Saturn hydrocarbon abundance from Cassini/CIRS limb measurements

T. Fouchet, B. Bézard, E. Lellouch, S. Guerlet (1), C. Howett, P.G.J. Irwin (2), D.E. Jennings, R.C. Carlson, A.A Simon-Miller, and F.M Flasar (3)

(1) Observatoire de Paris, LESIA ; (2) Oxford University, AOPP; (3) Nasa, GSFC

Saturn hydrocarbon chemistry is initiated with the photolysis of methane in the upper stratosphere. Subsequent reactions produce more complex hydrocarbons like ethane (C_2H_6), acetylene (C_2H_2), propane (C_3H_8), methylacetylene (CH_3C_2H), diacetylene (C_4H_2). These hydrocarbons are transported downwards by eddy turbulent diffusion and possibly advection to be recycled methane deep in the troposphere. If the Saturn's hydrocarbon photochemistry is basicaly understood, many uncertainties remain. The chemical reaction paths and rates are often unknown at the pressure/temperaure conditions prevalent in Saturn's stratosphere, the eddy diffusion transport is a free parameter poorly constrained. Meridional transport is supposed to exist but also poorly constrained. The CIRS infrared spectrometer abord the Cassini mission can provide several insights into that chemistry. Its wavelentgh range encompasses emission from C_2H_6, C_2H_2, C_3H_8, CH_3C_2H, C_4H_2, while the methane emssion at 7.8 μm can be used to probe the temperature. In limb sounding mode, a vertical resolution between one and two scale can be achieved. This mode allows us to retrieve the volume mixing ratios of these species from 0.01 hPa (mbar) down to 10 hPa. With this dataset in hand, the eddy diffusion coefficient can be determined, whereas the relative importance of different reaction paths can be explored. We will present our analysis of limb CIRS sounding, and their implications for the stratospheric hydrocarbon photochemistry.