



## Reassessing the planetary boundary for freshwater consumption

Dieter Gerten (1), Amandine Pastor (2), Jonas Jägermeyr (1), Holger Hoff (1,3), Johan Rockström (4), and Matti Kummu (5)

(1) Earth System Analysis, Potsdam Institute for Climate Impact Research, Potsdam, Germany (gerten@pik-potsdam.de), (2) Earth System Science, Wageningen University, Wageningen, The Netherlands, (3) Stockholm Environment Institute, Stockholm, Sweden, (4) Stockholm Resilience Centre, Stockholm, Sweden, (5) Water & Development Research Group, Aalto University, Espoo, Finland

This presentation reviews the conceptual and quantitative foundation of the recently suggested ‘planetary boundary’ for freshwater (i.e. the volume of human ‘blue’ water consumption that is deemed to be tolerable; see Rockström et al. in *Nature* 2009). It also proposes ways forward to refine and reassess this planetary boundary. As a key element of such a revision we provide a bottom-up quantification of local water availabilities taking account of environmental flow requirement in a spatially explicit manner and using five different methods to estimate these flow requirements with a global dynamic hydrology and vegetation model (LPJmL). Our analysis suggests that the planetary boundary for freshwater consumption may adopt a value of about 2800 km<sup>3</sup> yr<sup>-1</sup> (which is the average of an uncertainty range of 1100–4500 km<sup>3</sup> yr<sup>-1</sup>). This is notably lower than the original suggestion based on a simpler top-down analysis that relied on some global estimates of environmental flow requirements (4,000 km<sup>3</sup> yr<sup>-1</sup>, the lower value of an uncertainty range of 4000–6000 km<sup>3</sup> yr<sup>-1</sup>). Although assessed with spatial detail, this new estimate remains provisional, pending further refinement by analyses of local water accessibility and further constraints up-scaled to the global domain, including study of cascading impacts on Earth system properties. Nonetheless, with a current blue water consumption of >1,700 km<sup>3</sup> yr<sup>-1</sup>, it appears that the freshwater boundary appears is being approached fast, and perhaps faster than suggested earlier. Thus, design opportunities to remain within this boundary are imperative - we argue that their comprehensive quantification requires analysis of tradeoffs with other planetary boundaries such as those for land use and climate change.