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Study of Venus cloud layers with polarimetric data from SPICAV/VEx

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The study of Venus's cloud layers is important in order to understand the structure, radiative balance and dynamics of the Venusian atmosphere. The main cloud layers between 50 and $70\,\mathrm{km}$ are thought to consist in $\sim 1\ \mu$m radius droplets of a H_2SO_4-H_2O solution. Nevertheless, the composition and the size distribution of the droplets are difficult to constrain more precisely. Polarization measurements have given great results in the determination of the constituents of the haze. In the early 1980s, Kawabata et al.(1980) used the polarization data from the OCPP instrument on the spacecraft Pioneer Venus to constrain the properties of the haze. They obtained a refractive index of 1.45 ± 0.04 at $\lambda = 550\,\mathrm{nm}$ effective radius of $0.23 \pm 0.04\,\mu\mathrm{m}$, with a normalized size distribution variance of 0.18 ± 0.1.

We introduce here new polarimetric measurements from the SPICAV-IR spectrometer onboard ESA's Venus Express. Observing Venus in the visible and IR from 650 nm to 1625 nm with a good spatial and temporal converage, SPICAV gives us an opportunity to put better constraints on haze and cloud particles at Venus cloud top, as well as their spatial and temporal variability.

Our analysis is based on a polarized radiative transfer code similar to the one used by Hansen and Hovenier (1974). Using the particle size distribution from Kawabata et al.(1980) and a simple two-layered cloud model, we try to retrieve particle size and refrative index from nadir observations. We are interested in particular by the glory which is also visible in polarization and whose linear degree of polarization as a function of observation geometry is dependent on the cloud parameters. The polarization measured at higher latitudes provides constrains on the hazes, in particular their optical thickness. We will discuss the first results of our modeling of the glory.

In the future we aim to characterize the cloud droplets on the planet along with their temporal and spatial variability. A comparison with the photometric observations of the glory from VMC could also provide stronger constrains on the size and composition of the cloud particles.

References:

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