Geophysical Research Abstracts
Vol. 16, EGU2014-2164, 2014
EGU General Assembly 2014

Simulated Martian pressure cycle based on the sublimation and deposition of polar CO_2

Osku Kemppinen, Mark Paton, Hannu Savijärvi, and Ari-Matti Harri
Finnish Meteorological Institute, Helsinki, Finland (osku.kemppinen@fmi.fi)

The Martian atmospheric pressure cycle is driven by sublimation and deposition of CO_2 at polar caps. In the thin atmosphere of Mars the surface energy balance and thus the phase changes of CO_2 are dominated by radiation. Additionally, because the atmosphere is so thin, the annual polar cap cycle can have a large relative effect on the pressure.

In this work we utilize radiative transfer models to calculate the amount of radiation incoming to Martian polar latitudes over each sol of the year, as well as the amount of energy lost from the surface due to thermal radiation. The energy budget calculated in this way allows us to estimate the amount of CO_2 sublimating and depositing at each hour of the Martian year. Since virtually all of the sublimated CO_2 is believed to enter and stay in the atmosphere until depositing, this estimate allows us to calculate the annual pressure cycle, assuming that the CO_2 is distributed approximately evenly over the planet.

The model is running with physically plausible parameters and producing encouragingly good fits to in situ measured data made by e.g. Viking landers. In the next phase we will validate the simulation runs against polar ice cap thickness measurements as well as compare the calculated CO_2 source and sink strengths to the sources and sinks of global atmospheric models.