CASL Computational Science Seminar

Title: Hydrologic data assimilation of multi-resolution microwave radiometer and radar measurements using ensemble smoothing.

Speaker: Dr Susan Dunne (UCD Meteorology and Climate Centre, and UCD CASL)

Date: Tue 15th May 2007 at 2:00PM

Location: CASL Seminar Room - Belfield Office Park

Abstract: The land surface plays an important role in the climatic system as a large fraction of incoming solar radiation passes through the atmosphere and is dissipated at the surface through turbulent and radiative fluxes. Soil moisture is a key state variable which integrates much of the land surface hydrology, and exerts considerable control on several land-atmosphere exchanges. Data assimilation techniques can be used to estimate soil moisture and related fluxes by merging noisy low frequency microwave observations from remote-sensing with forecasts from a conventional though uncertain land surface model (LSM). Here it is argued that soil moisture estimation is a reanalysis-type problem and thus smoothing is more appropriate than filtering. The Ensemble Kalman Smoother (EnKS) is used to assimilate observed L-band radiobrightness temperatures from the Southern Great Plains Experiment 1997. Estimated surface and root zone soil moisture is evaluated using gravimetric measurements and flux tower observations. It is shown that the EnKS can be implemented as a fixed-lag smoother with the required lag determined by the memory in subsurface soil moisture. In a synthetic experiment over the Arkansas-Red river basin, "true" soil moisture from the TOPLATS model is used to generate synthetic Hydros observations which

are subsequently merged with modeled soil moisture from the Noah LSM using the EnKS. It is demonstrated that the EnKS can be used in a large problem, with a spatially distributed state vector, and spatially-distributed multi-resolution observations. This EnKS-based framework is used to study the synergy between passive and active observations, which have different resolutions and error distributions.

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