FTIR Physical model chain

FIGURE 1 PHYSICAL MODEL CHAIN

The physical model chain of the FTIR measurement (Figure 1) displays the physical processes associated with the Fourier transform infrared spectroscopy for atmospheric solar absorption measurements. For ground-based FTIR spectroscopy, the primary measurand is the interferogram which is the detected (solar) light intensity against the optical path difference of the moving mirror of a Michelson interferometer setup. After applying a fast fourier transform (FFT), the interferogram is then transformed into an (uncalibrated) transmittance spectrum. The physical model chain also allows to measure cell spectra. From these dedicated cell measurements, where sharp absorption lines of the gas in the cell (e.g., HBr, N2O or HCl, at a verified pressure) are measured, the instrumental line shape (ILS) can be estimated.

Within NDACC, the ILS is then used as an input parameter in the retrieval process, with the purpose to mimic the instrument's potential small misalignment in the forward model of the radiative transfer in the retrieval software. In TCCON cell measurements with the derived ILS are used to ensure long term stability of the instrument.
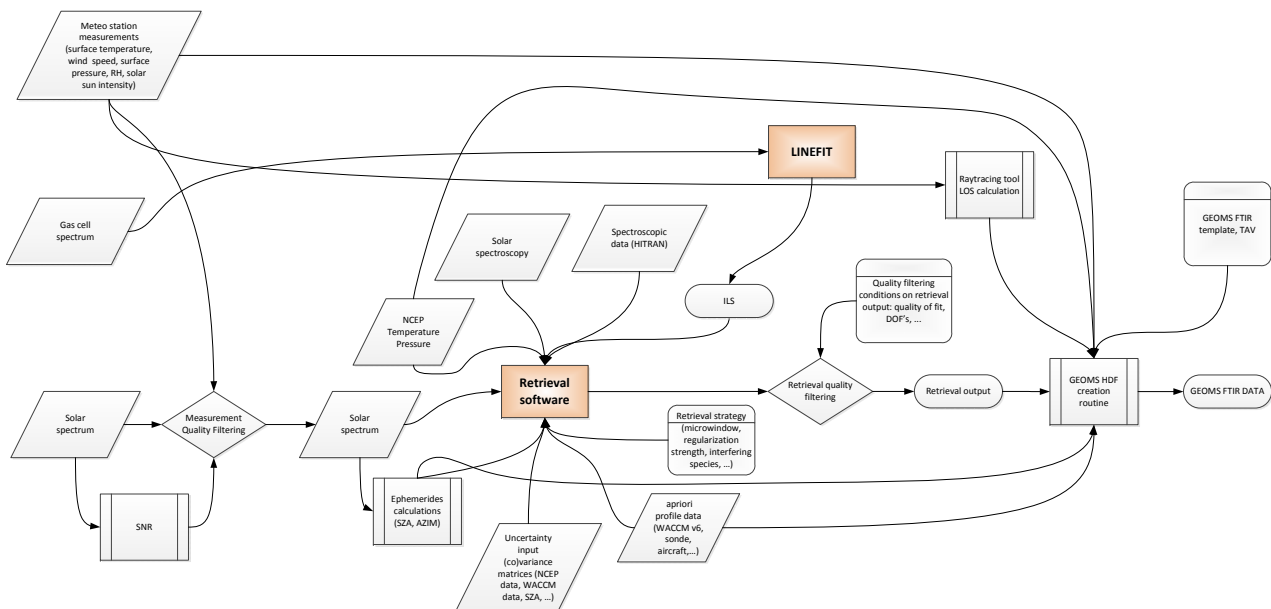

FIGURE 2. NDACC PROCESSING CHAIN

The processing model chain (Figures 2 and 3) display all required apriori and input parameters necessary to determine a retrieval of the abundance of a target gas out of an FTIR spectrum. In

the NDACC, the retrieval software uses optimal estimation or Tikhonov regularization for deriving information about the vertical distribution of the target gas in the atmosphere.

All input parameters are provided along with an uncertainty estimate and the retrieval software will propagate all different uncertainty contributions towards the uncertainty on the retrieved concentrations of the target gas using the formulas from Rodgers 2000. In the TCCON, an least square fitting algorithm is used to scale an a priori profile to retrieve the column averaged dry-air mole fraction of the target gas. An in-situ correction is applied to the retrieved TCCON data that uses aircraft profiles that where validated to the WMO standard.
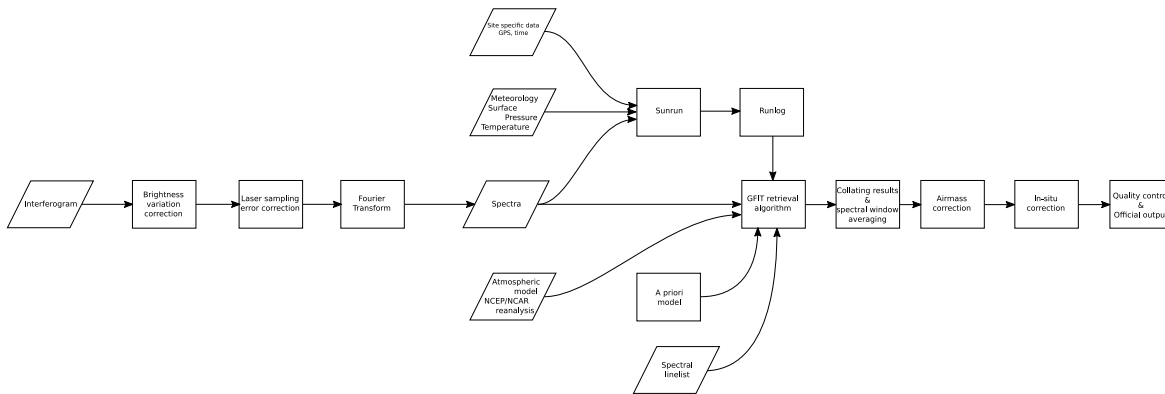
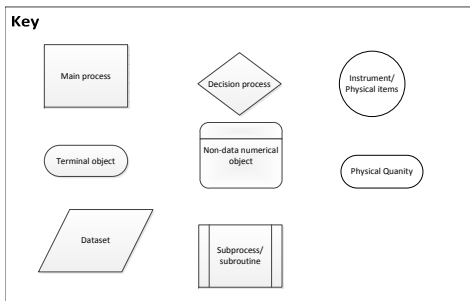FTIR Processing chain - TCCON

FIGURE 3. TCCON PROCESSING CHAIN

FIGURE 4. LEGEND