NASA Land Information System Multi-Model Ensemble Hydrological Predictions

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Overall Goal

- Multi-model ensemble streamflow prediction based on the Land Information System (LIS)
  - Noah (NOAA/NCEP)
  - SAC-distributed (NOAA/OHD)
  - Catchment-distributed (NASA/GSFC)
  - VIC (UW)
Specific Objectives

- Model evaluation and inter-comparison
  - In situ Soil moisture measurements
  - Surface heat measurements
- Multi-parameter model calibrations
- Assessment of AMSR-E soil moisture products and LIS data assimilation
- 14-day ensemble streamflow prediction
- To improve the LIS ‘Test Bed’ for NOAA applications
Related NASA/NOAA Projects

- NOAA/NWS River Forecasting Center Decision Support (RFS)
  - NASA data *(i.e., MODIS snow and cloud cover)* and LIS modeling to improve river forecasting
  - Implementation of SAC/SNOW-17 and NOAA/OHD streamflow router into LIS
- NASA LIS implementation *(e.g., NOAA NCEP, AFWA and new NOAA NOHRSC)*
Evaluation of Noah at Little Washita, OK

SCAN site

Monthly Rainfall (NLDAS) Amount (mm)

ARS micronet: http://ars.mesonet.org/sites/

Annual Total Rainfall (mm)
Evaluation of Noah at Little Washita, OK

Comparison of Soil Moisture (%) at 5 cm Depth

Comparison of Soil Moisture (%) at 100 cm Depth

Simulated Monthly Runoffs at a grid point

To route the subsurface runoff or not?
Evaluation of Noah at Little Washita, OK

Simulated Annual Total Runoff (mm)

Simulated Annual Evaporation (mm)

STATSGO Soil Texture

UMD 1KM Vegetation Type

Sand

Woodland
Multi-objective/Multi-parameter Model Calibration

Sensitivity analysis of Noah simulated heat flux at San Pedro basin, AZ

- Sensitivity analysis is performed using Monte Carlo simulation (MOGSA, *U. of Arizona*)
  - Kolmogorov-Smirnov(K-S) test for sensitivity
- Multi-objective/ multi-parameter calibration
  - MOSCEM algorithm (*U. of Arizona*) for model calibration

**Courtesy: Rosero and Bastidas, Utah State**
AMSR-E and Data Assimilation

- Evaluation of AMSR-E (Better versions of AMSR-E)
- The effect of AMSR-E on soil moisture & streamflow
- LIS data assimilation ability

USDA-FAS Soil Moisture

EnKF Soil Moisture Product

Courtesy: Bolten et al. (USDA-ARS)
Ensemble Streamflow Prediction

14-day Ensemble forcing

- **Noah**
- **SAC**
- **Catchment**
- **VIC**

Each model may have multiple configurations:
1. baseline
2. optimal calibration
3. data assimilation

Ensemble streamflow & others
OK & DMIP 2 Test Sites: Watersheds TBD

Test site requirements:
- Energy Flux measurement
- Soil moisture measurement
- DMIP 2 basins (for the calibrated parameters)

SGP flux tower

Little Washita watershed (236 sq miles)

NOAA/OHD DMIP 2 basins
Future Work

- Select a test site
- Model evaluations
- Model calibration
- AMSR-E evaluation & DA
- Ensemble forcing data

Router

Ensemble stream flow
Thank you!

Comments/suggestions/questions?