



SPECIES: a versatile spectrometer based on optical-feedback cavity-enhanced absorption for in situ balloon-borne and airborne measurements

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Over the last twenty years, thanks to significant technological advances in measurement techniques, our understanding of the chemistry and dynamics of the upper troposphere and stratosphere has progressed significantly. However some key questions remain unsolved, and new ones arise in the changing climate context. The full recovery of the ozone layer and the delay of recovery, the impact of the climate change on the stratosphere and the role of this one as a feedback are almost unknown. To address these challenges, one needs instruments able to measure a wide variety of trace gas species simultaneously with a wide vertical range. In this context, LPC2E and LIPHY are developing a new balloon-borne and airborne instrument: SPECIES (SPECTromètre Infrarouge à lasErs in Situ, i.e. in-Situ Infrared lasEr SPECTrometer). Based on the Optical Feedback Cavity Enhanced Spectroscopy technique, combined with mid-infrared quantum cascade lasers, this instrument will offer unprecedented performances in terms of the vertical extent of the measurements, from ground to the middle stratosphere, and the number of molecular species simultaneously measured with sub-ppb detection limits (among others: NO, N₂O, HNO₃, H₂O₂, HCl, HOCl, CH₃Cl, COF₂, HCHO, HCOOH, O₃, NH₃ NO₂, H₂O, OCS, SO₂). Due to high frequency measurement (>0.5 Hz) it shall offer very high spatial resolution (a few meters).