Closing the global water cycle: recent results from analyzing long-term Climate Data Records

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Abstract: Comprehensive documentation of the terrestrial water and energy cycles at the global scale, and their evolution over time, is fundamental to understanding Earth's climate system and assessing the impacts due to climate change. Such documentation is also needed to characterize the memories, pathways and feedbacks between key water, energy and biogeochemical cycles. With such enhanced understanding, there is the potential for research programs to resolve overarching scientific goals to document the energy and water cycles. The WCRP Global Energy and Water Exchanges (GEWEX) project has a long-term scientific goal to obtain a quantitative description of weather-scale variations in the global energy and water cycles over a period of at least 20 years, which will provide the needed scientific basis for understanding climate variability and change.

This presentation will present research at Princeton on the development of multi-decadal (1982-2009) Climate Data Records (CDR) for the terrestrial water and energy budget variables using multiple remote sensing estimates, merged with in-situ and model estimates. The resulting data set, merged with estimates over the oceans from the GDAP SeaFlux initiative demonstrates that the global water cycle can be closed to within less than 5%. These data sets have been used to assess the variability and trends in the terrestrial water and energy budgets for ~1600 small basins, 32 large global basins and at continental scales. The CDR are used to assess climate change and whether there has been detectable changes to the terrestrial hydrological cycle.