Global high-resolution reference potential evaporation

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Abstract: The increasing pressure on water resources worldwide request for both global and local scale assessments of fresh water availability. Gridded global reference potential evaporation (PET) datasets derived from either satellite or re-analysis data already exist, yet their time-coverage is often limited. Moreover the spatial and/or temporal resolution does not match the local scale requirements or the ever increasing resolutions of global hydrological models. We here introduce a high-resolution gridded reference potential evaporation dataset covering a period of 34 years that can be used in data sparse regions and for global scale analysis.

The dataset is derived from the WATCH-Forcing-Data-ERA-Interim (WFDEI) dataset which has a resolution of 0.5◦ by 0.5◦. By basic oversampling of such coarse data large and systematic biases are introduced, particularly in areas with strong relief. By down-scaling based upon a high resolution DEM, the main variables for determining reference evaporation can be down-scaled and improved considerably for the complete period of the reanalysis based meteorological forcing.

Down-scaling 10x10 km resolution was performed by applying a lapse rate on temperature, an altitude correction on air pressure and incoming radiation and by taking the effect of aspect, slope and local shading on illumination into account. Subsequently we produced Penman-Monteith, Priestley-Taylor and Hargreaves reference evaporation estimates. We analysed the impact of the down-scaling methods on calculated reference evaporation by comparison with (1) reference potential evaporation estimates based upon the WorldClim datasets and (2) locally derived Hargreaves evaporation for the Australian Murrumbidgee basin.

The WFDEI based Hargreaves estimates show highest resemblance with the WorldClim estimates, the Priestley-Taylor estimates are closest to the ensemble mean of the three estimates. The Penman-Monteith equation results in relatively large biases for the Sahara, Amazon and desert region of Australia. This is in line with other comparisons of the different PET equations for arid climates.

The high resolution data and the down-scaling tools are made available through the eartH2Observe data portal at http://wci.earth2observe.eu and https://github.com/earth2observe/downscaling-tools.

Keywords: *Reference potential evaporation, eartH2Observe, WFDEI, high-resolution*

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