30 year changes in global surface water extent - implications for conservation and biodiversity

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Freshwater ecosystems are among the most threatened on Earth facing environmental and anthropogenic stressors often surpassing their terrestrial counterparts. Aquatic ecosystems are particularly vulnerable because they undergo the cumulative effects of stressors in the watershed. Analysis of satellite imagery allows for an impartial assessment of the changes in the extent of surface water over time, as well as means for documenting land cover changes affecting the aquatic ecosystems from the catchment to continental scales. However, multi-temporal, spatially explicit, standardized surface water data are scarce. We created multi-temporal global surface water extent data from Landsat imagery from the mid 1980s to 2016. Results illustrate notable decreases in water extent over time for many ecoregions with high aquatic biodiversity worldwide. As a case study example we present the implications of the changes in the surface water extent on the habitat quality and conservation for the freshwater fish family Cichlidae with results from South America, continental Africa and Madagascar. This family with over 1600 described species is natively exclusive to tropical fresh water. Cichlids have colonized most major bodies of water and share these habitats with a great diversity of other aquatic species. Because many have limited ranges and high levels of specialization and/or endemism they are good indicators for overall habitat loss and degradation. We compare our results from the multi-temporal surface water datasets to other publicly available sources. We illustrate large discrepancies between data based on direct observation of surface water as opposed to other sources. Our findings highlight the importance of considering the limitations of the source of the surface water data in the decision making process especially when these sources are used to determine conservation priorities. We further illustrate the need to include smaller lakes and river systems in regional planning strategies. While our case study examples focus on tropical species, the data and findings are applicable elsewhere to other freshwater ecosystems.