Geophysical Research Abstracts
Vol. 19, EGU2017-9625, 2017
EGU General Assembly 2017

Estimating the global surface area of rivers and streams using satellite imagery

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Global observational assessments of river and stream systems are based largely on gauge station data, which are fragmented and often limited to country-level statistics. This limitation severely impedes our understanding of global-scale hydrologic, geomorphic, and biogeochemical fluvial processes. In contrast, satellite remote sensing data provide a globally-consistent and spatially-continuous tool for studying rivers. Here we present a novel method estimate the total surface area of all rivers and stream globally using measurements from the recently-developed Global River Widths from Landsat (GRWL) database and field surveys. The surface area of rivers and streams is a key model parameter in global evaluations of greenhouse gas emissions from inland waters. Preliminary analysis suggests that rivers occupy a total area of ∼80 thousand square kilometers, or ∼0.58% of Earth's land surface. This result is ∼30% greater than the previous best estimate that is based on digital elevation models and gauge station measurements. Compared to previous regional assessments, we find that rivers and streams occupy a greater proportion of the land surface in the arctic and in the tropics, and a lower proportion of land surface in the United States and in Europe. Our results suggest that current estimates of greenhouse gas emissions from inland waters should be revised upwards to account for the greater abundance of river and stream surface area.