Identification of hotspots and trends of fecal surface water pollution in developing countries

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Water is the essential resource ensuring human life on earth, which can only prosper when water is available and accessible. But of importance is not only the quantity of accessible water but also its quality, which in case of pollution may pose a risk to human health. The pollutants which pose a risk to human health are manifold, covering several groups such as pathogens, nutrients, human pharmaceuticals, heavy metals, and others. With regards to human health, pathogen contamination is of major interest as 4% of all death and 5.7% of disability or ill health in the world can be attributed to poor water supply, sanitation and personal and domestic hygiene. In developing countries, 2.6 billion people lacked access to improved sanitation in 2011. The lack of sanitation poses a risk to surface water pollution which is a threat to human health. A typical indicator for pathogen pollution is fecal coliform bacteria.

The objective our study is to assess fecal pollution in the developing regions Africa, Asia and Latin America using the large-scale water quality model WorldQual. Model runs were carried-out to calculate in-stream concentrations and the respective loadings reaching rivers for the time period 1990 to 2010. We identified hotspots of fecal coliform loadings and in-stream concentrations which were further analyzed and ranked in terms of fecal surface water pollution.

Main findings are that loadings mainly originate from the domestic sector, thus loadings are high in highly populated areas. In general, domestic loadings can be attributed to the two subsectors domestic sewered and domestic non sewered. The spatial distribution of both sectors varies across catchments. Hotspot pattern of in-stream concentrations are similar to the loadings pattern although they are different in seasonality. As the dilution varies with climate its dilution capacity is high during seasons with high precipitation, which in turn decreases the in-stream concentrations. The fecal pollution is increasing from 1990 to 2010 with increased loadings and larger number of river kilometers with high fecal pollution. Fecal pollution is mainly caused by the domestic sector, and hence, the sanitation type, collection and treatment (level) of collected wastewater are highly important to ensure good quality of water bodies.