Integrated modelling of forest growth and hydrologic processes for forest management

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Abstract: Forests play a major role in regulating the global carbon cycle and the hydrologic cycle, global warming, and forest production. This poses a big challenge for forest catchment management, as it requires addressing several questions, e.g. what is the impact of deforestation and reforestation on hydrologic processes (e.g. evaporation, streamflow, groundwater system, and flooding), and what is the impact of climate change on hydrologic processes (evaporation, streamflow, etc) and forest production. This often requires a holistic understanding the interactions among climate, geology, tree growth, nutrient, and both surface and groundwater bodies. In this study, we integrated a forest hydrologic model CABALA (Battaglia et al. 2004) with a groundwater model (Pauwels et al. 2002) to simulate these interactions. This integrated model was then applied in two forest experimental catchments in Chile, i.e. Maria Las Cruces and Quivolgo with drainage areas of 19 ha and 40 ha (Balocchi et al. 2002), respectively, where water resources and forest production are of major concerns. Results indicate the integrated model can correctly simulate forest growth, catchment evapotranspiration and streamflow. Sensitivity analysis indicates that parameters of tree species and forest growth, soil (e.g. hydraulic conductivity), and topography (e.g. catchment slope) have the most impact on the streamflow. The integration of these models seems promising to support the management of forest catchments that need to consider a more holistic approach regarding water management.

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