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Interferometric phase analysis from clay areas for soil water storage change estimation

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The soil moisture status of the unsaturated zone is a key factor affecting hydrological fluxes. Several methods to measure soil water content on different scales have been proposed. In-situ methods are generally confined to very small spatial scales ($\sim 10^{-3}$ m^3), while many larger scale soil moisture products have resolutions exceeding the relevant scale for local scale water management and policy making.

Active microwave sensors (like SAR) are a type of sensors to meet the required spatial resolution (10-100 meter) for local scale water management. Active microwave soil moisture estimates are however limited to the upper few centimeters of the soil. For many hydrological studies the changes in total water present in the soil is needed. In soils with a large clay content, water content variations result in volume changes which are observable as soil surface elevation changes. These elevation changes may be used as an estimate of total soil water storage change.

We investigate whether these subtle surface elevation changes are observable by interferometric phase analysis of TerraSAR-X data. These data offer high resolution (3 meter) and high frequency (11 days) observations. In-situ observations of soil moisture and surface elevation changes are linked to phase observations. The results suggest that swell and shrinkage of clays is observable by in the interferometric phase signal and could in the future be used to estimate soil water storage changes for local water management purposes.