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Sensitivity of river discharge to the quality of external meteorological forcings

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Large-scale river routing models are essential tools to close the hydrological cycle in fully coupled climate models. Moreover, the availability of a realistic routing scheme is a powerful instrument to assess the validity of land surface parameterization, which has been recognized to be a crucial component of the global climate.
This study is dedicated to assess the sensitivity of river discharge to the variation of external meteorological forcing. The Land Surface Scheme created at the Center for Ocean, Land and Atmosphere Studies (COLA), the SSiB model, was constrained with different meteorological fields. The resulting surface and sub-surface runoffs were used as forcing data for the HD River Routing Scheme. As expected, river flow is mainly sensitive to precipitation variability, but changes in radiative forcing affect discharge as well, presumably due to the interaction with evaporation. Also, this analysis provided an estimate of the sensitivity of river discharge to precipitation variations. A few areas, like Central and Eastern Asia, Southern and Central Europe and the majority of the US, show a magnified response of river discharge to a given percentage change in precipitation. Hence, an amplified effect of droughts following the reduction in precipitation, as it is indicated by many climate scenarios, may occur in places such as the Mediterranean. Conversely, increasing summer precipitation foreseen in Southern and Eastern Asia may amplify floods in one the poorest and most populated regions in the world.
These results can be used for the definition and assessment of new strategies for land use and water management in the near future.