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# CHARACTERIZATION OF L-BAND RADIO FREQUENCY INTERFERENCE ACROSS THE CONTINENTAL USA USING A KURTOSIS DETECTOR

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*Abstract*

The Soil Moisture Active/Passive (SMAP) mission is intended to produce global soil-moisture maps. It operates at L-Band, where the presence of man-made interfering signals that can be mistaken as natural thermal emissions has been noted in a few airborne campaigns (LeVine, 2002; Misra *et al.,* 2007). Biases in the brightness temperature measurements can be detrimental to retrieving soil moisture data (O'Neill *et al.,* 2006). Thus it becomes necessary to analyze the impact of Radio Frequency Interference (RFI) at L-Band measurements.

The University of Michigan's Agile Digital Detector (ADD) was one of three radiometer back ends that were integrated with the JPL Passive/Active L/S Band (PALS) (Wilson *et al.,* 2001) combined radar and radiometer for flights on board a Twin Otter during 22 September through 19 October 2008. The other two back ends were the L-Band Interference Suppressing Radiometer (Johnson *et al.,* 2005) and the Analog Double Detector (Piepmeier *et al.,* 2008). The Twin Otter campaign involved transit flights between Grand Junction, Colorado and Wilmington Delaware, numerous soil moisture science flights near Des Moines, Iowa and Choptank, Maryland, and several RFI-specific flights near New Your City, Atlanta and elsewhere. RFI-related measurements were also made by ADD during all transit and science flights. This paper presents results of the analysis of ADD measurements to characterize the extent and properties of the RFI that was encountered during the campaign. Specific attention is paid to the differences between pulsed RFI (typically radar in origin) and continuous wave (typically communication signals), which can be distinguished by the kurtosis detector in ADD (Ruf *et al.,* 2006). Initial analysis reveals pulsed-type RFI to be much more prevalent compared to continuous wave RFI. RFI brightness temperature contribution for both types of RFI can exceed a 100K. The occurrence and frequency of these types of RFI has been characterized.

Attention is also paid to the performance of an Aquarius radiometer–like RFI detection and mitigation algorithm, which has been adapted for use by the PALS/ADD sensor from the baseline Level 1 Aquarius RFI flight algorithm (Misra and Ruf, 2008). This is the type of RFI algorithm, known as the peak detection algorithm, that could be employed by

SMAP if it uses a similar detection and sampling scheme as does Aquarius. A combination of the kurtosis detection algorithm and the peak detection algorithm is used to detect all types of RFI that will serve as "ground-truth" for performance characterization of other algorithms. The peak detection algorithm performance is assessed by observing the residual RFI still remaining after its application. Results indicate that even though the baseline peak detection algorithm detects most RFI sources, a smaller percentage of high order RFI around 100K still remains that could be detrimental to science measurements.

A brief description of the hardware involved and an overview of the kurtosis algorithm and the peak detection algorithm for RFI detection and mitigation will be presented. A description of the different types of RFI observed during the Fall 2008 Twin Otter campaign will be shown, followed by an analysis of the performance of the peak detection algorithm by observing residual RFI.

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