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Interpretation of CAROLS L-band measurements in the Gulf of Biscay

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The L-band Cooperative Airborne Radiometer for Ocean and Land Studies (CAROLS) radiometer (see Zribi et al., Pardé et al., IGARSS 2008) flew four times over the Gulf of Biscay between September 24 to September 28, 2007 around 20UTC. These flights were the first ones over the ocean of this new instrument. Brightness temperatures (Tb) of the surface were measured by one antenna looking at 33° on the right hand side of the aircraft and optionally by a nadir antenna. Measurements are compared with simulations conducted with the Terrestrial Radiometry Analysis Package (TRAP) (Tenerelli et al., 2008) software run for CAROLS geometry and different observed geophysical conditions. Concomitant ship campaign and drifter deployments provide in situ ground truths for sea surface salinity (between 34.6 and 35.8pss) and temperature (between 15°C and 17°C). Wind speed (between 2 and 10m/s) and direction are estimated from the QSCAT scatterometer.
TRAP uses the physical modelling of atmospheric radiative transfer, sea surface emissivity and galactic glint foreseen for the processing of the Soil Moisture and Ocean Salinity satellite data. The circle flights and wing-wags movements of the CAROLS aircraft (The French research ATR42 aircraft) allow to explore a wide range of incidence angles (from 0° to about 60°) and of galactic signals reflected by the sea surface.
On a whole, simulated and observed variations of Tb with incidence angle are very consistent, demonstrating a good sensitivity of CAROLS instrument. During the wing-wags, differences between observations and simulations occur in some azimutal directions possibly linked to imperfect knowledge of the galactic signal in some parts of the sky close to the Milky Way. During circle flights, observed azimutal variations are consistent with the galactic noise signal scattered by the sea surface as simulated with the model of (Tenerelli et al., 2008) and the signal due to rough sea assymmetry as simulated by a two-scale model using the Durden and Vesecky x2 wave spectrum (Dinnat et al, 2003). On September 28, a more than 1K increase of Tb over 2° longitude is observed, mainly linked to an increase of wind speed from 2 to 8m/s.