MERITXELL: THE MULTIFREQUENCY EXPERIMENTAL RADIOMETER WITH INTERFERENCE TRACKING FOR EXPERIMENTS OVER LAND AND LITTORAL

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Passive microwave sensors have been intensively employed with great success in Earth remote sensing during the last decades due to their accuracy and large swath. The measured data is the so-called antenna temperature, which is related to the amount of power collected by the antenna. From it, a number of geophysical parameters from ocean (surface sea salinity, sea surface wind speed, ice coverage…), soil (soil moisture, vegetation health…), and atmosphere (rain rate, temperature profiles, water vapour…) can be obtained.

For a given application, antenna temperatures must be measured at given frequency bands and/or polarizations. Furthermore, data from other geophysical parameters obtained by other methods can be included to develop models with improved accuracy. Therefore, in general, the more frequencies and polarizations a radiometer can measure, the more geophysical parameters can be determined, and/or the better retrieval accuracy is obtained. This is the reason why airborne and spaceborne multi-frequency microwave radiometers are currently flown, such as the HUT multifrequency RADiometer (HUTRAD) [1], the Polarimetric Scanning Radiometer (PSR) [2], or the Special Sensor Microwave Imager/Sounder [3], among many others.

One of the biggest problems the microwave radiometry community is facing today is the increased contamination (or Radio Frequency Interference) that suffer measurements acquired in theoretically protected bands. To analyze the statistics of the RFI (frequency of appearance, duration, type, polarization dependence, etc.) in different bands and scenarios (urban and rural), as well as detection and mitigation techniques a multifrequency dual-polarization Dicke radiometer has been designed and it is currently under implementation stage. It covers the following bands usually used in Earth remote sensing: L-band (1.400 GHz – 1.427 GHz), S-band (2.69 GHz – 2.70 GHz), C-band (7.14 GHz – 7.23 GHz), X-band (10.6 GHz – 10.7 GHz), K-band (18.6 GHz – 18.8 GHz and 23.6 GHz – 24.0 GHz), Ka-band (36 GHz – 37 GHz), and W-band (86 GHz – 92 GHz). To add flexibility and simplify the design, a spectrum analyzer is used as IF stage, filter and power detector for all the radiometric measurement bands. In addition, the instrument includes a thermographic camera operating in the range of 8–14 μm and a multi-spectral camera with four spectral bands: Red (~0.62 μm), Green (~0.54 μm), Blue (~0.45 μm) and Near InfraRed (~0.80 μm).

As the spectrum analyzer is able to analyze each band of the spectrum separately and with a very high frequency resolution, it is expected to be able to resolve RFI present in the received radiometric signal. On the other hand, spectrum can be divided in sub-bands of lower bandwidth so the interference can be isolated in a narrow band and can be eliminated. The same process can be performed in the temporal domain and in joint frequency-temporal domain, as in [4]. Furthermore, the stored received data can be used to compute histograms, so several normality tests can be applied to the signal to detect RFI [5].

Moreover, as the spectrum analyzer can store the measured data, other RFI detection and mitigation techniques can be studied offline, so as to select the best one for each scenario.

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