SMAP: Analysis of Residual Radio Frequency Interference Sources

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NASA's Soil Moisture Active and Passive (SMAP) satellite was launched in January 2015 to provide global measurements of soil moisture and freeze/thaw state. Soil moisture products are derived from SMAP radiometer measurements acquired at L Band (1.4 GHz). Even though this is a protected band, unauthorized transmitters emitting either within the band or in adjacent bands cause radio frequency interference (RFI). Because RFI contributions corrupt the radiometer measurements and therefore can lead to biases in retrieved soil moisture, the SMAP radiometer includes special hardware to enable RFI detection and filtering using multiple detection algorithms.

Despite the good overall performance of the nine algorithms to detect and mitigate most of the RFI sources, persistent residual RFI sources are still noticeable in the filtered data. The undetected RFI are usually low or moderate wideband sources that makes them hard to detect by the algorithms. An additional method for investigating residual RFI contributions involves examining RFI levels detected by SMAP as the SMAP antenna scans over a continuous RFI source of moderate to large amplitude. Because the source is observed at varying RFI levels as the antenna pattern scans over the source, the RFI level encountered at its maximum amplitude can be used as "truth" value for other antenna scan positions having lower level RFI contributions. The performance of SMAP detection and filtering can then be examined as a function of a "known" RFI level at low amplitudes, with the results used to refine detector performance for low amplitude sources. Results from this study will also be reported in the presentation.

Finding the precise location of RFI sources is also critical. An advanced signal processing method to invert for the RFI location will also be investigated based on the use of "super resolution" methods. The approach will be tested for various types of RFI sources and more particularly for low and moderate continuous wideband RFI. The presentation will include the results of this analysis, as well as a discussion of the potential use of these methods in larger scale RFI processing of SMAP data.