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Land water storage from space and the geodetic infrastructure

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In recent years, remote sensing techniques have been increasingly used to monitor components of the water balance of large river basins. By complementing scarce in situ observations and hydrological modelling, space observations have the potential to significantly improve our understanding of hydrological processes at work in river basins and their relationship with climate variability and socio-economic life. Among the remote sensing tools used in land hydrology, several originate from space geodesy and are integral parts of the Global Geodetic Observing System. For example, satellite altimetry is used for systematic monitoring of water levels of large rivers, lakes and floodplains. InSAR allows the detection of surface water change. GRACE-based space gravity offers for the first time the possibility of directly measuring the spatio-temporal variations of the vertically integrated water storage in large river basins. GRACE is also extremely useful for measuring changes in mass of the snow pack in boreal regions. Vertical motions of the ground induced by changes in water storage in aquifers can be measured by both GPS and InSAR. These techniques can also be used to investigate water loading effects. Recently GPS has been used to measure changes in surface soil moisture, which would be important for agriculture, weather prediction, and for calibrationg satellite missions such as SMOS and SMAP. These few examples show that space and ground geodetic infrastructures are increasingly important for hydrological sciences and applications. Future missions like SWOT (Surface Waters Ocean Topography; a wide swath interferometric altimetry mission) and GRACE 2 (space gravimetry mission based on new technology) will provide a new generation of hydrological products with improved precision and resolution.