Fourth Symposium on Future National Operational Environmental Satellites

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Satellite-Derived Land Surface Fields in the Data Assimilation, Validation and Forcing of the Land Component of NCEP Global and Regional Weather and Climate Prediction Models

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This presentation will describe the source and application by the Environmental Modeling Center (EMC) of the National Centers for Environmental Prediction (NCEP) of a wide suite of large-scale satellite-derived land surface fields in the data assimilation, validation, and forcing of the land component of NCEP Global and Regional Weather and Climate Prediction Models. Such satellite-derived large-scale land surface fields include the following: 1) snow cover, 2) albedo, 3) land surface skin temperature (LST), 4) density and fraction of vegetation cover, 5) vegetation type (landuse class), 6) soil moisture, 7) surface emissivity, and 8) surface solar insolation. Many of these products have been developed by NESDIS, NASA and the Department of Defense in collaboration with key external investigators in the university or federal laboratory arena, such as in the NOAA-NASA-DOD Joint Center for Satellite Data Assimilation (JCSDA) and the NOAA Climate Program Office (CPO).

Several land data assimilation approaches will be illustrated such as 3-D variational assimilation (3DVAR), ensemble Kalman filters (EnKF), and direct insertion. Also, for the case of assimilation of satellite soil moisture fields from microwave sensors, the problem of the lack of dynamic range and low bias in the satellite retrievals will be addressed.

Additionally, this presentation will emphasize the important role of the MODIS satellites in providing the basis for a generational upgrade in the resolution and accuracy of satellite-derived land surface fields and the critical need for the NPOESS era of satellites to continue and improve upon the MODIS capabilities for providing high quality land surface fields. Examples of newly available, JCSDA-sponsored, MODIS-based retrievals of land surface albedo and vegetation characteristics will be presented.

This presentation will also touch on the growing role (and implications) in land data assimilation of applying radiative transfer models, such as the JCSDA Community Radiative Transfer Model (CRTM), including land-surface emission models, in conjunction with adjoint models or Kalman filter techniques, in the direct assimilation of satellite brightness temperatures. One such implication is the growing importance of the correct simulation and validation of land surface skin temperature and land surface emissivity.

Finally, the land-data assimilation infrastructure known as the Land Information System (LIS) will be briefly introduced. LIS was developed by the Hydrological Sciences Branch of NASA/GSFC and it provides a publicly available, flexible and computationally efficient land modeling and land data assimilation infrastructure, such as for use by JCSDA land data-assimilation investigators. LIS includes Kalman filter assimilation algorithms and will include the CRTM as an option in the near future.

Session 5, Societal Benefits: Improving Models and Tools

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