

CALIBRATION PROCEDURES IN 2-D LARGE INTERFEROMETRIC RADIOMETERS:  
STUDY APPLIED TO THE MIRAS/SMOS INSTRUMENT

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Soil moisture and sea salinity are key geophysical parameters for global climate modeling. Since the mid '80s aperture synthesis radiometers have received increased attention as they offer a potential way to monitor the Earth at low microwave frequencies where there is a maximum sensitivity to soil moisture and ocean salinity. During the '90s, the European Space Agency (ESA) issued several technological studies to address the development of an L-band space-borne 2-D instrument called MIRAS (Microwave Imaging Radiometer by Aperture Synthesis), aimed at providing global coverage of soil moisture and sea salinity. In 1998, ESA approved the SMOS (Soil Moisture and Ocean Salinity) mission, based on the MIRAS concept.

An issue of main interest concerns to error correction and calibration of large 2D aperture synthesis radiometers, since many of the techniques inherited from radio astronomy cannot be directly applied, due to the nature of extended sources of thermal radiation, which, in the case of Earth observation applications, occupy a large field of view. This application requires a large number of antennas and receivers closely arranged to achieve a large alias free field of view and the required synthesized beam.

This work starts by classifying the main error sources that impact in the instrument basic measurements, the so-called visibility samples. Then it follows with a summary of the possible calibration approaches, which are compared in terms of hardware requirements, robustness and what kind of error can be removed. Finally, a study of a calibration approach of large 2D interferometers, which is applied to the SMOS/MIRAS instrument, is discussed.