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Variations in spectral reflectivity and vertical cloud structure of Jupiter's Great Red Spot

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The Great Red Spot (GRS) of Jupiter is a large anticyclonic vortex present in the Jovian atmosphere. First observed in the XVII century, it is almost constantly located at 22°S. Since its discovery it has gradually decreased in size at an average rate of 170 km/year in longitude and 60 km/year in latitude. The nature of the chromophore species that provide its characteristic color to the GRS's upper clouds and hazes is still largely unknown, as well as its creation and destruction mechanisms. During year 2019, the GRS began to lose some of this reddish material as a consequence of the interaction with other vortices present in nearby latitudes, raising serious doubts about its possible disappearance (Sánchez-Lavega et al., 2019).

In this work we have analyzed images provided by the Hubble Space Telescope between 2015 and 2019, with a spectral coverage from the ultraviolet to the near infrared, including some methane absorption bands of different depths. These images have been calibrated in absolute reflectivity, and from them we have obtained the spectral variations in brightness that occur in different dynamically interesting regions of the GRS and its surroundings.

The spectral reflectivity of the studied regions over the mentioned years has been analyzed using the NEMESIS radiative transfer code (Irwin et al., 2008). In this way it has been possible to retrieve the main features playing a key role in the spectral reflectivity of GRS's upper clouds and hazes, such as particle size distribution, refractive indexes and optical thickness. At the same time, this analysis has provided the vertical distribution of particles for pressure levels above 1 bar, allowing a comparative study of its evolution over recent years.

References

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