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Advances in using radar to observe vegetation water dynamics

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Vegetation acts as an interface between the earth's surface and the atmosphere, modulating exchanges of water, carbon and energy and responding to environmental stressors. Improved understanding of water transport through the soil-vegetation-atmosphere continuum is essential to understand the role of vegetation at a catchment and a global scale. The sensitivity of radar remote sensing observations to the water content of soil and vegetation makes it well-suited to monitoring spatio-temporal dynamics of processes in the soil-vegetation-atmosphere continuum.

Here, we present the latest results from studies using ground-based and spaceborne radar demonstrating the potential of radar to monitor vegetation water dynamics at scales from meters to tens of kilometers. Field data will be used to demonstrate the sensitivity of radar observations to surface and internal vegetation water content. These results illustrate the potential value of radar for monitoring rapid plant water dynamics, and the impact of water-limited conditions on land-atmosphere exchanges. Satellite data will be used to illustrate the degree to which current spaceborne radar systems can already be used to monitor these processes and the limitations posed by revisit time and resolution.

We will conclude with an outline of future opportunities and challenges. The next generation of spaceborne radar sensors offers unprecedented monitoring capability. To avail of this opportunity, we need improved alignment between the treatment of vegetation in hydrological and radiative transfer models. This is essential to ensure meaningful relationships between new radar data products and hydrological states of interest, and to facilitate the assimilation of radar observations to constrain vegetation processes in hydrological models.