MODIS Semi-Annual Report
Snow and Ice Project
Reporting Period: July - December 1998
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Summary

MODIS snow and sea ice deliveries were made.

Research continued on pre-launch validation efforts of the MODIS snow-mapping algorithm, and on development of a multiple snow cover dataset product.

MODIS snow and ice products deliveries (G. Riggs/RDC, H. Powell/GSC and Jon Barton/GSC)

Version 2.1 of the MODIS daily sea ice algorithm (MOD_PR29A1) and product (MOD29) was developed and delivered to the project. Version 2.1 included code generation of separate day and night sea ice products (MOD29) and file specifications for them.

An automated quality assessment (QA) procedure for the MODIS snow product, MOD10_L2, was developed, tested, implemented and delivered tothe MODLAND Land Operational Processing (LDOPE) group.

Version 2.0 of the MODIS eight-day snow algorithm (MOD_PR10A2) and data product (MOD10A2) was developed, tested and delivered to the project.

Version 2.2 of the MODIS snow algorithm (MOD_PR10) and data product (MOD10_L2) was developed, tested and delivered to the project.

A collaborative comparative study of MODIS Airborne Simulator (MAS) sea ice mapping with that from the special sensor microwave imager (SSM/I) sea ice mapping was undertaken.

MODIS snow data products (MOD10_L2) and the MODIS data inputs to the snow algorithm (MOD_PR10) generated in the MODIS Emergency Backup System (MEBS) week in the life test (WILT V2.0) were investigated in regards to algorithm accuracy and continuity of data ingest among the products. This was a QA investigation of the products and enhanced definition and techniques of QA.

MODIS/Passive MW Data Product Development (A. Tait/USRA)

We have developed a Multiple-Dataset Snow Cover Product (MDSCP) that combines two satellite-derived snow cover products and ground-based climate station snow depth data. The satellite products are derived from optical data (the NOAA snow charts, which are compiled from the analysis of Geostationary Operational Environmental Satellites (GOES) and Advanced Very High Resolution Radiometer (AVHRR) data) and from passive microwave data (the Grody and Basist (1996) filtering scheme, which uses Special Sensor Microwave Imager (SSM/I) data). Surface daily mean air temperature, cloudiness, a surface terrain roughness index, and a forest density map are also used in the analysis. The new snow cover maps are compared with the original NOAA snow charts and passive microwave snow cover maps, as well as cooperative station snow depth data from Idaho and Minnesota. The comparisons show that the MDSCP draws together the advantages of each of the component products while minimizing the potential errors. The compatibility of this method for use with Moderate Resolution Imaging Spectroradiometer (MODIS) and Advanced Microwave Scanning Radiometer (AMSR) data, which will be available in 2000, is discussed.

It is concluded that these EOS datasets will not only be highly compatible, but will greatly enhance the product. First, the MODIS snow cover product will be produced on a daily basis (Hall ***et al***., 1998); hence, the temporal resolution will be enhanced by a factor of seven. Second, the MODIS snow-mapping algorithm, SNOWMAP, is fully automated and has a Normalized Difference Vegetation Index (NDVI) component to map snow cover more accurately, even in dense forests (Klein ***et al***., 1998). Third, SNOWMAP and the MODIS cloud cover algorithm will be generated at the same time using data from the same instrument, eliminating the manual cloud cover step in the current analysis. Last, both the MODIS data (500 m) and the AMSR data (10 km) will be at higher spatial resolutions than the digitized NOAA snow charts (125 to 205 km) and the SSM/I EASE-grid data (25 km). This will improve the accuracy of the respective snow cover maps, and hence the accuracy of the combined product.

References:

Grody, N.C. and Basist, A.N., "Global identification of snowcover using SSM/I measurements." ***IEEE Transactions on Geoscience and Remote Sensing,*** 34(1), pp 237-249, 1996.

Hall, D.K.; Tait, A.B.; Riggs, G.A. and Solomonson, V.V., "***Algorithm Theoretical Basis Document (ATBD) for the MODIS Snow-, Lake Ice- and Sea Ice-Mapping Algorithms***." Version 4.0. Available from the MODIS web site: http://ltpwww.gsfc.nasa.gov/MODIS/MODIS.html, 50pp, October 1998.

Klein, A.G., Hall, D.K. and Riggs, G.A., "Improving snow cover mapping in forests through the use of a canopy reflectance model." ***Hydrological Processes***, 12(10-11), pp 1723-1744, 1998.

Journal papers published during this reporting period (reprints are available)

Klein, A.G., D.K. Hall and G.A. Riggs, 1998: "Improving snow-cover mapping in forests through the use of a canopy reflectance model," Hydrological Processes, 12:1723-1744.

Hall, D.K., J.L. Foster, D. Verbyla, A.G. Klein and C.S. Benson, 1998: "Assessment of snow-cover mapping accuracy in a variety of vegetation-cover densities in central Alaska," Remote Sensing of Environment, 66:129-137.

Hall, D.K., J.L. Foster, A.T.C. Chang, C.S. Benson and J.Y.L. Chien, 1998: Determination of snow-covered area in different land covers in central Alaska, U.S.A., from aircraft data – April 1995, Annals of Glaciology, 26:149-155.

Journal paper accepted during this reporting period

Riggs, G.A., D.K. Hall and S.A. Ackerman, in press, "Sea Ice Detection with the Moderate Resolution Imaging Spectroradiometer Airborne Simulator," Remote Sensing of Environment.

Conference proceedings papers and presentations

Hall, D.K., "Error analysis for global snow-cover mapping in the Earth Observing System (EOS) Era," IGARSS'98, 8 July 1998.

Tait, A., "High frequency passive microwave radiometry over a snow-covered surface in Alaska," IGARSS'98, 8 July 1998.