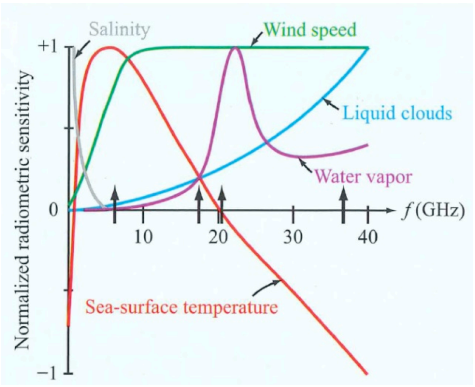
Master's Thesis

Sensitivity of Spaceborne Microwave Radiometers to Surface and Atmospheric Parameters



Left: CIMR (launch 2028) with 7 m antenna reflector, Right: The famous sensitivity plot by Wilheit (1979) reproduced in Long and Ulaby (2014).

Spaceborne microwave radiometers observe a broad variety of surface and atmospheric parameters, such as surface temperature, sea ice cover and type, surface wind speed, or atmospheric water vapour and cloud liquid water content. These capabilities will even be expanded with the planned Japanese sensor AMSR3 on GOSAT-GW (launch 2023) observing up to 183 GHz (currently 89 GHz) and with the European sensor CIMR (Copernicus Imaging Radiometer) with a spatial resolution three times higher than that of previous sensors (figure top left).

Any physical measurement is based on the *sensitivity* of the measuring device to the desired quantity. The scope of this project is a broad sensitivity study putting the satellite observed radiances into relation with the desired geophysical quantities. The results will be sensitivity plots similar to the classical qualitative plot by Wilheit (1979) reproduced many times in the literature (figure top right), but only little quantitative efforts exist. The study will expand the frequency range, the surface types (adding sea ice) and the atmospheric states (polar, mid-latitudes, tropic). The results of this study will be directly used in the currently ongoing development of CIMR by ESA.

A baseline software in Python is available so that you can start directly.

What you need and what you will learn

You need enjoying physical understanding and transferring it into quantitative calculations on computers. Programming experience will be of advantage. You will learn about the principles of the fascinating field of microwave remote sensing atmospheric and surface properties from space, modelling it with radiative transfer calculations using software developing technologies.

Our working group offers an open discussion atmosphere and worldwide contacts to the leading institutions in the field.

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