



Data Fusion in Hydrology

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Data Fusion in Hydrology

- Moisture Map

- High resolution water accounting
- Satellite/Model Validation

- General Data Assimilation

- Soil Moisture
- LAI
- Fluxes





Improve weather and climate forecasts with coupled models

Forecast streamflow and river stages

Quantify water availability for water resource management

Above-ground Carbon stock accounting



Assimilated Observations (Collaborations)

Soil Moisture

- -Surface soil moisture (Albergel, Calvet, Reichle)
- -Screen level observations (Mahfouf, de Lannoy)
- -Vegetation (Calvet, Jarlan, Sabater)
- -Skin temperature (Boulet, French)
- -Streamflow (Rüdiger)

Streamflow

- -Runoff (Martin, Thirel)
- -Snow (Dong, Rodell, Sun)



Remotely Sensed Data Products

• Fluxes

–MODIS, Landsat

(future missions: Sentinel, LTM)

Soil moisture and groundwater

–AMSR-E, SMOS, WindSat, ERS-Scat, ASCAT, GRACE, GOCE, (future missions: SMAP, Aquarius)

Vegetation

–MODIS, Landsat, SPOT/VEGETATION (future: Sentinel, LTM)



MoistureMap: Overview ...

Engineering



MoistureMap: Focus Areas





SMOS calibration: a potential calibration site?



Engineering

MoistureMap: AACES





MoistureMap

Delivery

- High-resolution soil moisture information
- Satellite/Model validation
- VIS/NIR/TIR/MW observations

Model/DA Requirements

- Land Surface Model
- NWP/observed forcing data
- NWP ensembles
- Land surface parameterisation



Observation Capabilities

1-5cm surface soil moisture

Spatial Resolution 1-50km (active vs passive)

Observation accuracy approx. 0.06m³/m³

 $(goal 0.04m^3/m^3)$

Global availability 1-3 days

Past assimilation methods

OI, (S)EKF, EnKF



Soil Moisture cont'd





Albergel et al., submitted to HESS www.monash.edu.au

Observation capabilities

LAI, NDVI, NDWI, EVI etc.

Spatial Resolution 10m-1km

Observation accuracy approx. 1m²/m² (LAI)

Global availability 8-10 days

Past Assimilation Methods

(S)EKF, EnKF, 2DVAR



Leaf Area Index cont'd

Model Performance



Leaf Area Index cont'd



Joint Assimilation



Summary

- Universities have the capability to undertake validation and development studies
- All the individually studied remotely sensed products have the capability to improve LSM hydrology
- Those individual assimilation studies have revealed some issues in LSM conceptualisation & DA
- Joint assimilation reduces the error level achieved by assimilating individual observation types
- Main challenge remains in the quantification of model and observation errors
- To continue in this line of study, Universities require
 - a supply adequate forcing and parameterisation data
 - an LSM with dynamic vegetation
 - more support from the agencies that call for our input
 - · being included in the development of models & related activities



Thanks



Observation capabilities

- High temporal resolution
- High spatial resolution in western European countries, US coasts, Australian east coast; low otherwise
- Point scale measurements



Screenlevel Variables cont'd

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Figure 10. Total soil moisture increments in the root zone (mm) accumulated over the month of July 2006 produced (left) by the EKF soil analysis and (right) by the OI analysis.

Mahfouf et al., JGR-Atm, 2009

