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A new representation of river basin discharge in the global climate system

S. Materia, A. Alessandri, and A. Navarra
Centro Euromediterraneo per i Cambiamenti Climatici, Bologna, Italy

Large scale river routing models are essential tools to close the hydrological cycle in fully coupled models. Moreover, the availability of a realistic routing scheme is a powerful instrument to assess the validity of land surface parameterization, which is a crucial component of the global climate.
In this study, the hydrological model Hydrology Discharge (HD) has been used as the basis of a new concept of river routing scheme. The new model, named HYDROS (HYdroDynamic ROuting Scheme), overcomes one of the major limitation of the approaches currently used in GCMs, that is the use of time-independent flow velocities parameterized as a function of topography. Through the equation of Darcy-Weisbach, HYDROS defines a time-varying flow velocity, depending on the amount of runoff generated by the GCM and the flow through the river system. River width was parameterized through hydraulic geometry relations, and water resistance to flow was simulated by means of the friction factor f. This inclusions are fundamental to separate the stream into overland flow (on the surface) and river flow (inside the river bed).
Results show some improvements in simulation of the phase of mean annual river discharge, especially in regions where the flow is slowed down by territory characteristics. One example is Parana catchment basin, where discharge is delayed during the year due to floods. Refinements are evident at high latitudes also, where the improved flow velocity better catches the discharge peaks after the spring snow-melting.
The new routing model cannot improve the volumes of simulated river discharge, which magnitude depends on the ability of the GCM land surface scheme to generate correct surface and sub-surface runoff.
In order to resolve possible feedbacks in the climate system, the new routing scheme will be soon implemented into the CMCC coupled model to guarantee a plausible amount and timing of fresh water discharge into the global ocean.