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Evaporation over saturated bare soil: the role of soil texture

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Calculating actual bare soil evaporation (ET_a) on the basis of potential bare soil evaporation (PE) is a widely followed approach in many disciplines including hydrogeology, hydrology and agricultural sciences. This approach considers that PE is independent from soil properties, and only ET_a is affected by soil properties. In this work, in a unique experiment, seasonal and diurnal cycles of PE over saturated bare soil were assessed for lysimeters installed in the Guanzhong Basin, China. The assessment was made for different soil textures including gravel (PE_{gravel}), coarse sand (PE_{coarse}) and fine sand (PE_{fine}) and also open water (PE_{water}). Meteorological variables, ground heat flux and soil temperature were captured at a high temporal resolution (5 min.) for more than 15 consecutive months. The daily evaporation rates over saturated bare soil (PE_{soil}) showed clear differences between gravel, coarse sand and fine sand, with higher PE for fine sand, smaller PE for coarse sand and smallest PE for gravel, during spring and summer. In addition, PE_{water} was smaller than PE for the saturated bare soil lysimeters. In autumn and winter, the measured PE rates over different surfaces showed only minor differences. The measurement data also revealed that during spring and summer night-time PE was considerable with ~1.0 mm ET per night. These results can be quantitatively explained with detailed calculations of the energy balance, considering the different porosities for gravel, coarse sand and fine sand, as well as the thermal conductivities of the phases which constitute the porous media.