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Cloud mapping in the upper Jupiter troposphere from JIRAM/Juno data: preliminary sensitivity study

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Abstract

The Jupiter InfraRed Auroral Mapper (JIRAM) on board of the Juno spacecraft is a spectro-imager operating in the 2-5 μm range with a spectral resolution of 9 nm.

Grassi et al. [1] provided a quantitative assessment of the retrieval capabilities of the instrument in measuring mixing ratios of minor species in hot-spot conditions.

The present study extends the previous investigations focusing on the aerosol retrieval capabilities in a variety of conditions, including daytime measurements. Namely, we confirm that JIRAM data at 2 μm can effectively map clouds opacities in the lower stratosphere (p < 500 mbar).

1. Introduction

The orbit of Juno around Jupiter will lead to sub-spacecraft tracks very close to the terminator. As a consequence, the JIRAM spectrometer slit will often measure the solar radiation reflected by the Jupiter clouds.

Several authors investigated in the past the information content offered by the measurements of Jupiter in the solar domain. In this study we adopted the methods described by Kedziora-Chudczer and Bailey [2] for the analysis of ground-based observations.

2. Methods

The ARS line-by-line code [3,1] was adopted to simulate the Jupiter radiance between 2 and 2.4 μm in a variety of conditions (fig. 1), and to compute the Jacobians with respect to a number of input parameters. The Bayesian formalism [4] allowed eventually to estimate, from Jacobians, values of retrieval errors for the atmospheric quantities derived from JIRAM data.

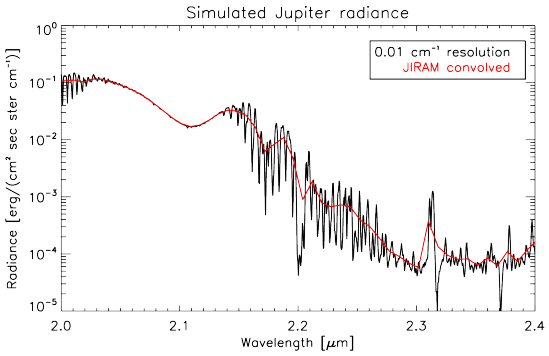

Figure 1: Example of expected Jupiter spectrum as observed by JIRAM.

3. Results

The signal expected from JIRAM instrument in the 2-2.4 μm range will be driven mostly by the aerosol densities for p < 500 mbar, as previously reported in [2]. The simulations demonstrated however the high sensitivity of results to the details of methane absorption modeling. Namely, far wing shape and foreign-broadening may substantially shift the retrieved cloud mixing ratio profile, justifying therefore more experimental effort toward their characterization.

Acknowledgements

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