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Coupling soil-atmosphere mass and energy fluxes: the effect of the soil surface resistance on vapor flux.

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The quantification of soil evaporation and of soil water content dynamics near the soil surface are critical in the physics of land-surface processes on regional and global scales, in particular in relation to mass and energy fluxes between the ground and the atmosphere. Questions remains about the correct computation of key factors such as the soil surface resistance or the soil surface temperature. This study was conducted to test different formulations for the soil surface resistance parameter and test their effect on soil evaporation. A numerical code implements a non-isothermal solution of the vapor flux equation that accounts for the thermally driven water vapor transport and phase changes. Simulated soil temperature, heat flux, and water content were in good agreement with measured values. Different results were obtained for evaporation calculations, depending on the choice of the soil surface resistance equation, which was shown to be a fundamental term in the soil-atmosphere interactions. The results also demonstrated that soil water dynamics are strongly linked to temperature variations and that it is important to consider coupled transport of heat, vapor and liquid water when assessing energy dynamics in soils.