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STEAM (Stratosphere-Troposphere Exchange And climate Monitor)

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Mankind's influence on the atmosphere of the planet Earth has expanded in recent decades from the local scale of urban pollution to global scale effects such as the ozone hole. Global problems require global monitoring and global solutions.
The widespread use of 3D-models for predicting the effects of future changes in the atmosphere necessitates validation of the models with measurements. The STEAM explorer will provide a unique global data set in the region 5-25 km by measuring, simultaneously, target species such as O3, H2O, ClO and CO within a very fine vertical grid (1-2 km) and a fine horizontal grid along the satellite track (30-50 km), focusing on three main objectives, namely climate evolution, stratospheretroposphere exchange, and tropospheric and stratospheric ozone.
STEAM will measure molecular thermal emission spectra at sub-millimetre wavelengths. The instrument consists of a telescope that views thermal emission from the atmospheric limb imaged by a small linear array of receivers in the instrument platform. The incoming radiation from the Earth's limb is down converted in each mixer and amplified in low noise amplifiers. Spectrometers measure the spectral power density across each band. To keep the crowding of the focal plane reasonable, not more than 8-12 mixers will be used. The reduction in sensitivity due to a non-optimum mixer configuration is compensated by the increase in integration time enabled by multiple mixers
The frequency bands have to be selected to include strong spectral features of the target species while at the same time the atmosphere is transparent when viewed from space. The 320-360 GHz range has been found to be suitable for stratospheretroposphere exchange studies and includes the main target species H2O at 325GHz and CO at 345 GHz.

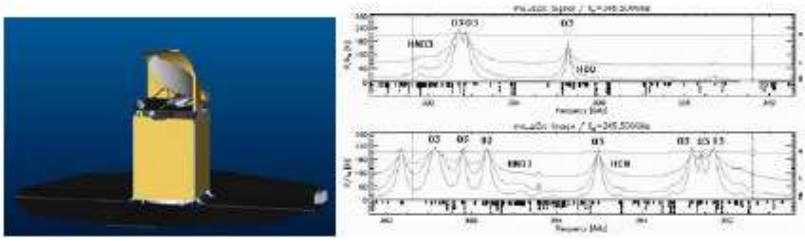

Figure 1: The STEAM satellite and typical spectra at 320-340 GHz