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Global Flood and Drought Prediction

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While methods and accuracy of weather and climate forecasts have improved greatly over the last two decades, this capability has yet to be evidenced in mitigation of water-related natural hazards (primarily floods and droughts) in the developing world. For instance, Mozambique experienced major droughts in 2005 and 2002 which resulted in widespread food shortages, and major floods in 2000 and 2001 which affected large parts of the country. In Southeast Asia, early monsoon rains that began in July 2000 resulted in flooding of the Mekong River and its tributaries in Cambodia, Vietnam, Laos and Thailand. It was the worst flooding in several decades and affected more than 4.5 million people and killed several hundreds. Despite the above noted improvement in weather and climate forecast accuracy, there is at present no system for forecasting of floods and droughts globally, although the potential clearly exists. We describe a methodology that is eventually intended to generate global flood and drought predictions routinely. It draws heavily from the experimental North American Land Data Assimilation System (N-LDAS) and the companion Global Land Data Assimilation System (G-LDAS) for development of nowcasts, and the University of Washington Experimental Hydrologic Prediction System to develop ensemble hydrologic forecasts based on the NCEP Global Forecast System for lead times from seven days to six months. In the spin up phase, the system is driven by the CMORPH global precipitation products, and ECMWF surface air temperature products, which drive the Variable Infiltration Capacity (VIC) model globally. In the forecasting mode, VIC is driven by global ensemble forecasts. Downward solar and longwave radiation, surface relative humidity, and other model forcings are derived from relationships with the daily temperature range. The initial system is implemented globally at one-half degree spatial resolution. We evaluate model performance retrospectively for observations of the discharge of 26 major global rivers that are minimally regulated, and compare predictions of major floods in the Mekong in 2002 (mentioned above) and

the Limpopo (2001), as well as major drought events. We also evaluate retrospective forecasts (using higher quality data than would have been available in real-time) for these same events.