Mars' Annular Polar Vortex

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The Martian winter polar vortex has recently been shown to be annular in nature, with a local minimum in potential vorticity near the pole. This suggests barotropic instability, yet the vortex is remarkably persistent. It has been shown that its annular nature may be due to the release of latent heat from CO₂ condensation, CO₂ clouds, changes in dust distributions, and the strength of the Hadley circulation circulation, with many of these being interlinked. In this poster, we present results using the the Mars Analysis Correction Data Assimilation (MACDA) reanalysis dataset, which demonstrates clearly the annular vortex. Additionally, we perform simulations of the Martian atmosphere and its response to varying topography and radiation scheme in the flexible Isca framework, a climate model capable of simulating the Martian basic state at varying levels of complexity. It is noted that the strength of the Martian polar vortex is significantly lower in Isca simulations than in the MACDA dataset. Through further simulations with Isca, we aim to investigate the effect of CO₂ condensation on the strength and shape of the Martian polar vortex.