An Enhanced MAPS for the GCIP EOP

NOAA/ERL/FSL

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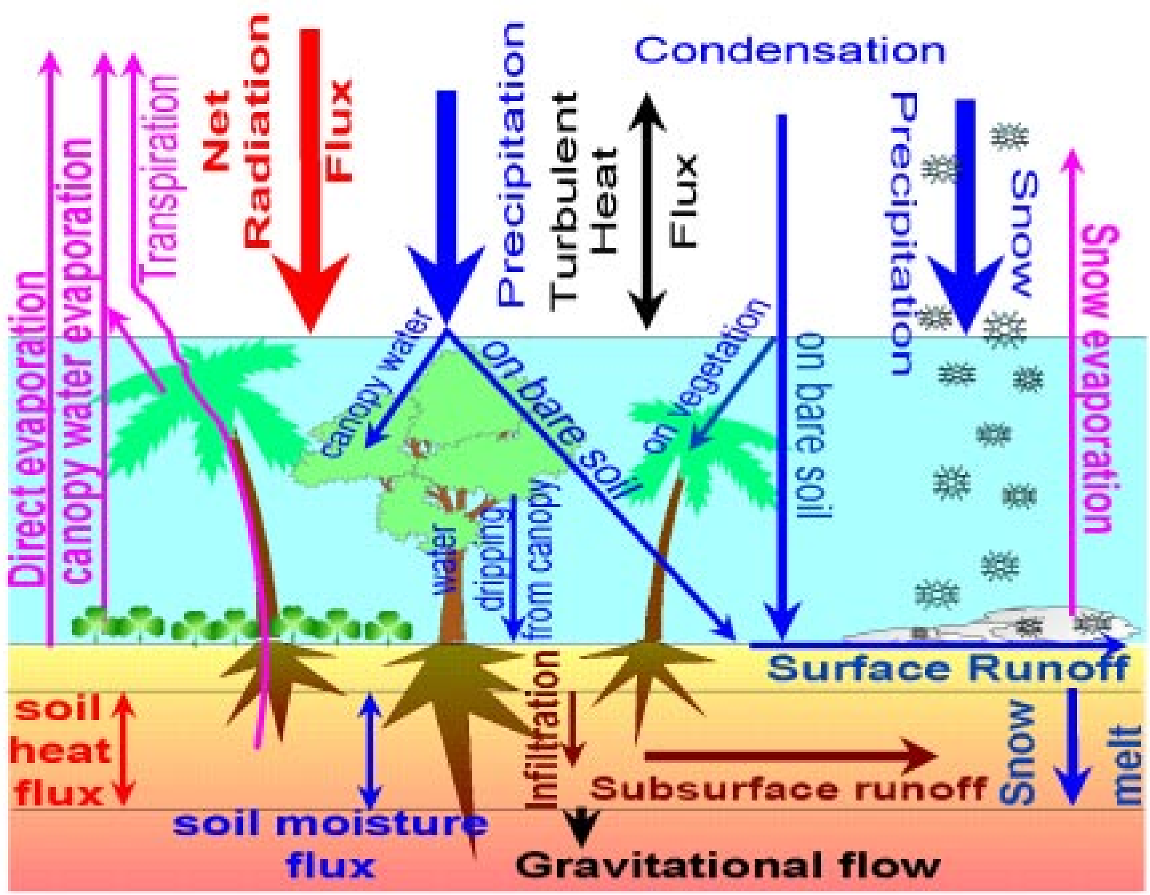
MAPS/GCIP homepage at *http://maps.fsl.noaa.gov/gcip/maps_gcip.cgi*

Abstract - We propose to

- continue to use MAPS (Mesoscale Analysis and Prediction System) to provide high-frequency (1-h), high-resolution regional analyses and short-range forecasts over central North America and adjacent oceanic areas during the balance of the GCIP Enhanced Observational Period;
- develop, test, and implement capabilities for MAPS for improved soil, snow, and boundary-layer processes, including use of new data bases for soil, vegetation, and radiation developed elsewhere;
- perform data sensitivity experiments for use of WVSS (water vapor sensing system) observations from commercial aircraft.



A summary of processes in the 1998 MAPS soil/vegetation/snow land-surface scheme.

Specific tasks

We will improve the quality of gridded data sets provided to GCIP from MAPS by accomplishing the following tasks:

- Use of available higher resolution data sets for land-use and soil types and properties over part of the MAPS domain (USA). We have already switched from a 1° data set for vegetation fraction to the higher resolution NESDIS fields. We plan to incorporate into MAPS the 1-km resolution Continental United States Multi-Layer Soil Characteristics Dataset (CONUS-SOIL), developed at the Earth System Science Center at The Pennsylvania State University. CONUS-SOIL is based on the USDA State Soil Geographic Database (STATSGO). This dataset can provide information for introducing vertical variations in soil types and properties that can be important especially in the mountain areas where the bedrock is closer to the surface than on flatter terrain.

- Improvement in calculation of surface runoff, taking into consideration the slope of terrain and Hydrologic Soil Groups from CONUS-SOIL, which classifies soils by their potential for runoff. This will provide a more realistic infiltration of water into soil and improve the evolution of soil moisture fields.

- Introduction of variable rooting depth and plant resistance to evaporation depending on atmospheric conditions.

- Development, off-line 1-d testing (including PILPS cases), and implementation of frozen soil physics in MAPS. The first step in this direction will be a simple consideration of processes in frozen soil consisting in changing of soil properties in the frozen areas, considerable reduction of hydraulic and diffusional conductivity, or even termination of water movement inside frozen soil, depending on soil temperature. The second step will be the development of a more sophisticated model of frozen soil taking into account the heating or cooling related to phase change of available soil moisture. This will lead to modification of the heat diffusion equation in soil and to considerable complication of its numerical solution.

- Improved treatment of snow cover and snow melt. Energy budgets will be added on the bottom of snow cover as well as on the snow surface, providing possibility of snow melt from the warming effect of underlying soil. The surface energy budget will also be determined for patchy snow cover and other sub-grid-scale variability.

- Further investigation of local climate drift in data-sparse regions (Smirnova et al. 1997a)

- Limited intercomparison of MAPS coupled model products with those from the NCEP Eta and Canadian GEM models, especially for precipitation, surface fluxes, and soil moisture

- Development of boundary-layer techniques to account for counter-gradient fluxes within the context of Burk-Thompson level-3.0 scheme or other higher-order turbulence scheme. These counter-gradient fluxes are important in adequately accounting for entrainment at the top of the boundary layer, an important source of energy for its daytime growth.

Further enhancements to the MAPS assimilation system funded under other auspices are planned over the next 2 years. A major enhancement will be introduction of a 3DVAR analysis procedure now under development (Devenyi 1996) that will produce a more accurate and less noisy analysis than the present optimum interpolation method, and include direct assimilation of remotely sensed data, such as radar reflectivity and radial winds, satellite radiances, GOES and GPS precipitable water and water-vapor drift winds. An improved moisture/cloud analysis is under development as part of the overall 3DVAR effort. In addition to these data types, we also plan to assimilate implied latent heating from NCEP hourly precipitation analyses (being developed at least partly under GCIP sponsorship) when these become available. Resolution of the the national-domain MAPS analysis/model will be increased to ~20 km as new computer resources become available.

MAPS grids will continue to be supplied to NCAR for archival, and an archive of raw model output will continue to be maintained at FSL. Improvements in MAPS will be introduced to the operational Rapid Update Cycle at NCEP within 6-12 months after their introduction in MAPS at FSL, providing a path into operations for GCIP-funded research and development

Experiments showing sensitivity of precipitation and moisture forecasts to WVSS aircraft observations will be conducted when sufficient numbers of these observations become available. The MAPS analysis and model are well-suited to complete use of single-level observations. We plan to run parallel MAPS assimilation cycles for periods of four to seven days with and without WVSS observations. Short-range forecasts of precipitation, clouds, and relative humidity will be compared to assess their impact.