Geophysical Research Abstracts
Vol. 12, EGU2010-3887-7, 2010
EGU General Assembly 2010

Mars Mesospheric Winds around Northern Spring Equinox - Comparison of Observations and Model

Guido Sonnabend (1), Manuela Sornig (1), Peter Krötz (1), Dusan Stupar (1), Luca Montabone (2), Miguel Lopez-Valverde (3), and Kelly E. Fast (4)

(1) University of Cologne, KOSMA, Köln, Germany (samstag@ph1.uni-koeln.de), (2) Laboratoire de Meteorologie Dynamique, Universite' Pierre et Marie Curie, Paris, France, (3) Instituto Astrofisica Andalucia/CSIC, Granada, Spain, (4) NASA GSFC, Greenbelt, MD, USA

During the last decade general circulation models (GCM) for Mars have evolved to a state allowing detailed predictions of atmospheric dynamics. Wind speeds are a key variable in the models and need to be validated by observations. We put a focus on studying the evolution of dynamcis in the upper atmosphere of Mars around northern Spring Equinox ($L_S = 0$). Model calculations predict the global circulation around 50 to 100 km altitude to change from a dominant northern jet configuration during northern winter to a dominant southern jet configuration in early northern summer.

We present a detailed comparison between observations of mesospheric winds on Mars around northern Spring Equinox and predictions of these winds from a general circulation model. Data was gathered using ground based ultra-high spectral resolution observations of non thermal (non-LTE) CO_2 features around 10 μm wavelength. Observations were carried out during three seasons (L_S=335 (season 1), 357 (season 2), 040 (season 3)) using the Cologne Tuneable Heterodyne Infrared Spectrometer (THIS) at the McMath-Pierce Solar Telescope on Kitt Peak, Arizona and the NASA InfraRed Telescope Facility on Mauna Kea, Hawaii). Heterodyne techniques allow a spectral resolution of more than 10^6 and thus the observation of fully resolved molecular features and the retrieval of Doppler shifts down to $\sim$1 MHz. In the case of our observations this corresponds to an accuracy of 10 m/s. In addition the high spatial resolution on the planetary disk intrinsic to infrared wavelength enables unique ground-based studies of latitudinal variations. The model prediction were composed from the Mars Climate Database (MCD) [Forget2007]. Due to the complex observing geometry the GCM data needs to be extracted from the database in such a way that it reconstructs the field-of-view of the telescope. In addition, since the altitude of the observed winds cannot be determined from the data directly we use the Granada non-LTE radiative transfer code [Valverde2010] to estimate the altitude distribution of emission in our observed spectra.

Season 1 was observed in November 2005 and the results from that campaign are in reasonable agreement to the model predictions [Sonnabend2006]. Two additional observing campaigns were conducted in November 2007 and March 2008 to match the seasons 2 and 3. Those data also agree with tha model except some deviations were found for higher latitudes (>45 degrees).

The presented observations provide the first seasonal study of zonal winds on Mars at high spatial resolutions.

References

[Sonnabend (2008)] G. Sonnabend et al.. *JQSRT*, 109:1016–1029, April 2008.

[Sonnabend(2006)] G. Sonnabend et al. *GRL*, 33:18201–+, September 2006.

[Forget(2007)] F. Forget et al. *LPI Contributions*, 2007, 1353, 3098.

[Lopez-Valverde(2010)] M.A. Lopez-Valverde, et al. *submitted to PSS*, 2010.