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Greenhouse gases measurement from portable infrared spectrometer

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Ground-based high spectral resolution infrared measurements are considered to be the most efficient way to obtain accurate tropospheric abundances of different gaseous species and in particular greenhouse gases, such as CO_2 and CH_4. Furthermore, this type of measurement is also commonly used to validate the satellite retrievals. Despite the outstanding capabilities of the spectrometers used by the TCCON and NDACC networks, they have some limitations, such as their large dimensions, their heavy mass and they require a substantial infrastructure that makes them impossible to transport. The latter obstruct the expansion of these measurements, in particular for field campaign. To overcome these problems, the usage of smaller, cheaper and portable spectrometers was recently investigated.

The **CHRIS** (**C**ompact **H**igh-spectral **R**esolution **I**nfrared **S**pectrometer) is an instrumental prototype based on the EM-27 (Bruker) instrument. This instrument has many interesting characteristics such as its high spectral resolution (0.135 cm^{-1} non-apodized) with a spectral sampling every 0.065 cm^{-1} to satisfy the Nyquist criterion. Each spectrum corresponds to the solar transmission light in the total atmospheric column of a pixel field of view of 0.006 mrad. This optically stable instrument also allows recording spectra in a wide spectral range (700 to 5200 cm^{-1}). Furthermore, it is transportable (m = 40 kg) which offers an unprecedented advantage. This instrument is designed to perform measurements of greenhouse gases (CO_2, CH_4, H_2O), trace gases (SO_2, CO, HCl, NO_x...), but also aerosols and clouds which have very typical spectral features in particular in the thermal infrared region. In order to fully exploit these spectra, we must firstly characterize this prototype properly in terms of radiometric and spectral calibration.

Here, we present the CHRIS capabilities to retrieve the CO_2 and CH_4 vertical profiles through a complete information content analysis, a channel selection and error budget estimation. The preliminary results of such measurement retrievals, as in the Franco-German collaborative project MAGIC-COMET, will also be presented.