Comparing the Climates of Mars and Earth

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BACKGROUND

Atmospheric characteristics are important indicators of a planet's physical processes, history, and physical mechanics; however, our understanding of atmospheric systems on other planets is inhibited by scarcity of spacecraft instruments and difficulty involved in sending more. As such, models of planetary atmospheres, verified by observable data, are essential for filling the gaps where data has not yet been collected and for understanding large scale planetary atmosphere mechanics.

METHODS

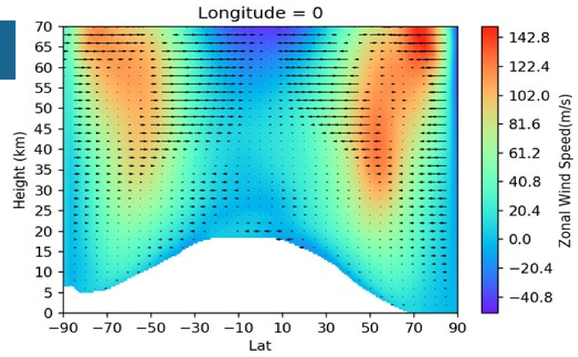
In this study, we used the Mars Climate Database (MCD) to create and graph models of Mars' atmosphere.

- Among the data collected were temperature, pressure, wind velocity, and composition
- Graphs are compared to MPAS graphs, similar modeling software used for the Earth

RESULTS

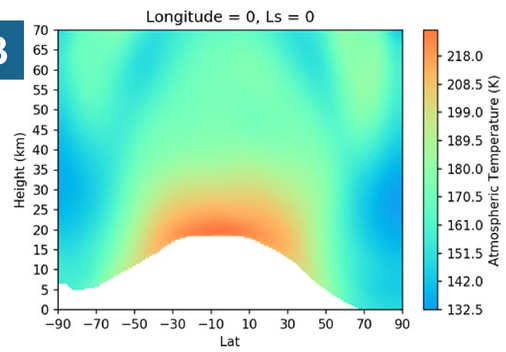
MCD Wind Speed

A



MCD Temperature

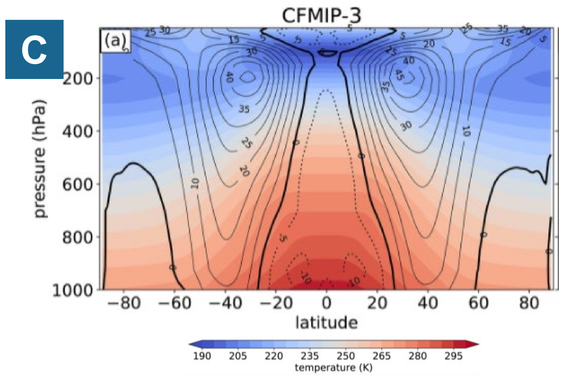
B



a) Graph of wind speed on Mars created with the MCD
b) Graph of temperature on Mars created with the MCD
c) Graph of temperature on Earth with wind speed contour lines, created with MPAS[1]

MPAS Temperature and Wind Speed

C



Wind Speeds and Temperatures on Mars vs Earth

- The thermal gradients are very similar between Mars and Earth
- Locations of higher temperatures are seen on Mars at high altitudes to a much greater extent than on Earth
- Four locations of higher wind speed at high altitudes mark the two sets of jet streams found on both Mars and Earth
- Jet streams on Mars occur at significantly higher latitudes than those on Earth

CONCLUSIONS

With the MCD, we were able to produce many viable models of Mars' atmosphere. There are many similarities, such as the thermal gradient and presence of jet streams; however, there are also many differences to be further investigated, such as the location and altitude of the jet streams.

Better models of Mars' atmosphere such as those created with the MCD will continue to improves further exploration, answers fundamental questions about Earth's evolution, and may give clues as to how to Earth will continue to evolve.

REFERENCES

[1] Rios-Berrios, R., Medeiros, B., & Bryan, G. H. (2020). Mean Climate and Tropical Rainfall Variability in Aquaplanet Simulations Using the Model for Prediction Across Scales-Atmosphere. Journal of Advances in Modeling Earth Systems, 12(10). https://doi.org/10.1029/2020ms002102

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