P3.9 DEVELOPING A BLENDED CONTINENTAL SNOW COVER DATASET

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1. INTRODUCTION

Snow cover is a sensitive indicator of climate dynamics and climate change and an integrator of basic climate elements. Snow plays a critical role in the earth-atmosphere energy budget, and is the dictating factor in a major climatic feedback. In recent years there have been considerable efforts to improve means of monitoring the distribution and variability of snow. They include datasets developed from stations and snow courses, from visible satellite imagery, and from microwave satellite returns. These data have been used in numerous studies that attempt to better understand the variability of snow and its role in the climate system. Despite the excellent advances in snow monitoring, individual datasets tend to focus on one source of data or one element (snow coverage, depth or water equivalent), and many are limited in their spatial and temporal coverage. To date, there is no research-quality dataset in direct support of climate and global change studies that contains files of snow extent, depth and water equivalent and incorporates information from multiple observing systems. A project is underway at Rutgers to develop such a blended dataset for Northern Hemisphere lands.

2. THE NEED FOR A BLENDED DATASET

Research to date demonstrates clearly that accurate information on snow cover is critical for understanding the kinematics and dynamics of snow in the climate system, for developing accurate weather and hydrological forecasts, and for parameterizing and verifying climate models. For instance, in looking at the NOAA weekly visible snow map dataset, we found that areas covering less than 6% of Northern Hemisphere lands north of 20°N explain 62-92% of the interannual variance across the continents (Frei and Robinson, 1999). Thus there is a need to refine our present knowledge of snow coverage to better understand the variability that has been observed on annual and seasonal time frames over the past several decades. On average, snow was more extensive across both Eurasia and North America from the 1970s to middle 1980s than from the late 1980s to early 2000s (Robinson and Frei, 2000). This is most pronounced from late winter to summer. A better understanding of these fluctuations will result from a refinement of snow coverage, and will benefit from the availability of wide-scale snow depth and water equivalent information. Up-to-date figures and tables displaying these time series are found at http://climate.rutgers.edu/snowcover, the primary website for this project.

3. SNOW DATA

Station and satellite-derived snow observations are being assembled from a variety of sources for the satellite era (late 1960s through present). NOAA hemispheric snow maps available from 1966 through present constitute the longest and most spatially complete dataset available for this project. These maps are constructed from visible satellite imagery and are displayed on the project website. The site also contains climatological maps and a variety of tabular data.

The project site will be expanded to include microwave and station derived maps. The latter two datasets are being developed in cooperation with Thomas Mote at the University of Georgia, and will begin to appear on the website in 2002. A daily, gridded dataset is being developed from U.S. Cooperative Observer reports and similar, though less spatially complete sets will be constructed for Canada and the Former Soviet Union. Microwave maps of snow of extent and depth are being produced from SSM/I and SMMR data based on the land cover decision tree of Grody and Basist (1996), the Goodison and Walker (1995) snow water equivalent algorithm and the Walker and Goodison (1993) snow melt algorithm, augmented with a melt algorithm based on work by Mote and Anderson (1995). The SMMR to SSM/I crossover period in 1987 was used to create an SSM/I like brightness

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temperature field from the SMMR data, recognizing that the 85 GHz channel did not exist on SMMR. All datasets, each retaining their particular spatial and temporal resolutions, will be available through the project office.

4. BLENDED PRODUCT

All data sources will be imported into a geographic information system and differences in resolutions will be addressed. Maps produced for each data source will have common temporal (likely five day frequency) and spatial (likely 1 deg. by 1 deg) resolutions. This will facilitate intercomparisons and blending, enabling us to learn more about the strengths and weaknesses of each product and to ultimately create the most accurate and complete map for a given variable during a selected period. Blended maps of snow extent will have complete spatial and temporal coverage from the late 1960s to present, while maps of snow depth and especially snow water equivalent will have less complete coverage.

5. CONCLUSION

This project will make available critical data for climate assessments and for documenting the quantitative character of observed snow cover variations and changes. By fusing and enhancing space and ground-based observations, a research quality dataset will be available for climate assessment efforts, such as those falling under the U.S. National Assessment of Climate Change and the Intergovernmental Panel on Climate Change.

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