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# NUMERICAL MODELING OF JUPITER'S MOIST CONVECTION LAYER: SENSITIVITY TO DEEP WATER CONTENT

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'Moist convection' i.e., convection associated with the phase change and the cloud physics of water, is supposed to occur in Jupiter's atmosphere.Nakajima et al (2000) examined the structure of the moist convecting layer by runnung a large-domain two-dimensional fluid dynamical model for a long time.Their result shows that the water condensation level acts as a dynamical and compositional boundary. The convection below the condensation level is Benard-like and water mixing ratio is homogeneous.Above the condensation level, transient convective clouds develop and water mixing ratio is highly inhomogeneous. The horizontal average of mixing ratio decreases rapidly with height just above the condensation level, resulting in a distinctive stable layer at 5 bar. These features do not match the observation by the Galileo probe showing dry layer extends down to as deep as 20 bar level, but they did not take the discrepancy seriously because the Galileo probe entered a rather special place where the humidity is exceptionaly low.

Nakajima et al (2000) assumed that the mixing ratio of water vapor in deep levels to be the value computed from the oxygen content in the solar atmosphere. However, a recent theory of solar nebula suggests that the water content in Jupiter may be 9 times the amount in the solar atmosphere (Gautier, 2001), which is consistent with the large value implied by the fast propagation speeds of the wavy features observed after the impacts of the nuclei of Comet Shoemaker-Levy 9 in 1994 (Ingersoll and Kanamori, 1995). If the deep water mixing ratio is so large, the water condensation can occur at much lower levels. Then the deep dryness observed by Galileo probe may be global feature of Jupiters atmosphere.

Considering the wide uncertainty of the deep water vapor content, we repeat the numerical experiment of Nakajima et al (2000) with different values of deep water mixing ratios assumed. The results shows that, until a certain critical value of deep water mixing ratio, which corresponds to about 5 times the 'solar' value, the convective clouds develop from the water condensation level, which moves to deeper levels with the increase of water vapor. At the same time, the activity of convective clouds becomes more vigorous because larger amount of latent becomes available. However, with still larger amount of water vapor, the clouds around the condensation level becomes stratiform; convective clouds develop from a higher levels. This behavior results from the heavy molecular weight of water compared with 'dry' component of Jupiter's atmosphere (Guillot,1995). The present result implies a possibility as well as a limitation of the diagnoses of deep water content from the structure of atmosphere that is remotely observable from space.