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Halogen Occultation Experiment (HALOE) and balloon-borne in situ measurements of methane in stratosphere and their relation to the quasi-biennial oscillation (QBO)

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Abstract. Measurements of methane have been made from various observational platforms in the atmosphere. In this article, we have compared four high precision balloon-borne measurements from Hyderabad (17.5°N), India in the period of 1987 and 1998 with a part of HALOE/UARS global observations available since 1991. All the balloon measurements correspond to boreal spring (March and April) but belong to different years. A comparison shows fairly good agreement with each other. The gradient in CH₄ profiles in the troposphere is controlled by the variation in vertical transport. The strongest effect of dynamical influence on methane vertical profiles is shown to be resulting from the dynamical quasi-biennial oscillation in the stratosphere, and that has been consistently derived from both the measurement techniques and chemistry-transport model simulations. It is observed that the QBO signal in CH₄ anomaly exhibits interhemispheric asymmetry caused by the tropics to midlatitude circulation in the stratosphere. A mechanism is suggested to explain how and to what extent the methane vertical profiles over Hyderabad and higher latitudes could be modulated by the prevailing QBO winds in the tropics. We have also discussed how the same mechanism would affect ozone distribution in the stratosphere quite differently.

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