

Hydrological balance of the Danube river basin: an intercomparison study

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The assessment of the reliability of the current climate models in the representation of the climatology of the hydrological balance, both in terms of mean value and variability, of the basin of the Danube river is crucial, because of its relevance at social, economical, and environmental level. The hydrological balance of the Danube basin bears at least a twofold direct relevance to the climate of the Mediterranean region. Firstly, the Danube runoff gives a relevant contribution of freshwater flux into the Mediterranean sea. Secondly, given the geographical position and the complex orography of the basin, the Danube depends mostly on precipitated water of Mediterranean origin. The Danube basin is the second-largest in Europe, is shared between 17 countries and accounts for an area of about 800.000 Km². The hydrological balance is computed by integrating the precipitation and evaporation fields over the region of interest. The considered datasets include the 1961-2000 simulations of several Global Climate Models included in the IPCC 4th Assessment Report, the 1961-1990 simulations of several Regional Climate Models produced for the recent PRUDENCE project. Data from the NCEP/NCAR and ECMWF reanalyses are also analyzed. Large discrepancies exist for the monthly climatology as well as for the mean and variability of the yearly balances, and only few datasets, which do not include the reanalyses, provide estimates which are consistent with the observed discharge values of the Danube at its Delta. Since the considered approach relies on the mass conservation principle at the air-land interface and essentially bypasses the details of soil modelling, we propose that the atmospheric components of climate models still face difficulties in representing the current water balance even on a relatively large scale, and we further suggest that these issues should be carefully analyzed in the perspective of estimating the impacts of future climate changes.