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A Hybrid Modelling Approach for Assessing the Water Footprint of the German Bio-Economy

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Abstract: The national research strategy “BioEconomy 2030” of the German Federal Ministry of Education and Research (BMBF) portrays the vision of a sustainable, bio-based economy. This bio-economy (BE) is oriented towards nature-like material cycles, supplies sufficient and healthy food and delivers high value products and energy from renewable raw materials while preserving natural resources. Management and controlling of the societal and economic transition towards such a BE requires appropriate monitoring and assessment tools. We present the concept and prototypic application of a new method for the accounting and modelling of water use in global agricultural production related to the German BE. The method is an integral component of a national BE-monitoring system, which is currently under development. The water footprint concept introduced by Arjen Hoekstra and colleagues is enhanced to analyse the ‘remote impacts’ of imported agricultural commodities both on water quantity and water quality in producer countries on sub-watershed level. Information on trade flows is derived from multiregional input-output databases (e.g. EXIOBASE). This data is linked with different types of water scarcity metrics based on outcomes generated with the global-scale water resources model WaterGAP3 and the land-use model LandSHIFT. Both models operate on a 5 by 5 arc-minute grid scale and simulate hydrological and land-use processes as well as water use by agriculture (irrigation), industries, electricity generation and households. This allows us to account for the contribution of exported agricultural commodities to regional water scarcity as well as for water pollution impacts by nutrient loads and salinization from agricultural management.

***Keywords**:* Bio-economy; monitoring; water footprint; modelling.