Basis Of An Australian Radar Soil Moisture Algorithm Theoretical Baseline Document (ATBD)

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The preferred radar mission design for soil moisture mapping would be a fully polarimetric S-, L-, P-band system so as to cover the full range of conditions ranging from bare to forested, while the minimum mission would be a dual polarized (HH and VV) or compact polarimetric L-band system. The mission should have an exact orbit repeat with 2-3 day revisit in order to meet the requirements of most soil moisture applications and retrieval algorithms. A constellation of satellites will be required to achieve this, and thus inter-sensor calibration will be critical for the time-series based retrieval algorithms that are proposed. Moreover, a 6AM overpass time should be used to minimize Faraday and ionospheric effects. Presuming the minimum mission with a 2-3day exact orbit repeat is adopted, a 50m spatial resolution of the derived soil moisture product would be required to set an Australian radar soil moisture mission apart from the capabilities of other existing and/or near-term missions. Moreover, the 50m resolution would be required to address issues in relation to irrigation scheduling.

A time-series soil moisture retrieval algorithm is recommended, making use of frequent radar observations to distinguish backscatter changes due to soil moisture dynamics from those due to changes in surface roughness and vegetation, together with decomposition of fully-polarimetric observations to determine dominant scattering mechanisms within each cell. However, attention to the retrieval algorithms, related ancillary information, and calibration methodologies will be required before committing to a final system design, particularly if compact polarimetric mode is to be adopted. This would require dedicated pre-launch airborne field campaigns that closely mimic the specifications of the proposed mission design. Careful attention to post-launch algorithm validation and final algorithm selection should also be included as a fundamental component of any radar soil moisture mission for Australia.