Geophysical Research Abstracts, Vol. 8, 10927, 2006
SRef-ID: 1607-7962/gra/EGU06-A-10927

Monthly-diurnal water budget variability over Gulf of Mexico-Caribbean Sea basin from satellite observations.

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This study presents results from a multi-satellite/multi-sensor retrieval system designed to obtain the atmospheric water budget over the open ocean. A combination of hourly-sampled monthly datasets derived from the GOES-8 5-channel Imager, the TRMM TMI radiometer, and the DMSP 7-channel passive microwave radiometers (SSM/I) have been acquired for the combined Gulf of Mexico-Caribbean Sea basin. Whereas the methodology has been tested over this basin, the retrieval system is designed for portability to any open-ocean region.

Algorithm modules using the different datasets to retrieve individual geophysical parameters needed in the water budget equation are designed in a manner that takes advantage of the high temporal resolution of the GOES-8 measurements, as well as the physical relationships inherent to the TRMM and SSM/I passive microwave measurements in conjunction with water vapor, cloud liquid water, and rainfall. The methodology consists of retrieving the precipitation, surface evaporation, and vapor-cloud water storage terms in the atmospheric water balance equation from satellite techniques, with the water vapor advection term being obtained as the residue needed for balance. Thus, the intent is to develop a purely satellite-based method for obtaining the full set of terms in the atmospheric water budget equation without requiring *in situ* sounding information on the wind profile.

The algorithm is validated by cross-checking all the algorithm components through multiple-algorithm retrieval intercomparisons. A further check on the validation is

obtained by directly comparing water vapor transports into the targeted basin diagnosed from the satellite algorithms to those obtained observationally from a network of land-based upper air stations that nearly uniformly surround the basin, although it is fair to say that these checks are more effective in identifying problems in estimating vapor transports from a "leaky" operational radiosonde network than in verifying the transport estimates determined from the satellite algorithm system.

Total columnar atmospheric water budget results are presented for an extended annual cycle consisting of the months of October-97, January-98, April-98, July-98, October-98, and January-1999. These results are used to emphasize the changing relationship in E-P, as well as in the varying roles of storage and advection in balancing E-P both on daily and monthly time scales and on localized and basin space scales. Results from the algorithm-to-algorithm intercomparisons are also presented in the context of sensitivity testing to help understand the intrinsic uncertainties in evaluating the water budget terms by an all-satellite algorithm approach.