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The daily and annual (2007) effects of dew on a non-ventilated net radiometer

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Although dew is an unimportant source of moisture in humid areas, plants and arthropods living in some arid regions depend on it for survival. On the other hand, the formation of dew mainly on the upper dome of a non-ventilated net radiometer seriously affects the measurement of available energy (net radiation). Net radiometers measure the available or net energy and are widely used for estimation of evapotranspiration throughout the world. To study the effects of dew on a non-ventilated net radiometer, a radiation station was set up which uses 2 CM21 Kipp & Zonen pyranometers (one inverted), 2 CG1 Kipp & Zonen pyrgeometers (one inverted), along with a Q*7.1 net radiometer (Radiation & Energy Balance Systems, Inc.; REBS) in a semi-arid mountainous valley in Logan, Utah, U.S.A. The pyranometers and pyrgeometers were ventilated using 4 CV2 Kipp & Zonen ventilation systems. The net radiometer was not ventilated. The ventilation of pyranometers and pyrgeometers prevents dew and frost deposition and snow accumulation which otherwise would disturb measurements. All sensors were installed at about 3.0 m above the ground, which was covered with natural vegetation during the growing season (May - September). The incoming and outgoing solar or shortwave radiation, the incoming (atmospheric) and outgoing (terrestrial) longwave radiation, and the net radiation have been continuously measured by pyranometers, pyrgeometers and a net radiometer, respectively, since 1995. These parameters have been measured every 2 seconds and averaged into 20 minutes. To evaluate the effect of dew on the non-ventilated net radiometer 6 April 2007 with early morning dew was chosen. Dew formation occurred mainly on the upper dome of the non-ventilated Q*7.1 net radiometer on this day, while the ventilated Kipp & Zonen system was free of dew. Net radiation measured by the non-ventilated net radiometer Rn,unvent. during dew periods of the above-mentioned day was greater than the ventilated ones Rn,vent. (-0.3 MJ m-2 vs. -1. 2 MJ m-2 during almost 4 hours on 6 April 2007). The reason for higher reading by the non-ventilated net radiometer during dew periods was due to emission of additional longwave radiation from water formed mainly on the upper dome of the Q*7.1 net radiometer. During 2007, net radiation measured by the non-ventilated net radiometer Rn,unvent. during dew periods was 326 MJ m-2 compared to 316 MJ m-2 for Rn,vent.