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The land surface transforms incoming, absorbed radiation into other energy forms and radiation with longer wavelengths. The land surface emits long-wave radiation, stores energy in the soil, the biomass and the air in the boundary layer, and exchanges sensible and latent heat with the atmosphere. The latter, latent heat consists of evaporation from the soil and canopy and transpiration by plants. Plants enhance in this picture the absorption of incoming radiation and decrease the resistance for evaporation of deeper soil water. Transpiration by plants is therefore either energy-limited by low incoming radiation or water-limited by small soil moisture. In the extreme cases, all available energy will be used for evapotranspiration in cold regions and all available water will be used for evapotranspiration in arid regions. Very simple formulations of latent heat, which include plant processes only very indirectly, work well in hydrologic models for these limiting cases. These simple formulations seem to work also surprisingly well in temperate regions. Hydrologic models have, however, considerable problems in semi-arid regions where the vegetation influence on latent heat should be largest. But the models have to deal with much more problems in these regions. For example data scarcity in the Mediterranean leads to very large model uncertainty due to the forcing data. Water supply is also often very regulated in semi-arid regions. Variability in river discharge can hence be largely driven by the anthropogenic influence rather than natural meteorological variations in these regions.

Here we will show for Europe the areas and times when the descriptions of plant processes are important for hydrologic models. We will compare differences in model uncertainties that come from 1. different formulations of evapotranspiration, 2. different descriptions of soil-plant interactions, and 3. uncertainty in the model's input data. It can be seen that model uncertainty stemming from uncertain input data is similar or larger in magnitude than the uncertainty coming from the descriptions of the vegetation in the models. Acquisition of better input data should thus go hand in hand with more sophisticated descriptions of the land surface.