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Identification of water quality degradation hotspots in developing countries by applying large scale water quality modelling

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Decreasing water quality is one of the main global issues which poses risks to food security, economy, and public health and is consequently crucial for ensuring environmental sustainability. During the last decades access to clean drinking water increased, but 2.5 billion people still do not have access to basic sanitation, especially in Africa and parts of Asia. In this context not only connection to sewage system is of high importance, but also treatment, as an increasing connection rate will lead to higher loadings and therefore higher pressure on water resources. Furthermore, poor people in developing countries use local surface waters for daily activities, e.g. bathing and washing. It is thus clear that water utilization and water sewerage are indispensable connected.

In this study, large scale water quality modelling is used to point out hotspots of water pollution to get an insight on potential environmental impacts, in particular, in regions with a low observation density and data gaps in measured water quality parameters. We applied the global water quality model WorldQual to calculate biological oxygen demand (BOD) loadings from point and diffuse sources, as well as in-stream concentrations. Regional focus in this study is on developing countries i.e. Africa, Asia, and South America, as they are most affected by water pollution. Hereby, model runs were conducted for the year 2010 to draw a picture of recent status of surface waters quality and to figure out hotspots and main causes of pollution.

First results show that hotspots mainly occur in highly agglomerated regions where population density is high. Large urban areas are initially loading hotspots and pollution prevention and control become increasingly important as point sources are subject to connection rates and treatment levels. Furthermore, river discharge plays a crucial role due to dilution potential, especially in terms of seasonal variability. Highly varying shares of BOD sources across regions, and across sectors demand for an integrated approach to assess main causes of water quality degradation.