**Land surface temperature retrieval from microwave observations: towards the production of a climate record**

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Passive microwave measurements are less affected by clouds than IR observations. The Land Surface Temperature (LST) can be derived from microwave measurements, regardless of the cloud conditions. However, retrieving LST from microwave is still challenging. Contrarily to the infrared emissivities, the microwave emissivities vary strongly with surface properties (soil moisture, vegetation, snow). Moreover, the microwave radiation can emanate from the subsurface, not from the surface skin as in the infrared.

A methodology has been developed in the past to estimate the LST, along with atmospheric water vapor, cloud liquid water, and surface emissivities over land, from passive microwave imagers. It is based on a neural network inversion, trained on a large data set of simulated radiances, and makes use of first guess information about microwave emissivity, coincident surface skin temperature, and the overlying atmosphere. The theoretical root mean square error of the LST retrieval over the globe is 1.3 K under clear-sky conditions and 1.6 K in cloudy conditions. These LSTs have been compared with in situ LST measurements, with errors of ~4 K as compared to in situ measurements for most LST stations. The performance of the algorithm is similar under clear and cloudy conditions. However, this neural network inversion requires a large range of ancillary observations that are difficult to collect in near-real time.

Here, we present a new retrieval approach, limiting the number of ancillary inputs that are required while maintaining the LST accuracy. An algorithm, easily and broadly applicable to past and current microwave imagers, has been developed based on a neural network inversion trained on the LST retrievals obtained with the method previously described. The only inputs required by the new algorithm are the brightness temperatures provided by the microwave conical scanners, from 19 to 90 GHz, and pre-calculated atlases of microwave land surface emissivities, at the same frequencies. Global LST estimates derived from the new approach will be presented and compared with in situ observations (over a large range of environments) and with different sources of infrared satellite estimates (under clear sky conditions).

The final objective of this project is to produce a long climate record of an “all weather” LST, applying the methodology to all conical scanners in the microwaves (SSM/I, SSMI/S, AMRS-E) and limiting the inconsistency related to inter-calibration problems and to overpassing local times. This new dataset will complement the available IR datasets for the cloudy cases, and better describe the diurnal cycle of the LST regardless of the cloud conditions.