

Stream Gauges and Satellite Measurements

Doug Alsdorf

School of Earth Sciences, Byrd Polar Research Center, The Climate, Water, & Carbon Program,
Ohio State University, Columbus OH

Satellite measurements should not be viewed as a replacement for stream gauges. However, occasionally it is suggested that because satellite-based measurements can provide river discharge, a motivation for satellite approaches is an increasing lack of stream gauges. This is an argument for more stream gauges, but not necessarily for satellite measurements. Rather, in-situ and spaceborne methods of estimating discharge are complementary. Stream gauges provide frequent measurements at one point in the river reach whereas satellites have the potential to measure throughout all reaches but at orbital repeat intervals of days to weeks. The Surface Water and Ocean Topography satellite mission (SWOT) is an opportunity to further develop these complements. The motivation for SWOT, and indeed for any satellite based method of estimating discharge, should not be as a replacement for stream gauges. Scientific and application uses should motivate the measurements. For example, understanding floods with their dynamic water surfaces are best sampled from remote platforms that provide water surface elevations throughout the floodwave. As another example, today's water and energy balance models are giving outputs at increasing spatial resolution and are making use of water surface elevations throughout the modeled basin. These models require a similar resolution in the calibrating and validating observations. We should also be aware of practical limitations. In addition to providing spatially distributed hydrodynamic measurements on rivers, SWOT will be able to measure storage changes in the estimated 30 million lakes in the world that are larger than a hectare. Knowing the storage changes in these lakes is especially important in certain regions such as the Arctic but gauging even a small fraction of these is impractical. Another motivator for satellite methods is that even in the presence of stream gauges, discharge data is not always well shared throughout all countries within an international river basin (this is also an argument for better diplomacy). Essentially, where gauges exist, satellite measurements allow the spatial extension of in-situ observations, especially when jointly combined in models such as data assimilation methods. The opportunity for new hydrologic science and discovery is enhanced when the strengths of traditional and new measurements are combined.