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Sounding capability of millimetre-submillimetre wave radiometry from geostationary orbit

B. Bizzarri, F. Baordo, **A. Mugnai**, S. Pinori
Istituto di Scienze dell'Atmosfera e del Clima, CNR, Roma, Italy
(bibizzar@tin.it / Phone: +39 06 4426.1604)

Millimetre-submillimetre wave sounding from geostationary orbit has being proposed with the primary objective of frequent observation of precipitation (typically, at 15-min intervals), for specific use in Nowcasting and Hydrology. The technique is based on sounding the atmosphere in absorption bands of oxygen and water vapour. The reason for using millimetre-submillimetre wave stems from the requirement of conveniently high spatial resolution (target: 10 km). The need for using absorption bands is that, at this sort of frequencies, atmospheric windows, that constitute the basis for precipitation observation from low orbits, do not exist, because of the intense water vapour continuum. Thus the observing principle is to exploit the 'disturbance' of clouds and precipitation on radiometric channels that, in clear-air, would measure the temperature (from oxygen bands) and water vapour profiles. The cloud disturbance differently affects different frequencies depending on water phase, particles size and columnar amount and distribution. The selected frequency bands are: 54, 118 and 425 GHz for temperature, 183 and 380 for water vapour. The number of channels in each band ranges from 7 to 11, with SNR = 100, that would provide full profiling capability in clear air. These are the reference characteristics of GOMAS (Geostationary Observatory for Microwave Atmospheric Sounding), and GEM (Geostationary Microwave observatory), two connected projects currently being pursued in Europe and USA respectively.

We have simulated brightness temperatures in all bands and channels candidate for GOMAS/GEM, in clear-air condition, under controlled cloudiness interference and in precipitation conditions. Single bands were used, as well as different combinations of bands. The experiment results indicate that, when all bands are synergistically used,

clear-air temperature and humidity profiles can be retrieved with accuracy of 1.5 K and 5 % respectively, in the mid-high troposphere. Temperature-humidity sounding is possible in the presence of cirrus and moderately-thick stratus clouds. Several types of precipitation can be retrieved (convective, frontal, light, snowfall) and some information also is retrieved about cloud microphysical parameters (Integrated Liquid and Ice Content with some indication of profile and particle type). It is stressed that the use of absorption bands evenly enables application over sea and land.

The importance of frequent temperature-humidity sounding in clear-air and close to precipitation should be appreciated. Although the 15-min cycle does not represent *per-sé* a requirement as convincing as for precipitation, 4-D assimilation of frequent temperature-humidity profiles could improve Quantitative Precipitation Forecasting as a good complement to the direct observation (for certain applications, even more useful).

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