Drought Monitoring and Applications of NASA's Hydrosphere States Mission

NASA's Hydrosphere States Mission, to be launched in 2010, will provide unprecedented global view of the Earth's changing soil moisture and surface freeze/thaw conditions, enabling new scientific studies of global change and atmospheric predictability, and making new hydrologic applications possible, including drought monitoring.

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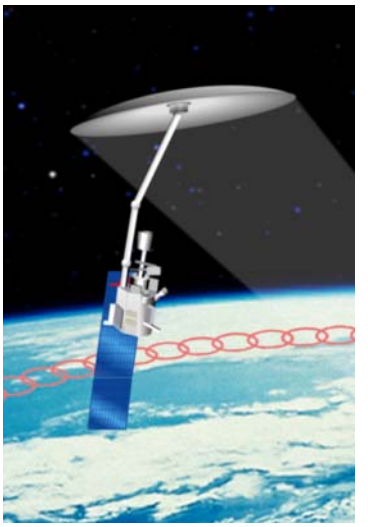
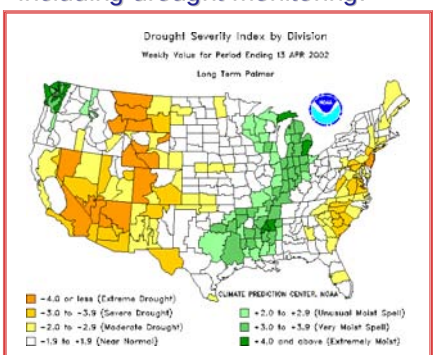
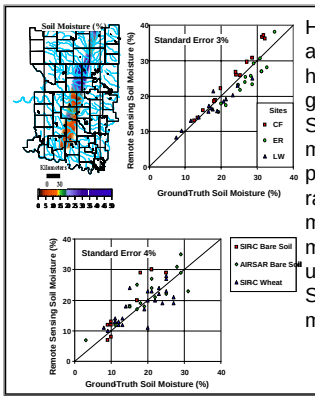
A NASA Earth System Science Pathfinder





Current NOAA and National Drought Mitigation Center (NDMC) Operational Drought Index is Formed by *Modeled* Soil Moisture Accounting

Hydros observations replace proxy estimate used today

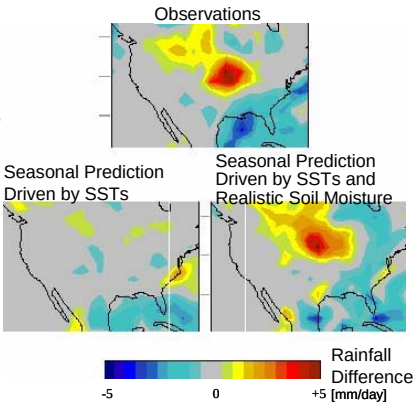


HYDROS soil moisture algorithms are based on a heritage of experiments using ground-based, airborne and Shuttle instruments. (a) Soil moisture map and retrieval performance using airborne radiometer (ESTAR) measurements, and (b) Soil moisture retrieval performance using Airborne (AIRSAR) and Shuttle (SIR-C) radar measurements.

Summer 1993 Flood-Year Rain Accumulation *Minus* Summer 1988 Drought-Year Rain Accumulation

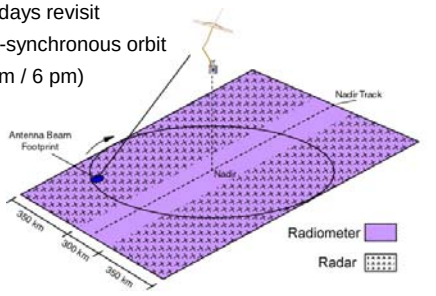
L3_40km_SM Data Product:
Gridded 40 km radiometer global surface (0-5 cm) soil moisture with 2-3 day refresh rate

Soil moisture data can extend seasonal climate predictability by incorporating land memory and land-atmosphere interaction processes in seasonal prediction models



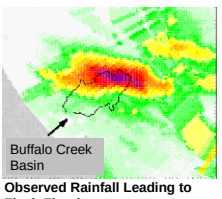
Measurement Approach

- Conically scanning 6-m deployable lightweight mesh reflector
- Simultaneous 40 km passive radiometer and 3-10 km active radar low frequency (L-band) microwave measurements at constant 40° incidence
- 1000 km total swath width for global mapping with 2-3 days revisit
- Sun-synchronous orbit (6 am / 6 pm)



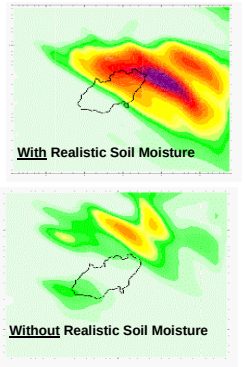
L3_SM_A/P Data Product:
Gridded 10 km radar-radiometer global soil moisture (0-5cm) with 2-3 day refresh rate

Initialization of the soil moisture state in numerical models extends the predictability of processes influenced by surface fluxes



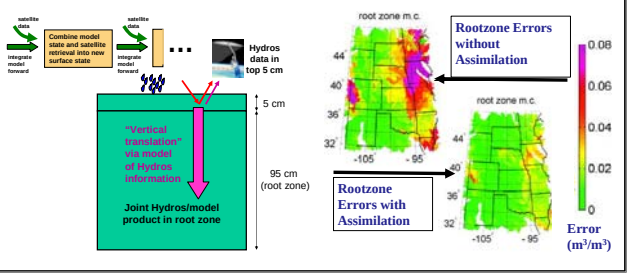
Observed Rainfall Leading to Flash Flood
0000Z to 0400Z 13/7/96
Chen et al. (2001), J. Atm. Sci., 58, 3204-3223.

24-Hours Ahead Atmospheric Model Forecasts



L4_4DDA Data Product:
Gridded 5-10 km global surface and rootzone estimates of soil moisture and surface hydrologic fluxes based on model assimilation of Hydros and other available data

Value-added data assimilation products that extend soil moisture estimates to the rootzone using Hydros, other satellite and ground-based information, and physics-based models



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