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# Hydrological cycle of the Danube basin: Present-day and XXII Century simulations by IPCC models

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We present an intercomparison and verification analysis of 20 global climate models (GCMs) included in the 4th IPCC assessment report regarding their representation of the statistical properties of the hydrological balance of the Danube river basin for 1961-2000. The hydrological balance is computed by integrating the precipitation and evaporation as well as the runoff fields over the area of interest. The span of the simulated mean annual balances is about 50% of the observed discharge values of the Danube at its Delta; the true value is within the range simulated by the models. When considering the monthly climatology, for most models the water balance is negative in the summer and peaks near the winter solstice. The runoff seasonal cycle is delayed by a few months, with maximum in early spring and minimum in late summer. The existence of deficiencies in some land models is shown by the disagreement between the hydrological balance estimates obtained with the runoff fields with respect to those obtained via precipitation and evaporation. The overall performances and the degree of agreement of the GCMs are comparable to those of the RCMs analyzed in a previous work, in spite of the much coarser resolution and the common nesting of all the RCMs, so that the results are encouraging, and suggest that global modeling is a more robust procedure for simulating climate also when smaller scales are considered. We have also analyzed the changes in the hydrological balance as simulated by the 2161-2200 SRESA1B runs. All models agree on describing a stronger hydrological cycle in the basin, typically with increased precipitation and evaporation. Nevertheless, since the evaporation signal is stronger the net water balance typically decreases by about 15%. The main changes to the monthly climatologies occur in spring and are likely to be attributable mainly to the decrease of snow cover. We suggest that these results should

be carefully considered in the perspective of auditing climate models and assessing their ability to simulate future climate changes.