63 | May 16 | 12 |
| March 6 | 48 | May 18 | 10 |

AMERCIAN

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 4 | March 26 | 56 |
| November 17 | 5 | March 28 | 56 |
| November 19 | 13 | March 30 | 50 |
| November 23 | 20 | March 31 | 50 |
| November 26 | 23 | April 1 | 48 |
| December 1 | 21 | April 12 | 51 |
| December 7 | 22 | April 13 | 55 |
| December 15 | 13 | April 16 | 54 |
| December 17 | 18 | April 17 | 54 |
| December 23 | 24 | April 18 | 52 |
| January 11 | 30 | April 27 | 46 |
| January 13 | 28 | April 28 | 48 |
| January 17 | 32 | May 1 | 48 |
| January 19 | 25 | May 6 | 43 |
| January 21 | 20 | May 8 | 48 |
| January 22 | 24 | May 12 | 43 |
| January 24 | 23 | May 16 | 37 |
| January 25 | 23 | May 18 | 37 |
| January 28 | 22 | May 23 | 42 |
| January 30 | 22 | May 25 | 37 |
| February 11 | 62 | May 27 | 35 |
| February 16 | 52 | May 29 | 26 |
| February 21 | 46 | May 30 | 31 |
| February 23 | 46 | May 31 | 30 |
| February 24 | 43 | June 4 | 29 |
| February 25 | 40 | June 8 | 20 |
| February 26 | 42 | June 10 | 19 |
| February 28 | 38 | June 14 | 17 |
| March 1 | 38 | June 16 | 13 |
| March 3 | 44 | July 1 | 14 |

AMERICAN

1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 21 | 40 | May 10 | 32 |
| January 30 | 42 | May 13 | 31 |
| February 4 | 39 | May 20 | 21 |
| February 6 | 38 | May 21 | 19 |
| February 12 | 22 | May 23 | 25 |
| March 13 | 29 | May 26 | 17 |
| April 4 | 31 | May 31 | 16 |
| April 15 | 39 | June 5 | 11 |
| April 17 | 38 | June 10 | 11 |
| April 30 | 34 | June 13 | 8 |
| May 3 | 30 | June 18 | 4 |
| May 6 | 32 | | |

AMERICAN

1973

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| Febryary 23 | 36 | May 8 | 17 |
| February 28 | 67 | May 10 | 24 |
| March 2 | 40 | May 14 | 22 |
| March 12 | 44 | May 18 | 19 |
| March 15 | 46 | May 23 | 12 |
| April 2 | 41 | May 29 | 7 |
| April 8 | 33 | June 2 | 6 |
| April 11 | 36 | July 2 | 1 |
| May 2 | 25 | July 4 | T |

## BOISE

### 1977-1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 28 | March 18 | 78 |
| November 30 | 82 | March 26 | 75 |
| December 5 | 64 | March 29 | 68 |
| December 20 | 98 | April 9 | 57 |
| January 1 | 100 | April 12 | 53 |
| January 7 | 86 | April 23 | 39 |
| January 23 | 89 | May 3 | 31 |
| February 19 | 94 | May 8 | 33 |
| February 20 | 94 | May 31 | 23 |
| February 28 | 88 | June 4 | 22 |
| March 6 | 82 | June 7 | 21 |
| March 10 | 89 | June 17 | 19 |
| March 15 | 78 | June 27 | 13 |
| | | July 9 | 11 |

## BOISE

### 1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 30 | 7 | March 25 | 40 |
| December 15 | 11 | April 4 | 43 |
| December 19 | 11 | April 7 | 39 |
| December 28 | 12 | April 12 | 24 |
| February 17 | 20 | April 15 | 21 |
| February 20 | 13 | April 20 | 15 |
| March 5 | 88 | April 27 | 13 |
| March 11 | 70 | May 13 | 16 |
| March 16 | 82 | May 31 | 10 |
| March 22 | 59 | June 5 | 8 |

BOISE

1975-1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 70 | April 16 | 70 |
| November 18 | 38 | April 17 | 58 |
| December 3 | 96 | April 21 | 55 |
| December 9 | 81 | April 23 | 66 |
| January 16 | 96 | April 29 | 40 |
| January 20 | 94 | May 1 | 33 |
| January 25 | 96 | May 9 | 32 |
| January 28 | 93 | May 12 | 29 |
| February 1 | 94 | May 13 | 29 |
| February 7 | 97 | May 15 | 29 |
| March 10 | 93 | May 17 | 28 |
| March 12 | 88 | May 21 | 20 |
| March 21 | 89 | May 26 | 19 |
| March 29 | 93 | June 5 | 16 |
| April 4 | 85 | June 18 | 14 |
| April 8 | 80 | June 26 | 14 |
| April 10 | 65 | July 3 | 9 |
| April 14 | 63 | | |

BOISE

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 26 | 87 | May 12 | 68 |
| December 1 | 93 | May 13 | 57 |
| December 5 | 70 | May 14 | 60 |
| December 29 | 100 | May 25 | 42 |
| January 21 | 98 | May 29 | 34 |
| February 25 | 88 | June 1 | 32 |
| March 5 | 88 | June 5 | 27 |
| March 6 | 90 | June 6 | 26 |
| March 28 | 88 | June 10 | 21 |
| March 29 | 88 | June 14 | 18 |
| April 1 | 90 | June 16 | 16 |
| April 12 | 88 | June 22 | 15 |
| April 20 | 86 | June 29 | 12 |
| May 10 | 68 | July 5 | 10 |

BOISE

1974

| Date | Percent Snowcover |
|---|---|
| May 16 | 38 |
| May 31 | 15 |
| June 8 | 30 |
| June 10 | 21 |

CARSON

1977 - 1978

| Date | Percent Snowcover |
|---|---|
| January 21 | - |
| January 24 | - |
| February 23 | - |
| March 25 | - |
| April 22 | 8 |
| May 25 | 7 |
| June 25 | 3 |

CHEMUNG

1974 - 1975

| Date | Percent Snowcover |
|---|---|
| November 23 | 68 |
| November 27 | 80 |
| February 2 | 30 |
| February 21 | 83 |
| March 9 | 43 |
| March 18 | 59 |
| April 9 | 44 |
| April 11 | 11 |
| April 14 | 8 |
| April 16 | 8 |

CLEARWATER

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 20 | 92 | March 29 | 63 |
| December 20 | 99 | April 9 | 59 |
| January 30 | 98 | June 1 | 32 |
| February 12 | 100 | June 4 | 25 |
| February 22 | 82 | June 7 | 21 |
| March 10 | 76 | June 20 | 14 |
| March 15 | 87 | June 27 | 12 |
| March 18 | 76 | July 1 | 11 |
| March 21 | 72 | July 9 | 9 |
| March 27 | 63 | | |

CLEARWATER

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 20 | 2 | March 11 | 72 |
| November 30 | 26 | March 22 | 79 |
| December 1 | 27 | April 4 | 73 |
| December 3 | 25 | April 7 | 67 |
| December 16 | 42 | April 12 | 56 |
| December 19 | 35 | April 23 | 34 |
| December 28 | 55 | April 27 | 37 |
| February 7 | 77 | June 5 | 10 |
| February 20 | 49 | | |

CLEARWATER

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 13 | 44 | April 29 | 70 |
| November 18 | 80 | May 1 | 66 |
| December 21 | 77 | May 9 | 54 |
| January 20 | 87 | May 12 | 52 |
| January 31 | 88 | May 13 | 49 |
| March 4 | 92 | May 15 | 48 |
| March 6 | 90 | May 19 | 41 |
| March 8 | 89 | May 21 | 37 |
| March 12 | 88 | June 5 | 27 |
| April 4 | 75 | June 18 | 21 |
| April 5 | 73 | June 26 | 19 |
| April 8 | 71 | July 2 | 15 |

CLEARWATER

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 1 | 41 | May 14 | 67 |
| December 29 | 95 | June 1 | 49 |
| December 31 | 97 | June 10 | 42 |
| March 6 | 88 | June 29 | 26 |
| April 10 | 87 | July 2 | 13 |
| April 12 | 76 | July 5 | 14 |
| May 10 | 70 | July 8 | 10 |
| May 13 | 62 | July 11 | 6 |

CLEARWATER

1974

| Date | Percent Snowcover |
|---|---|
| April 13 | 91 |
| May 3 | 78 |
| June 10 | 31 |

COLUMBIA ABOVE MICA

1978

| Date | Percent Snowcover |
|---|---|
| May 6 | 74 |
| May 17 | 59 |
| May 18 | 61 |
| June 1 | 59 |
| June 4 | 55 |
| June 28 | 50 |
| July 19 | 33 |
| July 23 | 24 |
| July 25 | 18 |

COLUMBIA ABOVE MICA

1977

| Date | Percent Snowcover |
|---|---|
| May 23 | 63 |
| June 5 | 62 |
| June 6 | 50 |
| June 17 | 31 |
| July 23 | 17 |

COLUMBIA ABOVE MICA

1976

| Date | Percent Snowcover |
|---|---|
| June 18 | 54 |
| July 3 | 52 |
| July 15 | 44 |
| July 18 | 44 |
| July 25 | 39 |
| August 30 | 16 |

COLUMBIA ABOVE MICA

1975

| Date | Percent Snowcover |
|---|---|
| May 21 | 57 |
| July 1 | 40 |
| July 4 | 37 |
| July 5 | 32 |
| July 9 | 27 |
| August 12 | 17 |
| September 13 | 15 |

COLUMBIA ABOVE REVELSTOKE

1974

| Date | Percent Snowcover |
|---|---|
| March 7 | 69 |
| March 25 | 87 |
| April 13 | 74 |
| May 20 | 54 |
| June 12 | 58 |
| June 19 | 48 |

COLUMBIA ABOVE REVELSTOKE

1973

| Date | Percent Snowcover |
|---|---|
| May 18 | 65 |
| June 22 | 36 |

DESCHUTES

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 8 | 2 | March 18 | 24 |
| November 20 | 93 | March 26 | 17 |
| December 31 | 100 | April 9 | 10 |
| January 23 | 51 | April 12 | 9 |
| February 28 | 29 | May 8 | 5 |
| March 14 | 24 | | |

DESCHUTES

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 27 | 2 | February 14 | 2 |
| December 1 | 1 | March 5 | 39 |
| January 5 | 100 | April 4 | 10 |
| January 27 | 23 | April 14 | 9 |
| January 30 | 23 | April 27 | 6 |

DESCHUTES

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 76 | March 6 | 52 |
| December 9 | 3 | March 12 | 38 |
| January 18 | 45 | April 4 | 27 |
| January 25 | 36 | April 5 | 23 |
| January 28 | 38 | April 14 | 22 |
| February 1 | 34 | April 23 | 30 |
| February 5 | 71 | May 20 | 9 |
| | | June 14 | 2 |

DESCHUTES

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 23 | 92 | April 12 | 38 |
| December 25 | 86 | April 20 | 32 |
| December 28 | 70 | April 30 | 29 |
| December 31 | 66 | May 1 | 26 |
| January 18 | 45 | May 12 | 19 |
| January 21 | 41 | May 17 | 17 |
| January 27 | 100 | May 25 | 13 |
| January 30 | 100 | May 29 | 11 |
| February 21 | 67 | May 31 | 10 |
| February 23 | 54 | June 8 | 8 |
| March 27 | 86 | June 9 | 8 |
| March 28 | 78 | June 14 | 5 |

FEATHER

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 30 | March 6 | 61 |
| November 30 | 14 | March 10 | 67 |
| December 8 | 6 | March 14 | 59 |
| December 19 | 85 | March 25 | 52 |
| December 24 | 64 | April 1 | 51 |
| January 7 | 73 | April 12 | 36 |
| January 20 | 66 | April 21 | 59 |
| January 24 | 69 | May 3 | 20 |
| January 29 | 68 | May 7 | 27 |
| February 3 | 73 | May 10 | 14 |
| February 11 | 74 | May 17 | 14 |
| February 19 | 66 | May 30 | 9 |
| February 22 | 65 | June 4 | 7 |
| February 28 | 63 | | |

FEATHER

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 26 | 62 | March 10 | 54 |
| January 30 | 54 | March 19 | 46 |
| February 1 | 50 | March 21 | 42 |
| February 6 | 43 | March 26 | 62 |
| February 11 | 42 | March 27 | 40 |
| February 14 | 38 | April 4 | 28 |
| February 24 | 76 | April 12 | 16 |
| February 27 | 69 | April 20 | 9 |
| March 5 | 57 | May 20 | 5 |

GENESEE (ABOVE PORTAGEVILLE, NEW YORK)

1974-1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 23 | 80 | March 18 | 78 |
| November 27 | 81 | April 9 | 80 |
| January 31 | - | April 11 | 37 |
| February 2 | 100 | April 14 | 29 |
| February 21 | 100 | April 16 | 16 |
| March 9 | 80 | | |

GENESEE (ABOVE PORTAGEVILLE, NEW YORK)

1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| February 12 | 81 | April 10 | 100 |
| March 18 | 100 | April 11 | 100 |

GENESSE (BELOW PORTAGEVILLE, NEW YORK)

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 23 | 62 | March 18 | 43 |
| November 27 | 89 | April 9 | 100 |
| January 31 | 76 | April 11 | 77 |
| February 2 | 46 | April 14 | 67 |
| February 21 | 84 | April 16 | 24 |
| March 9 | 91 | | |

GENESEE (BELOW PORTAGEVILLE, NEW YORK)

1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| February 12 | 93 | April 10 | 100 |
| March 18 | 95 | April 11 | 67 |

HUMBOLDT

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 8 | 7 | February 20 | 95 |
| November 20 | 40 | February 21 | 89 |
| November 23 | 45 | February 23 | 79 |
| November 28 | 8 | February 24 | 73 |
| December 19 | 88 | February 28 | 65 |
| December 25 | 73 | March 14 | 54 |
| January 1 | 79 | March 15 | 44 |
| January 7 | 66 | March 20 | 22 |
| January 15 | 69 | March 25 | 18 |
| January 21 | 80 | April 9 | 34 |
| January 24 | 91 | April 12 | 14 |
| January 29 | 78 | April 19 | 8 |
| February 8 | 58 | May 8 | 8 |
| February 12 | 99 | May 12 | 6 |

HUMBOLDT

1976 - 1977

| Date | Percent Snowcover |
|---|---|
| November 17 | 3 |
| November 28 | 1 |
| January 6 | 98 |
| January 24 | 80 |
| January 25 | 84 |
| January 26 | 75 |
| February 2 | 68 |
| February 4 | 64 |
| February 13 | 14 |
| March 6 | 45 |
| March 8 | 24 |
| March 11 | 42 |
| March 21 | 17 |
| March 26 | 11 |
| April 4 | 32 |
| April 6 | 8 |
| April 19 | 3 |

HUMBOLDT

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 2 | 62 | February 21 | 54 |
| December 3 | 54 | February 24 | 43 |
| December 8 | 16 | February 26 | 32 |
| December 14 | 89 | March 5 | 57 |
| December 17 | 76 | March 7 | 41 |
| December 21 | 51 | March 8 | 28 |
| January 17 | 57 | March 9 | 23 |
| January 19 | 48 | March 12 | 30 |
| January 20 | 48 | March 20 | 35 |
| January 21 | 41 | April 2 | 19 |
| January 25 | 75 | April 7 | 10 |
| January 31 | 34 | April 17 | 27 |
| February 3 | 28 | April 21 | 11 |
| February 7 | 72 | April 29 | 9 |
| | | May 11 | 3 |

JOHN DAY

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 8 | 5 | February 28 | 41 |
| November 20 | 96 | March 14 | 37 |
| December 18 | 77 | March 18 | 28 |
| December 19 | 75 | March 26 | 15 |
| December 31 | 100 | April 9 | 17 |
| January 23 | 51 | April 12 | 14 |
| January 27 | 37 | May 8 | 4 |
| February 8 | 39 | | |
| February 21 | 38 | | |

JOHN DAY

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 27 | 22 | March 5 | 65 |
| November 29 | 9 | March 14 | 47 |
| December 28 | 2 | March 30 | 42 |
| January 5 | 100 | April 4 | 32 |
| January 27 | 62 | April 6 | 25 |
| January 30 | 62 | April 12 | 12 |
| February 14 | 8 | April 20 | 3 |
| February 17 | 7 | | |

JOHN DAY

1975-1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 54 | March 6 | 49 |
| December 9 | 8 | March 8 | 46 |
| January 1 | 76 | March 12 | 46 |
| January 18 | 47 | March 29 | 50 |
| January 19 | 42 | April 4 | 38 |
| January 20 | 42 | April 5 | 32 |
| January 21 | 42 | April 14 | 20 |
| January 25 | 44 | April 23 | 23 |
| January 28 | 41 | May 9 | 7 |
| February 1 | 38 | May 20 | 8 |
| February 5 | 86 | June 5 | 2 |
| February 20 | 74 | June 14 | 2 |
| March 4 | 69 | | |

JOHN DAY

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 23 | 80 | March 27 | 73 |
| December 28 | 69 | March 28 | 68 |
| December 31 | 70 | March 28 | 62 |
| January 18 | 56 | March 29 | 68 |
| January 21 | 46 | April 12 | 40 |
| January 27 | 100 | April 20 | 42 |
| January 30 | 100 | April 30 | 38 |
| February 15 | 54 | May 1 | 28 |
| February 21 | 81 | May 12 | 21 |
| February 23 | 54 | May 17 | 13 |
| February 24 | 52 | May 25 | 10 |
| February 25 | 47 | May 29 | 6 |
| March 5 | 41 | May 31 | 7 |
| March 13 | 51 | June 8 | 6 |
| March 16 | 54 | June 10 | 3 |
| March 20 | 56 | June 14 | 2 |

KOOTENAY

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| May 8 | 48 | June 20 | 32 |
| May 19 | 41 | June 28 | 26 |
| June 1 | 43 | July 14 | 16 |
| June 4 | 40 | July 15 | 16 |
| June 7 | 34 | July 25 | 6 |

KOOTENAY

1976 - 1977

| Date | Percent Snowcover |
|---|---|
| April 12 | 49 |
| April 25 | 39 |
| May 30 | 41 |
| June 5 | 30 |
| June 9 | 22 |
| June 17 | 16 |

LAKE OF THE WOODS (4 Sub-basins) 1977

| Date | Basin | Percent Snowcover |
|---|---|---|
| March 21 | Lake of the Woods | 76 |
| | Namakan Lake | 53 |
| | Rainy Lake | 67 |
| | Rainy River | 59 |
| March 28 | Namakan Lake | 6 |
| | Rainy Lake | 58 |
| | Rainy River | 9 |
| March 31 | Lake of the Woods | 100 |
| | Namakan Lake | 100 |
| | Rainy Lake | 100 |
| | Rainy River | 100 |
| April 10 | Lake of the Woods | 42 |
| | Rainy Lake | 62 |
| | Rainy River | 0 |

LAKE OF THE WOODS (4 Sub-basins) 1976

| Date | Basin | Percent Snowcover |
|---|---|---|
| April 7 | Lake of the Woods | 42 |
| | Namakan Lake | 94 |
| | Rainy Lake | 94 |
| April 11 | Lake of the Woods | 16 |
| | Namakan Lake | 63 |
| | Rainy Lake | 59 |
| April 13 | Lake of the Woods | 16 |
| | Namakan Lake | 54 |
| | Rainy Lake | 58 |
| April 15 | Namakan Lake | 21 |
| | Rainy Lake | 9 |

LAKE OF THE WOODS (4 Sub-basins) 1975

| Date | Basin | Percent Snowcover |
|---|---|---|
| April 25 | Lake of the Woods | 67 |
| | Namakan Lake | 82 |
| | Rainy Lake | 80 |
| | Rainy River | 2 |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 9 | 81 | March 7 | 67 |
| November 10 | 49 | March 8 | 64 |
| November 20 | 100 | March 11 | 43 |
| December 20 | 82 | March I8 | 15 |
| December 25 | 70 | March 20 | 17 |
| January 2 | 98 | March 27 | 14 |
| January 22 | 100 | March 30 | 15 |
| February 4 | 90 | April 12 | 10 |
| February 13 | 100 | April 24 | 6 |
| February 21 | 100 | May 9 | 70 |
| February 23 | 79 | May 12 | 28 |
| February 28 | 100 | May 15 | 4 |
| March 4 | 93 | May 22 | 4 |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 24 | 3 | February 20 | 18 |
| Novebmer 27 | 100 | February 24 | 87 |
| December 6 | 97 | March 1 | 69 |
| December 12 | 78 | March 13 | 54 |
| December 14 | 58 | March 15 | 41 |
| December 15 | 43 | March 22 | 47 |
| December 18 | 29 | March 23 | 33 |
| December 28 | 56 | March 27 | 22 |
| January 5 | 100 | April 6 | 28 |
| January 24 | 51 | April 10 | 19 |
| January 27 | 41 | April 14 | 15 |
| February 3 | 43 | April 21 | 11 |
| February 7 | 31 | April 23 | 10 |
| February 9 | 27 | May 2 | 6 |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 13 | 20 | February 26 | 29 |
| November 20 | 38 | March 7 | 48 |
| November 30 | 97 | March 22 | 19 |
| December 2 | 15 | April 1 | 16 |
| December 17 | 100 | April 3 | 16 |
| January 17 | 83 | April 11 | 9 |
| January 19 | 99 | April 24 | 13 |
| January 20 | 82 | May 2 | 7 |
| January 21 | 69 | May 5 | 3 |
| January 29 | 62 | May 17 | 3 |
| February 8 | 82 | May 27 | 1 |
| February 22 | 85 | | |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 1 | 83 | March 28 | 100 |
| January 29 | 100 | April 14 | 19 |
| February 6 | 100 | April 24 | 12 |
| February 16 | 100 | May 3 | 12 |
| February 25 | 56 | May 15 | 6 |
| March 18 | 100 | May 26 | 3 |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 2 | 100 | March 11 | 26 |
| January 27 | 100 | March 29 | 14 |
| February 2 | 26 | April 5 | 33 |
| February 6 | 100 | April 16 | 27 |
| February 25 | 90 | May 1 | 9 |
| March 1 | 26 | | |

NORTH PLATTE (ALCOVA TO GUERNSEY) 1973

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 26 | 39 | April 28 | 81 |
| March 7 | 28 | May 11 | 12 |
| April 1 | 32 | May 16 | 11 |
| April 5 | 28 | May 23 | 4 |
| April 12 | 27 | May 31 | 2 |

NORTH PLATTE (Seminoe)

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 7 | 4 | March 8 | 87 |
| November 9 | 81 | March 11 | 89 |
| November 10 | 36 | March 18 | 78 |
| November 14 | 3 | March 20 | 67 |
| November 20 | 100 | March 27 | 54 |
| December 20 | 88 | March 30 | 54 |
| January 2 | 98 | April 12 | 32 |
| January 22 | 100 | April 24 | 30 |
| February 4 | 97 | May 9 | 68 |
| February 13 | 97 | May 12 | 36 |
| February 21 | 100 | May 15 | 19 |
| February 23 | 93 | May 22 | 22 |
| February 28 | 100 | June 12 | 17 |
| March 4 | 97 | June 16 | 9 |
| March 7 | 92 | | |

NORTH PLATTE (Seminoe)

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 4 | 2 | February 9 | 51 |
| November 7 | 1 | February 20 | 34 |
| November 15 | 13 | March 1 | 80 |
| November 24 | 3 | March 8 | 59 |
| November 27 | 96 | March 13 | 76 |
| December 6 | 98 | March 15 | 65 |
| December 12 | 79 | March 22 | 54 |
| December 14 | 55 | March 23 | 50 |
| December 15 | 54 | March 27 | 41 |
| December 18 | 42 | April 6 | 52 |
| December 28 | 82 | April 10 | 33 |
| January 5 | 90 | April 14 | 28 |
| January 24 | 84 | April 21 | 21 |
| January 25 | 79 | April 23 | 18 |
| January 27 | 76 | May 2 | 14 |
| January 30 | 65 | May 8 | 12 |
| February 3 | 58 | May 9 | 11 |
| February 7 | 56 | June 5 | 5 |

NORTH PLATTE (Seminoe)

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 9 | 38 | February 26 | 69 |
| November 13 | 55 | March 7 | 95 |
| November 16 | 17 | March 9 | 79 |
| November 20 | 82 | March 22 | 55 |
| November 30 | 100 | April 1 | 49 |
| December 2 | 51 | April 3 | 44 |
| December 17 | 100 | April 11 | 27 |
| January 17 | 88 | April 16 | - |
| January 19 | 98 | April 24 | 35 |
| January 20 | 96 | May 2 | 26 |
| January 29 | 87 | May 13 | 16 |
| February 8 | 100 | May 17 | 16 |
| February 22 | 99 | May 27 | 12 |
| | | June 5 | 7 |

NORTH PLATTE (Seminoe)

1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 1 | 100 | April 24 | 33 |
| January 29 | 100 | May 3 | 34 |
| February 6 | 100 | May 15 | 24 |
| February 16 | 100 | May 26 | 15 |
| February 25 | 93 | June 5 | 16 |
| March 18 | 99 | June 20 | 9 |
| March 28 | 100 | June 26 | 8 |
| April 14 | 52 | | |

NORTH PLATTE (Seminoe)

1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 2 | 100 | April 5 | 75 |
| January 27 | 100 | April 16 | 51 |
| February 2 | 89 | May 1 | 25 |
| February 6 | 100 | May 22 | 11 |
| February 25 | 94 | May 31 | 7 |
| March 1 | 76 | June 18 | 6 |
| March 11 | 62 | | |
| March 29 | 53 | | |

NORTH PLATTE (Seminoe)

1973

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 26 | 100 | April 28 | 72 |
| March 7 | 97 | May 11 | 26 |
| April 1 | 93 | May 16 | 21 |
| April 5 | 85 | May 23 | 14 |
| April 12 | 85 | June 1 | 14 |

PAYETTE

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 25 | March 27 | 71 |
| November 30 | 78 | March 29 | 64 |
| December 5 | 73 | April 9 | 68 |
| December 20 | 95 | April 12 | 61 |
| January 1 | 96 | April 23 | 50 |
| January 7 | 81 | May 8 | 44 |
| January 23 | 85 | May 31 | 31 |
| February 19 | 96 | June 4 | 25 |
| February 20 | 94 | June 7 | 23 |
| February 28 | 85 | June 17 | 22 |
| March 10 | 85 | June 27 | 19 |
| March 15 | 82 | July 9 | 9 |
| March 18 | 81 | | |

PAYETTE (above Emmett)

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 30 | 3 | April 4 | 62 |
| December 15 | 32 | April 7 | 49 |
| December 19 | 31 | April 12 | 36 |
| December 28 | 32 | April 15 | 35 |
| February 17 | 45 | April 20 | 27 |
| February 20 | 43 | April 27 | 24 |
| March 5 | 81 | May 13 | 16 |
| March 11 | 72 | May 31 | 10 |
| March 16 | 77 | June 5 | 8 |
| March 22 | 66 | | |
| March 25 | 57 | | |

PAYETTE (above Emmett)

1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| April 21 | 59 | May 17 | 36 |
| April 23 | 67 | May 21 | 28 |
| April 29 | 51 | May 26 | 27 |
| May 1 | 50 | June 5 | 17 |
| May 9 | 45 | June 18 | 19 |
| May 12 | 43 | June 26 | 15 |
| May 13 | 40 | July 3 | 8 |
| May 15 | 39 | | |

PAYETTE (above Emmett)

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 78 | March 10 | 92 |
| November 18 | 40 | March 12 | 93 |
| December 3 | 92 | March 21 | 92 |
| December 9 | 76 | March 29 | 87 |
| January 16 | 98 | April 4 | 82 |
| January 20 | 96 | April 8 | 76 |
| January 25 | 98 | April 10 | 65 |
| January 28 | 97 | April 14 | 65 |
| February 7 | 98 | April 16 | 72 |
| February 21 | 96 | April 17 | 63 |

PAYETTE (above Emmett)

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 26 | 85 | May 10 | 73 |
| December 1 | 94 | May 12 | 75 |
| December 5 | 66 | May 13 | 60 |
| December 29 | 98 | May 14 | 60 |
| January 21 | 100 | May 25 | 58 |
| February 25 | 91 | May 29 | 41 |
| March 5 | 88 | June 1 | 40 |
| March 6 | 88 | June 5 | 34 |
| March 28 | 87 | June 10 | 31 |
| March 29 | 88 | June 14 | 31 |
| April 1 | 88 | June 16 | 27 |
| April 12 | 88 | June 22 | 26 |
| April 20 | 84 | June 29 | 20 |
| May 8 | 79 | July 3 | 16 |

RIO GRANDE ABOVE DEL NORTE

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 10 | 60 | April 11 | 56 |
| November 13 | 42 | April 16 | 60 |
| December 5 | 59 | April 20 | 56 |
| December 9 | 55 | May 9 | 90 |
| December 20 | 81 | May 12 | 68 |
| December 25 | 63 | May 15 | 48 |
| January 13 | 64 | May 23 | 39 |
| February 24 | 90 | May 30 | 35 |
| March 7 | 87 | June 2 | 31 |
| March 26 | 64 | June 12 | 18 |
| April 4 | 68 | June 16 | 14 |
| April 7 | 62 | | |

RIO GRANDE ABOVE DEL NORTE

1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| February 19 | 33 | April 16 | 34 |
| February 23 | 93 | April 21 | 73 |
| March 12 | 74 | April 23 | 26 |
| March 14 | 55 | May 2 | 23 |
| March 15 | 49 | May 4 | 31 |
| March 19 | 46 | May 7 | 19 |
| March 23 | 41 | May 11 | 15 |
| March 27 | 39 | May 17 | 27 |
| March 30 | 39 | May 22 | 17 |
| April 7 | 55 | May 30 | 14 |

RIO GRANDE ABOVE STATE LINE

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 9 | 66 | March 7 | 46 |
| November 10 | 53 | March 8 | 38 |
| November 13 | 22 | March 16 | 37 |
| November 21 | 74 | March 18 | 36 |
| December 5 | 40 | March 26 | 29 |
| December 9 | 32 | March 30 | 32 |
| December 13 | 24 | April 4 | 31 |
| December 20 | 46 | April 7 | 32 |
| December 25 | 36 | April 11 | 29 |
| January 2 | 53 | April 16 | 26 |
| January 13 | 31 | April 20 | 24 |
| January 22 | 51 | May 9 | 49 |
| January 25 | 91 | May 12 | 29 |
| January 27 | 80 | May 15 | 19 |
| February 2 | 68 | May 22 | 17 |
| February 4 | 67 | May 30 | 15 |
| February 13 | 59 | June 12 | 8 |
| February 19 | 68 | | |
| February 21 | 56 | | |
| February 24 | 53 | | |

RIO GRANDE ABOVE STATE LINE

1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 22 | 86 | March 12 | 66 |
| January 30 | 80 | March 14 | 41 |
| February 3 | 79 | March 15 | 27 |
| February 7 | 75 | March 19 | 28 |
| February 9 | 74 | March 23 | 19 |
| February 15 | 61 | March 27 | 18 |
| February 19 | 30 | March 30 | 18 |
| February 23 | 61 | April 7 | 23 |
| February 27 | 96 | April 23 | 14 |
| March 6 | 81 | May 2 | 13 |
| March 7 | 72 | May 7 | 10 |
| March 9 | 56 | May 17 | 12 |

SACRAMENTO

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 15 | March 14 | 29 |
| December 8 | 2 | March 20 | I8 |
| December 19 | 97 | March 25 | 19 |
| December 24 | 90 | April 9 | 21 |
| January 25 | 42 | April 12 | 11 |
| January 29 | 39 | May 3 | 10 |
| February 11 | 63 | May 7 | 10 |
| February 19 | 45 | May 17 | 5 |
| February 22 | 34 | May 30 | 4 |
| February 28 | 28 | June 4 | 2 |
| March 10 | 26 | | |

SACRAMENTO

1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 26 | 83 | March 26 | 42 |
| January 30 | 80 | March 27 | 22 |
| February 1 | 80 | April 4 | 11 |
| February 6 | 73 | April 12 | 8 |
| February 11 | 54 | April 20 | 3 |
| February 14 | 32 | May 13 | 14 |
| March 5 | 49 | May 20 | 4 |
| March 21 | 24 | | |

SALMON ABOVE WHITEBIRD

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 42 | March 29. | 71 |
| November 20 | 65 | April 9 | 64 |
| November 30 | 78 | April 12 | 61 |
| December 20 | 98 | June 1 | 45 |
| March 10 | 92 | June 4 | 35 |
| March 15 | 92 | June 7 | 27 |
| March 18 | 88 | June 17 | 27 |
| March 21 | 84 | June 27 | 20 |
| March 27 | 78 | July 12 | 12 |

SALMON

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 20 | 2 | April 6 | 64 |
| December 1 | 14 | April 8 | 59 |
| December 16 | 36 | April 12 | 48 |
| December 19 | 31 | April 15 | 45 |
| December 28 | 31 | April 20 | 37 |
| February 20 | 44 | April 27 | 33 |
| March 11 | 85 | May 13 | 25 |
| March 22 | 74 | June 5 | 16 |

SALMON

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 18 | 81 | May 12 | 58 |
| December 9 | 81 | May 13 | 53 |
| February 2 | 98 | May 15 | 50 |
| March 10 | 99 | May 17 | 45 |
| March 18 | 95 | May 20 | 45 |
| April 4 | 87 | May 21 | 40 |
| April 5 | 83 | May 26 | 39 |
| April 8 | 84 | June 5 | 26 |
| April 10 | 80 | June 18 | 27 |
| April 29 | 77 | June 26 | 18 |
| May 1 | 73 | July 3 | 11 |
| May 9 | 60 | | |

SALMON

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 17 | 21 | June 1 | 50 |
| November 26 | 58 | June 5 | 46 |
| December 1 | 62 | June 10 | 42 |
| March 6 | 96 | June 14 | 36 |
| March 28 | 97 | June 29 | 26 |
| April 10 | 93 | July 2 | 15 |
| April 12 | 91 | July 3 | 16 |
| April 20 | 87 | July 7 | 15 |
| May 10 | 82 | July 11 | 9 |
| May 13 | 72 | | |
| May 14 | 75 | | |
| May 29 | 57 | | |

SALT

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 9 | 5 | March 7 | 15 |
| January 2 | 5 | March 8 | 13 |
| January 7 | 4 | March 14 | 31 |
| January 13 | 8 | March 15 | 16 |
| January 22 | 34 | March 16 | 16 |
| January 25 | 26 | March 20 | 16 |
| January 26 | 22 | March 25 | 10 |
| January 28 | 17 | March 28 | 10 |
| February 3 | 17 | April 3 | 10 |
| February 16 | 77 | April 5 | 8 |
| February 17 | 70 | April 11 | 7 |
| February 19 | 48 | April 20 | 4 |
| February 20 | 47 | May 8 | 4 |
| February 22 | 27 | | |
| February 23 | 22 | | |
| February 25 | 18 | | |

SALT

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 17 | 2 | February 14 | 9 |
| November 28 | 44 | February 15 | 9 |
| November 29 | 39 | February 19 | 5 |
| November 30 | 23 | February 23 | 4 |
| December 1 | 18 | February 26 | 27 |
| December 2 | 8 | February 27 | 14 |
| December 4 | 7 | February 28 | 12 |
| December 8 | 4 | March 2 | 40 |
| January 6 | 58 | March 3 | 12 |
| January 9 | 81 | March 6 | 5 |
| January 10 | 58 | March 30 | 38 |
| January 12 | 50 | March 31 | 22 |
| January 13 | 14 | April 4 | 48 |
| January 15 | 44 | April 5 | 29 |
| January 24 | 19 | April 6 | 16 |
| January 28 | 19 | April 7 | 16 |
| January 31 | 16 | April 10 | 5 |
| February 3 | 15 | | |
| February 7 | 17 | | |
| February 8 | 12 | | |
| February 13 | 13 | | |

SALT

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 30 | 82 | January 27 | 15 |
| December 1 | 75 | January 29 | 13 |
| December 2 | 74 | February 2 | 9 |
| December 3 | 61 | February 17 | 15 |
| December 4 | 45 | February 18 | 13 |
| December 7 | 22 | February 19 | 10 |
| December 8 | 20 | February 22 | 8 |
| December 10 | 10 | February 24 | 9 |
| December 15 | 47 | February 26 | 9 |
| | | March 9 | 21 |
| December 17 | 30 | March 13 | 44 |
| December 18 | 20 | March 14 | 13 |
| December 28 | 20 | March 15 | 12 |
| December 29 | 15 | March 18 | 9 |
| January 1 | 57 | March 20 | 8 |
| January 3 | 50 | March 24 | 7 |
| January 5 | 36 | March 30 | 36 |
| January 6 | 19 | April 1 | 17 |
| January 7 | 12 | April 4 | 7 |
| January 8 | 10 | April 18 | 61 |
| January 11 | 8 | April 20 | 20 |
| January 15 | 7 | April 21 | 7 |
| January 17 | 6 | April 24 | 4 |
| January 21 | 6 | | |
| January 25 | 21 | | |
| January 26 | 15 | | |

SALT
1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 4 | 14 | February 23 | 43 |
| November 7 | 5 | February 24 | 42 |
| November 10 | 2 | February 27 | 29 |
| December 7 | 15 | March 1 | 17 |
| December 10 | 3 | March 3 | 17 |
| December 15 | 2 | March 17 | 29 |
| December 24 | 41 | March 24 | 15 |
| January 3 | 76 | March 30 | 35 |
| January 4 | 67 | April 3 | 27 |
| January 5 | 44 | April 5 | 13 |
| January 12 | 40 | April 6 | 13 |
| January 14 | 30 | April 16 | 16 |
| January 18 | 9 | April 20 | 11 |
| January 20 | 9 | April 22 | 10 |
| January 25 | 8 | April 24 | 9 |
| February 2 | 21 | April 28 | 8 |
| February 6 | 20 | April 30 | 6 |
| February 11 | 23 | May 1 | 5 |
| February 12 | 17 | May 3 | 4 |
| February 18 | 70 | May 7 | 4 |
| February 19 | 64 | May 13 | 3 |

SAN JUAN

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| February 3 | 96 | May 9 | 11 |
| February 18 | 71 | May 12 | 15 |
| February 22 | 54 | May 15 | 5 |
| March 16 | 24 | | |
| March 25 | 19 | | |
| April 12 | 11 | | |
| April 18 | 9 | | |
| April 24 | 6 | | |

SAN JUAN

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 29 | 45 | January 15 | 92 |
| December 1 | 39 | January 17 | 92 |
| December 3 | 37 | January 31 | 58 |
| December 4 | 31 | February 7 | 41 |
| December 8 | 27 | February 13 | 34 |
| December 11 | 21 | February 18 | 25 |
| December 13 | 13 | February 26 | 47 |
| December 21 | 6 | March 6 | 32 |
| December 27 | 10 | March 12 | 10 |
| January 6 | 100 | March 30 | 6 |
| January 11 | 96 | | |

SAN JUAN

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 2 | 70 | January 30 | 31 |
| December 4 | 56 | February 2 | 33 |
| December 6 | 31 | February 11 | 41 |
| December 16 | 59 | February 13 | 32 |
| December 17 | 59 | February 19 | 29 |
| December 19 | 43 | February 22 | 28 |
| December 29 | 56 | February 25 | 16 |
| January 16 | 40 | March 6 | 22 |
| January 17 | 37 | March 18 | 8 |
| January 19 | 33.5 | March 20 | 8 |
| January 20 | 32 | March 23 | 5 |
| January 21 | 29.4 | March 26 | 5 |
| January 29 | 38 | April 24 | 5 |

SAN JUAN

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 5 | 13 | February 19 | 67 |
| November 7 | 14 | February 23 | 80 |
| November 12 | 10 | February 24 | 62 |
| November 13 | 9 | February 25 | 51 |
| November 20 | 6 | March 1 | 29 |
| November 21 | 5 | March 3 | 27 |
| December 1 | 7 | March 19 | 27 |
| December 3 | 6 | March 30 | 40 |
| December 16 | 21 | April 3 | 27 |
| December 17 | 20 | April 5 | 18 |
| December 18 | 17 | April 14 | 23 |
| December 22 | 16 | April 16 | 16 |
| December 24 | 81 | April 20 | 15 |
| January 5 | 95 | April 22 | 13 |
| January 18 | 88 | April 24 | 12 |
| January 20 | 78 | April 30 | 10 |
| January 22 | 67 | May 3 | 10 |
| January 26 | 34 | May 11 | 9 |
| February 1 | 26 | May 13 | 7 |
| February 2 | 26 | May 15 | 7 |
| February 6 | 65 | May 26 | 7 |
| February 11 | 59 | June 11 | 4 |
| February 12 | 30 | June 3 | 5 |
| February 18 | 77 | June 5 | 5 |

SNAKE ABOVE PALISADES

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 13 | 22 | June 5 | 47 |
| March 7 | 99 | June 8 | 38 |
| April 9 | 99 | June 13 | 38 |
| April 12 | 96 | June 18 | 32 |
| May 2 | 75 | June 21 | 27 |
| May 9 | 79 | June 27 | 25 |
| May 14 | 70 | July 1 | 22 |
| May 25 | 59 | July 7 | 20 |
| May 28 | 57 | July 11 | 16 |
| June 1 | 51 | July 19 | 11 |

SNAKE ABOVE PALISADES

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 4 | 20 | April 23 | 35 |
| November 14 | 10 | April 27 | 43 |
| November 23 | 9 | May 9 | 33 |
| November 27 | 83 | June 1 | 27 |
| April 13 | 67 | June 5 | 24 |
| April 19 | 60 | June 15 | 12 |

ST. JOHN

1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| March 30 | 99 | May 7 | 42 |
| April 10 | 99 | May 8 | 32 |
| April 19 | 98 | May 11 | 16 |

ST. JOHN

1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| April 4 | 96 | April 30 | 29 |
| April 10 | 100 | May 4 | 16 |
| April 18 | 79 | May 18 | 3 |
| April 19 | 78 | | |

ST. JOHN

1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| March 23 | 99 | | |
| April 6 | 86 | | |
| April 14 | 66 | April 29 | 29 |
| April 21 | 51 | May 1 | 16 |

ST. JOHN

1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| April 15 | 100 | May 10 | 35 |
| April 20 | 100 | May 14 | 21 |
| May 1 | 71 | May 17 | 15 |

SWEETWATER

1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 1 | 100 | April 14 | 31 |
| January 29 | 100 | April 24 | 24 |
| February 6 | 100 | May 15 | 9 |
| February 25 | 87 | May 26 | 9 |
| March 18 | 98 | June 5 | 2 |
| March 28 | 100 | June 20 | 2 |
| | | June 26 | 1 |

SWEETWATER

1974

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 2 | 100 | March 29 | 27 |
| January 27 | 100 | April 5 | 46 |
| February 2 | 64 | April 16 | 30 |
| February 6 | 100 | May 1 | 16 |
| February 25 | 92 | May 22 | 4 |
| March 1 | 64 | May 31 | 2 |
| March 11 | 41 | June 18 | 1 |

SWEETWATER

1973

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| January 26 | 100 | May 11 | 15 |
| March 7 | 91 | May 16 | 13 |
| April 1 | 87 | May 23 | 4 |
| April 5 | 84 | May 31 | 3 |
| April 12 | 74 | | |
| April 28 | 72 | | |

SWEETWATER

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 7 | 3 | March 4 | 88 |
| November 9 | 96 | March 7 | 71 |
| November 10 | 78 | March 8 | 68 |
| November 20 | 100 | March 11 | 49 |
| December 20 | 56 | March 18 | 43 |
| December 25 | 45 | March 20 | 35 |
| January 2 | 100 | March 27 | 29 |
| January 13 | 98 | April 12 | 14 |
| January 22 | 100 | April 24 | 5 |
| February 4 | 99 | May 9 | 86 |
| February 13 | 100 | May 12 | 38 |
| February 21 | 100 | May 15 | 6 |
| February 23 | 93 | May 22 | 7 |
| February 28 | 100 | | |

SWEETWATER

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 4 | 21 | February 7 | 43 |
| November 7 | 7 | February 9 | 41 |
| November 15 | 5 | February 20 | 25 |
| November 27 | 100 | February 24 | 31 |
| December 6 | 100 | March 13 | 72 |
| December 12 | 86 | March 15 | 44 |
| December 14 | 75 | March 22 | 54 |
| December 15 | 64 | March 23 | 35 |
| December 18 | 50 | April 6 | 53 |
| December 28 | 64 | April 10 | 18 |
| January 5 | 100 | April 14 | 14 |
| January 24 | 67 | April 23 | 4 |
| January 25 | 63 | May 2 | 2 |
| January 27 | 63 | May 9 | 1 |
| January 30 | 53 | June 5 | 1 |
| February 3 | 47 | | |

SWEETWATER

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 9 | 7 | February 22 | 91 |
| November 13 | 17 | February 26 | 53 |
| November 16 | 3 | March 7 | 56 |
| November 20 | 68 | March 9 | 48 |
| November 30 | 100 | March 22 | 38 |
| December 2 | 60 | April 3 | 35 |
| December 17 | 100 | April 11 | 19 |
| January 17 | 76 | April 24 | 19 |
| January 19 | 96 | May 2 | 11 |
| January 20 | 93 | May 13 | 7 |
| January 21 | 89 | May 17 | 5 |
| February 3 | 57 | May 27 | 1 |
| February 8 | 100 | June 5 | 1 |

TAHOE-TRUCKEE

1977 - 1978

| Date | Percent Snowcover |
|---|---|
| January 21 | - |
| January 24 | - |
| February 23 | - |
| March 25 | - |
| April 22 | 24 |
| May 25 | 12 |
| June 25 | 6 |

UMATILLA

1977 - 1978

| Date | Percent Snowcover |
|---|---|
| November 20 | 44 |
| December 19 | 40 |
| December 31 | 100 |
| January 23 | 31 |
| March 14 | 21 |
| March 26 | 7 |
| April 9 | 4 |
| April 12 | 6 |

UMATILLA

1977

| Date | Percent Snowcover |
|---|---|
| January 5 | 100 |
| January 27 | 34 |
| March 5 | 40 |
| April 4 | 13 |

UMATILLA

1975 - 1976

| Date | Percent Snowcover |
|---|---|
| November 12 | 36 |
| January 18 | 36 |
| February 5 | 68 |
| March 4 | 36 |
| March 6 | 25 |
| March 8 | 22 |
| March 29 | 35 |

UMATILLA

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 23 | 35 | March 20 | 40 |
| December 31 | 29 | March 27 | 30 |
| January 21 | 25 | March 28 | 32 |
| January 27 | 96 | April 12 | 14 |
| January 30 | 96 | April 20 | 16 |
| February 15 | 23 | May 1 | 13 |
| February 21 | 55 | May 12 | 6 |
| February 24 | 26 | May 25 | 2 |
| February 25 | 26 | | |

VERDE

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 8 | 8 | March 7 | 10 |
| November 9 | 3 | March 8 | 9 |
| January 2 | 2 | March 14 | 26 |
| January 7 | 3 | March 15 | 17 |
| January 13 | 15 | March 16 | 11 |
| January 25 | 29 | March 20 | 6 |
| January 26 | 22 | March 25 | 5 |
| January 28 | 18 | March 28 | 2 |
| February 3 | 16 | April 3 | 1 |
| February 16 | 86 | April 5 | 1 |
| February 16 | 57 | April 11 | 1 |
| February 19 | 36 | April 20 | 1 |
| February 20 | 35 | May 7 | 1 |
| February 21 | 30 | May 8 | 1 |
| February 22 | 24 | | |
| February 23 | 22 | | |
| February 25 | 17 | | |

VERDE

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 28 | 5 | February 7 | 15 |
| November 29 | 3 | February 13 | 9 |
| November 30 | 2 | February 14 | 8 |
| December 1 | 1 | February 15 | 8 |
| December 2 | 1 | February 19 | 2 |
| January 4 | 44 | February 26 | 28 |
| January 9 | 53 | February 27 | 13 |
| January 10 | 46 | February 28 | 12 |
| January 11 | 41 | March 2 | 7 |
| January 13 | 35 | March 3 | 8 |
| January 15 | 39 | March 6 | 4 |
| January 24 | 23 | March 30 | 2 |
| January 28 | 19 | April 4 | 36 |
| January 31 | 17 | April 5 | 24 |
| February 2 | 15 | April 6 | 8 |
| February 3 | 15 | April 7 | 4 |

VERDE

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 30 | 72 | January 25 | 17 |
| December 1 | 58 | January 26 | 13 |
| December 2 | 44 | January 29 | 7 |
| December 3 | 26 | February 2 | 5 |
| December 4 | 26 | February 11 | 29 |
| December 7 | 18 | February 17 | 18 |
| December 8 | 13 | February 19 | 14 |
| December 10 | 9 | February 22 | 10 |
| December 15 | 59 | February 24 | 10 |
| December 17 | 37 | February 26 | 10 |
| December 18 | 30 | March 9 | 22 |
| December 28 | 13 | March 13 | 12 |
| December 29 | 13 | March 14 | 9 |
| January 1 | 18 | March 15 | 10 |
| January 2 | 20 | March 18 | 8 |
| January 5 | 9 | March 20 | 7 |
| January 6 | 9 | March 24 | 5 |
| January 7 | 9 | April 18 | 39 |
| January 8 | 9 | April 20 | 21 |
| January 11 | 6 | April 21 | 8 |
| January 15 | 6 | April 24 | 3 |
| January 16 | 6 | | |
| January 21 | 6 | | |

VERDE

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 4 | 19 | February 12 | 15 |
| November 7 | 14 | February 18 | 57 |
| November 10 | 3 | February 19 | 55 |
| December 7 | 17 | February 23 | 38 |
| December 10 | 11 | February 24 | 30 |
| December 15 | 4 | February 27 | 22 |
| December 24 | 33 | March 1 | 14 |
| December 30 | 35 | March 3 | 9 |
| January 4 | 31 | March 17 | 33 |
| January 12 | 36 | March 19 | 21 |
| January 14 | 28 | March 21 | 15 |
| January 19 | 17 | March 24 | 12 |
| January 20 | 13 | March 29 | 33 |
| January 21 | 12 | March 30 | 27 |
| January 22 | 10 | April 3 | 13 |
| January 25 | 6 | April 5 | 5 |
| February 2 | 30 | April 16 | 13 |
| February 6 | 27 | April 20 | 3 |
| February 8 | 24 | April 22 | 4 |
| February 11 | 24 | April 24 | 3 |

WALKER

1977 - 1978

| Date | Percent Snowcover |
|---|---|
| January 21 | - |
| January 24 | - |
| March 25 | - |
| April 22 | 20 |
| May 25 | 8 |
| June 25 | 6 |

WEISER

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 6 | 6 | March 29 | 24 |
| November 30 | 71 | April 9 | 31 |
| December 5 | 44 | April 12 | 20 |
| December 20 | 93 | April 23 | 17 |
| Janaury 1 | 100 | May 8 | 15 |
| January 7 | 88 | May 31 | 13 |
| January 23 | 71 | June 4 | 7 |
| Fèbruary 19 | 74 | June 7 | 3 |
| February 20 | 58 | | |
| February 28 | 50 | | |
| March 10 | 41 | | |
| March 15 | 41 | | |
| March 18 | 43 | | |
| March 26 | 32 | | |

WEISER

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 15 | 17 | March 25 | 22 |
| December 19 | 5 | April 4 | 28 |
| December 28 | 9 | April 7 | 15 |
| February 17 | 21 | April 12 | 12 |
| February 20 | 21 | April 15 | 10 |
| March 5 | 38 | April 20 | 7 |
| March 11 | 30 | April 27 | 3 |
| March 16 | 38 | May 13 | 4 |
| March 22 | 24 | May 31 | 3 |

WEISER

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 37 | April 10 | 27 |
| November 18 | 12 | April 14 | 26 |
| December 9 | 66 | April 16 | 32 |
| January 16 | 100 | April 17 | 23 |
| January 20 | 100 | April 23 | 28 |
| January 25 | 100 | April 29 | 25 |
| January 28 | 100 | May 1 | 24 |
| February 1 | 100 | May 9 | 16 |
| February 7 | 100 | May 12 | 15 |
| February 21 | 100 | May 13 | 12 |
| March 10 | 95 | May 15 | 10 |
| March 12 | 95 | May 17 | 9 |
| March 29 | 83 | May 21 | 7 |
| April 4 | 59 | May 26 | 7 |
| April 8 | 55 | June 5 | 3 |
| | | June 18 | 2 |

WEISER

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 26 | 45 | May 8 | 34 |
| December 1 | 43 | May 10 | 25 |
| December 5 | 36 | May 12 | 22 |
| December 29 | 100 | May 13 | 20 |
| January 21 | 100 | May 14 | 23 |
| February 25 | 97 | May 25 | 22 |
| March 5 | 89 | May 29 | 15 |
| March 6 | 89 | June 1 | 13 |
| March 26 | 72 | June 5 | 11 |
| March 28 | 62 | June 10 | 9 |
| April 1 | 57 | June 16 | 7 |
| April 12 | 45 | June 22 | 5 |
| April 20 | 40 | | |

WILLAMETTE

1977 - 1978

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 8 | 6 | March 20 | 11 |
| November 20 | 27 | March 26 | 9 |
| December 25 | 18 | April 9 | 12 |
| December 31 | 20 | April 12 | 7 |
| January 23 | 27 | May 7 | 4 |
| January 24 | 20 | May 8 | 3 |
| February 19 | 19 | | |
| March 16 | 17 | | |

WILLAMETTE

1976 - 1977

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 27 | 1 | March 15, 16 | 32 |
| December 8 | 1 | March 21 | 25 |
| January 5 | 29 | April 4 | 20 |
| January 24 | 7 | April 14 | 22 |
| January 27 | 4 | April 19 | 20 |
| January 30 | 4 | Aparil 27 | 15 |
| February 1 | 15 | May 8 | 16 |
| February 2 | 3 | June 5 | 4 |
| February 14 | 2 | | |
| March 5 | 34 | | |

WILLAMETTE

1975 - 1976

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| November 12 | 29 | March 9 | 24 |
| November 18 | 27 | March 21 | 32 |
| December 19 | 12 | March 29 | 33 |
| January 20 | 17 | April 4 | 25 |
| January 28 | 16 | April 14 | 19 |
| February 1 | 17 | April 23 | 22 |
| February 4 | 16 | May 1 | 23 |
| February 7 | 15 | May 9 | 15 |
| February 20 | 40 | May 12 | 17 |
| March 6 | 30 | May 20 | 16 |
| March 8 | 29 | May 21 | 15 |
| | | June 14 | 3 |

WILLAMETTE

1974 - 1975

| Date | Percent Snowcover | Date | Percent Snowcover |
|---|---|---|---|
| December 7 | 16 | March 28 | 35 |
| December 23 | 47 | March 29 | 37 |
| December 28 | 42 | April 10 | 35 |
| December 31 | 33 | April 12 | 29 |
| January 21 | 19 | April 20 | 27 |
| January 27 | 45 | April 30 | 25 |
| January 30 | 36 | May 1 | 23 |
| February 21 | 37 | May 8 | 25 |
| February 23 | 30 | May 12 | 23 |
| March 5 | 20 | May 25 | 16 |
| March 10 | 20 | May 29 | 16 |
| March 11 | 25 | May 31 | 15 |
| March 27 | 36 | June 9 | 8 |
| March 28 | 38 | June 14 | 5 |

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15. Supplementary Notes

16. Abstract

Geostationary and polar orbiting satellite data from the National Oceanic and Atmospheric Administration have been used to operationally provide field hydrologists with basin snowcover percentages for inclusion in runoff models. Data reduction is accomplished thru the use of optical rectification devices and electronic color density slicers. Over two thousand (2000) satellite-derived snow maps covering 30 different basins in the western United States were provided to users during the four-year period of the ASVT project. Plans for improving snowmapping techniques on computer interactive systems and by all-digital analysis are presented. A description of the newest generation of NOAA polar orbiters, TIROS-N, and its potential for snowmapping is reviewed. Snowcover percentages for all basins determined between November 1974 and July 1978 are presented in tabular format.

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