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GLEAM evaporation and soil moisture: current state and ongoing efforts

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Approximately two-thirds of continental precipitation is evaporated back into the atmosphere. This highlights the influence of terrestrial evaporation for the distribution of hydrological resources, from catchment to planetary scales. The ability to monitor terrestrial evaporation dynamics is critical for climatological applications, since evaporation directly affects air temperature, influences air humidity and cloud formation, and is intrinsically connected to photosynthesis. To date, terrestrial evaporation cannot be observed directly from space, and in situ networks remain too sparse for both research and practical activities, making terrestrial evaporation one of the most uncertain components of Earth's energy and water balance. However, a range of approaches have been proposed over the last decade to indirectly derive evaporation by applying models that combine the satellite-observed environmental and climatic drivers of the flux. One of these pioneering methods is the Global Land Evaporation Amsterdam Model (GLEAM; Miralles et al. 2011).

GLEAM combines global satellite observations of meteorological variables – (e.g.) precipitation, surface net radiation and air temperature – and surface characteristics – (e.g.) soil and vegetation water content and snow depth. Since its publication almost 10 years ago, the model has been widely used to analyse trends in the water cycle, study land–atmospheric feedbacks or benchmark climate models. Advantages of GLEAM over analogous methods are the estimation of evaporation under cloud conditions due to the exploitation of microwave data, the explicit estimation of root-zone soil moisture data, and the detailed calculation of rainfall interception. Current model development efforts concentrate on (a) the increase in spatial resolution for its application to water management and agricultural applications and (b) the assimilation of novel satellite observations. This presentation provides a general overview of the framework and concentrates on ongoing efforts that strive in the direction of assimilating Gravity Recovery and Climate Experiment (GRACE) and Soil Moisture Active–Passive (SMAP) observations to improve the root-zone soil moisture estimates.

References Miralles, D. G., Holmes, T. R. H., De Jeu, R. A. M., Gash, J. H., Meesters, A. G. C. A. and Dolman, A. J.: Global land-surface evaporation estimated from satellite-based observations, Hydrol. Earth Syst. Sci., 15(2), 453–469, doi:10.5194/hess-15-453-2011, 2011.