Venus Polar Vortices and Atmospheric Mixing

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Description:
Active vortices have been observed in the atmosphere of Venus at both poles. The ESA Venus Express spacecraft has made detailed observations of the vortex at the south pole which changes dramatically from monopole to bipole and sometimes tripole structure [1]. With the current JAXA Akatsuki mission [2], and the proposed ESA EnVision M4 mission to Venus, more data will be expected in future. Atmospheric layers can form in the venusian atmosphere, and it is even possible that they could provide a ‘safe zone’, with environmental conditions potentially conducive to the persistence of microbial life. The movement and mixing of these layers is not yet understood, and is likely to be the critical factor in the potential for an aerial biosphere on Venus.

Strong polar vortices are also a feature of the Earth’s atmosphere in winter and they play a vital role in trapping and mixing air in the stratosphere. This project aims to employ knowledge and understanding gained observing and modelling the Earth’s winter polar vortices to help to understand and interpret existing observations from Venus, and to perform dedicated modelling of Venus atmospheric layers to quantify the vertical atmospheric flux of constituents and the degree of interlayer mixing. The student will investigate the interlayer mixing and representation of the polar vortices in a global circulation model and compare them with existing modelling results [3]. Data from the ESA Venus Express mission will be used to constrain the model, which can in turn be used to plan future observations.

References:

Qualifications required: Suitable for graduates with a physics, mathematics or related numerate undergraduate degree.