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Modelling Saturn's atmospheric circulations and cloud structure with OPUS

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We are investigating Saturn's atmospheric circulations and cloud structure in the Northern and Southern hemisphere as initial value problems by use of the Oxford Planetary Unified model System (OPUS), a sophisticated GCM based on the UK Met Office Unified Model. Solving an extended form of the Hydrodynamic Primitive Equations, OPUS is capable of including 40 vertical levels from 0.1 bar to 100 bar. The model was initiated with temperature and balanced thermal wind profiles recently obtained by Cassini's Composite InfraRed Spectrometer (CIRS). A simple cloud scheme for the Jovian planets has been added to OPUS and is employed to model the three major cloud decks (ammonia, ammonium-hydrosulfide and water) on Saturn and the advection of these clouds with the atmosphere.

We have already conducted several numerical studies with OPUS, simulating jet scale meridional circulations, the formation of cloud bands and discrete turbulent features on Jupiter. By modelling the dynamics and clouds of Saturn in a similar way, we are hoping to gain further insight into the formation of circulation cells over the zonal jet streams as well as to examine the distribution of atmospheric condensates in response to these motions. The model will also be used to numerically investigate the characteristic features in Saturn's Northern hemisphere. It is envisioned to directly compare the atmospheric configurations obtained for Saturn with previous results from the Jupiter model.