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Inter-annual energy partitioning over the West African savanna: evaporation and surface conductance measurments and modeling in Easter Burkina Faso

F. Bagayoko (1,2), N. van de Giesen (1,2), S. Yonkeu (3), J. Elbers (4)

(1) Water Resources, Faculty of Civil Engineering and Geosciences, TU Delft, The Netherlands, (2) Center for Development Research (ZEF), Bonn, Germany (3) Groupe EIER-ETSHER, Ouagadougou, Burkina Faso, (4) ALTERA, Wageningen, The Netherlands

Seasonal variability of the energy partitioning was analyzed with a combination of eddy flux and weather data on intensely farmed land in the savanna area of Eastern Burkina Faso, West Africa (11° 07' N; 0° 31' E). The analysis covers two rainy seasons (May to October 2003 and 2004), one dry season (December to April 2004), two dry to wet transition periods (May to June 2004) and two wet to dry transition periods (October to November 2004). This is the first time long-term flux measurements are reported upon for this part of the world. Latent heat flux was the main consumer of the available energy during the rainy season (71 %) while sensible heat flux was dominant during the dry season (77 %). The relatively wet rainy season of 2003 had higher peak of latent heat flux (194 W/m^2) than the relatively dry rainy season of 2004 (176 W/m^2). Similarly, sensible heat flux was lower in 2003 (66 W/m^2) and higher in 2004 (81 W/m^2) for the same period. Surface conductance peaked in 2003 and 2004 during the rainy season at 39 mm/s and 38 mm/s, respectively. During the dry season, surface conductance was strongly coupled to atmospheric demand but was much reduced due to low soil moisture availability and high vapor pressure deficit ($>$ 4 kPa). The study also shows a multiple correlations between variables, which make it difficult to point out the exact individual contribution of each of them. However, the main driving factor was found to be moisture availability, and all or part of the other contributing variables in the process depends on this main factor. During the rainy season, latent heat flux was decoupled from atmosphere demand. Following this pattern of coupling and decoupling, a new formulation of actual evapotranspiration and surface conductance was proposed. Results seem to be satisfactory and could be relevant inputs for

eco-hydrological models in the semi-arid region of West Africa. KEY WORDS: Energy partitioning, actual evapotranspiration, surface conductance, savanna, Burkina Faso, West Africa.