Wideband Radio Frequency Interference (RFI) Mitigation Subsystem for Microwave Radiometers

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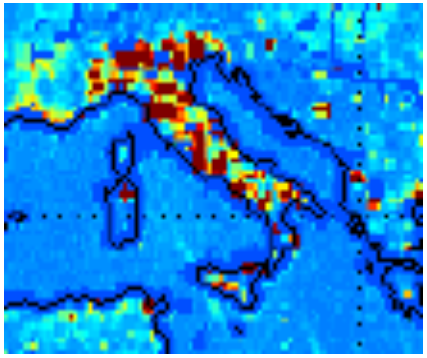
Objective

Develop a wideband (>200 MHz) digital detector subsystem to demonstrate innovative RFI detection and removal techniques for microwave radiometers

- Design and evaluate improved RFI detection approaches: complex-value Kurtosis and blind source separation (BSS) methods
- Demonstrate improved performance over the SMAP RFI detector (24 MHz bandwidth at L-Band)
    - Note: as frequency increases, higher bandwidths are needed to achieve the noise equivalent differential temperature required by science measurements

ROACH-II board with integrated Xilinx Virtex-6 FPGA available for high speed digital processing



RFI seen by GPM's GMI at 10.7 GHz due to fixed communication links in Italy

Accomplishments

- Developed a Wideband Digital Signal Processing Test-Bed for Radiometric RFI Mitigation to evaluate RFI detection approaches: complex-value Kurtosis and BSS (Independent Component Analysis (ICA) and Sparse Component Analysis (SCA)) methods
    - System based upon open-source system, Reconfigurable Open Architecture Computing Hardware (ROACH)
    - Developed DSP algorithms and tested using both simulated and recorded CONUS signals (18.7-GHz DirecTV). Tested algorithms using European recorded signals (10.7-GHz direct broadcast)
    - Conducted field activities at GSFC, Denmark and California coast.
- Compared BSS algorithms (ICA and SCA) versus existing SMAP RFI mitigation algorithms.
    - ICA works well only for over determined systems. Shows 2 dB improvement in detection of QPSK (DBS signals) compared to CSK and RSK but only for large INRs such as -6 dB or higher. SCA detects CW RFI well at high interference-to-noise ratios such as -15 dB or higher. Both methods did not show improved performance over previous detection methods used such as cross frequency, time domain or kurtosis detection algorithms.

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TRL_{in} = 2 **TRL_{out} = 4**