



Multi-scale multi-sensor data assimilation for terrestrial water budget estimation: experiment over Red-Arkansas river basin

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A long standing goal of the WCRP Global Energy and Water Experiment (GEWEX) is estimating the water and energy budgets globally through remote sensing. With the launch of the NASA Earth Observing System (EOS) Aqua platform of sensors, the possibility now exists for retrieving almost all terms of the terrestrial water budget. These budget terms (and their potential sources) are: precipitation (TRMM microwave + GOES infrared), terrestrial evapotranspiration (MODIS surface temperatures + AIRS surface air temperatures/humidity + CERES/MODIS net solar radiation), and soil moisture (AMSR-E microwave + AIRS surface temperatures). River discharge is currently taken from in-situ measurements, but in the future swath altimetry offers a space based sensor. In this study, we assimilate some of these remotely sensed quantities into a land surface modeling (LSM) system in order to achieve a more comprehensive estimation of terrestrial water and energy processes and to further advance our knowledge on global water and energy budgets.

Here, the Variable Infiltration Capacity (VIC) model will serve as the LSM to derive first guess of soil moisture, evapotranspiration and runoff, using satellite based rainfall ensembles (GOES + TRMM). An Ensemble Multiscale Filter (EnMSF) is then used to assimilate the satellite retrieved soil moisture. Together, this assimilation system produces a remote sensing based water budget estimation. EnMSF has been developed to efficiently merge spatial fields of high dimensions ($\sim O(10^6)$ pixels). This technique is especially attractive and promising for satellite based remote sensing applications

because satellite data are naturally of high dimensions and with multiscale features. Our experiment over the Red-Arkansas river basin (1062 pixels) during the summer of 2004 will test the EnMSF technique for the first time in a realistic setting so as to explore the strengths of the approach for regional water budget applications. The water budget terms obtained from the assimilation will be compared to values simulated by VIC using observations from the North American Land Data System (NLDAS) data archive.