First ever weather network on Mars

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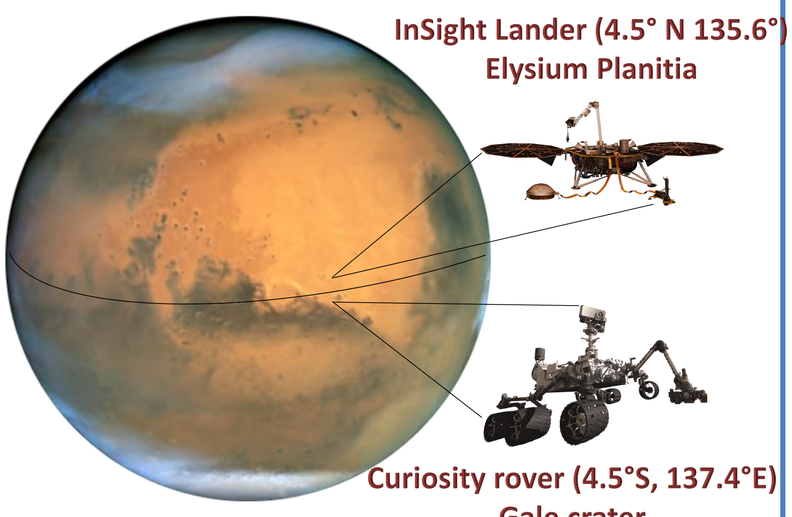
Abstract

For the first time ever, we examine the atmospheric pressure and air temperatures obtained by two different weather stations observing simultaneously on an extraterrestrial body (Mars): the *Rover Environmental Monitoring Station* (**REMS**) onboard NASA *Curiosity rover* inside Gale Crater and *Temperature and Wind for InSight* (**TWINS**) onboard NASA InSight lander on Ellisium Planitia. The meteorological model **MRAMS** had been used to better understand the martian meteorology in the two very diferrent environments. The results revealing changes in pressure and temperature driven by the change in altitude of the rover and meteorological cycles.

Missions locations

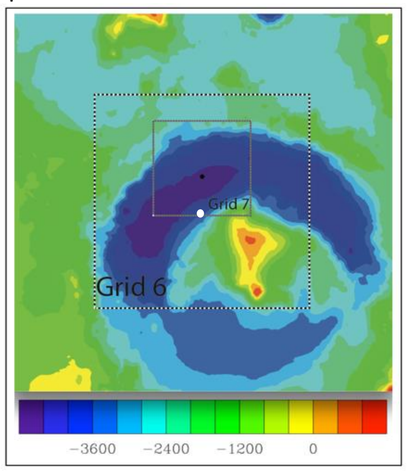


Meteorological simulations with MRAMS

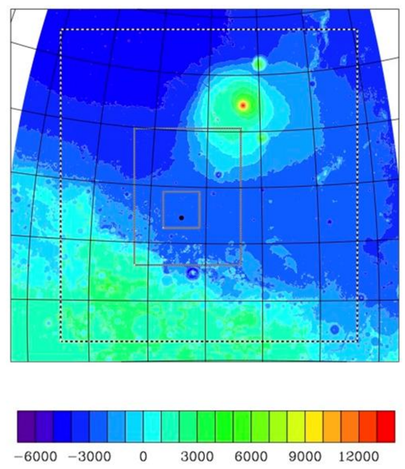
- MRAMS was applied to the mission locations
- Horizontal Grid Spacing applied to landing site region up tp 330 meters
- Initialization and boundary condition data are taken from a NASA Ames GCM simulation with column dust opacity driven by zonally-averaged TES retrievals.
- Vertical dust distribution is given by a Conrath-ν parameterization that varies with season and latitude.

Experiments design

Topo is shown as color-coded elevation (m) from the Mars Orbiter Laser Altimeter



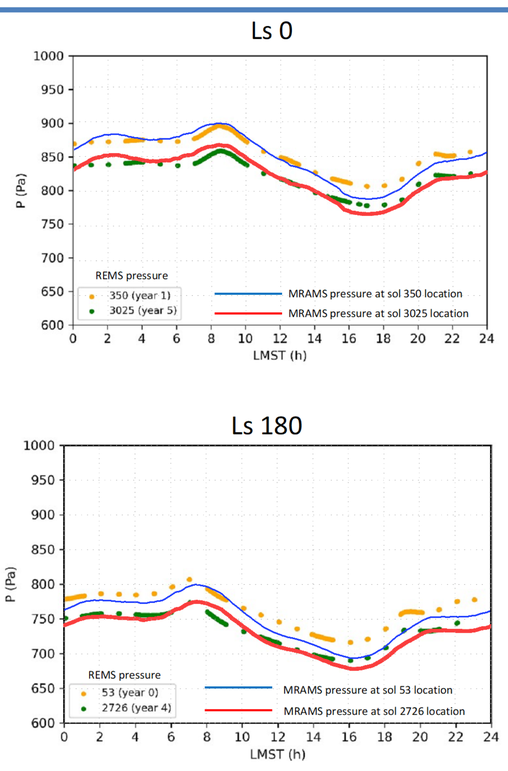
Curiosity landing location (black dot)
Curiosity new location (white dot)

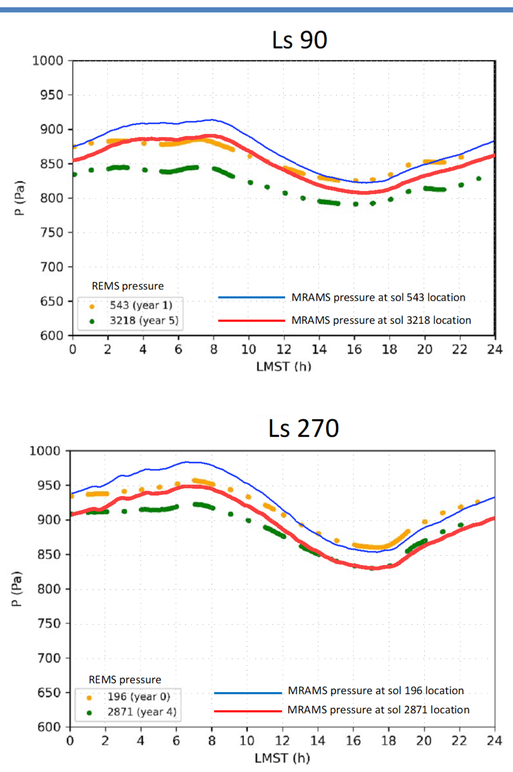


InSight location (black dot)

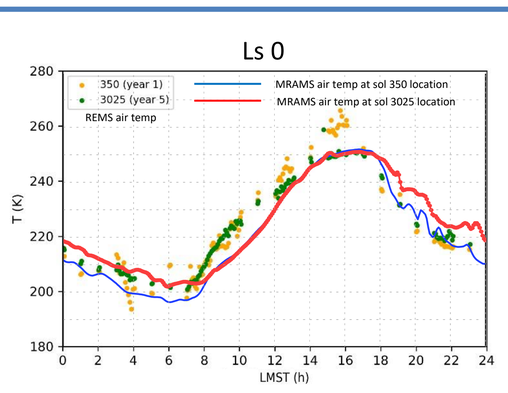
REMS vs MRAMS

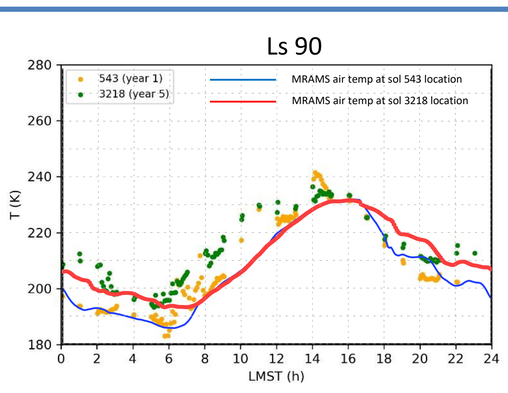
PRESSURE

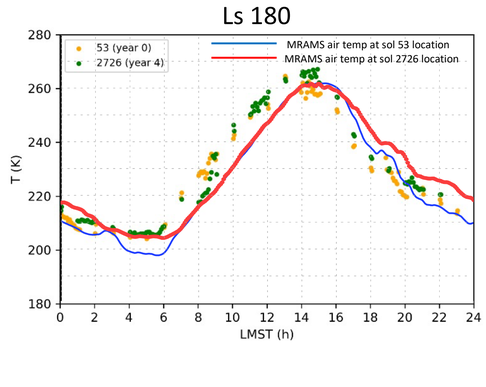


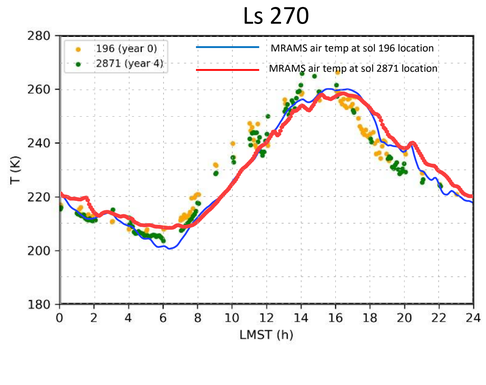


TEMPERATURE



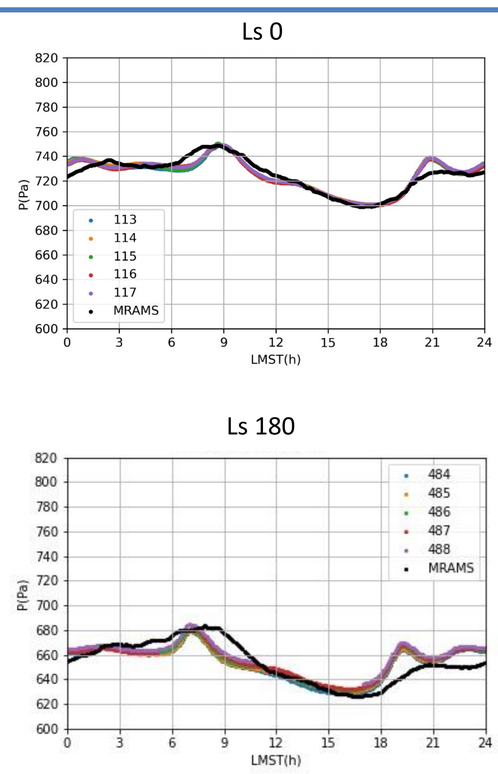


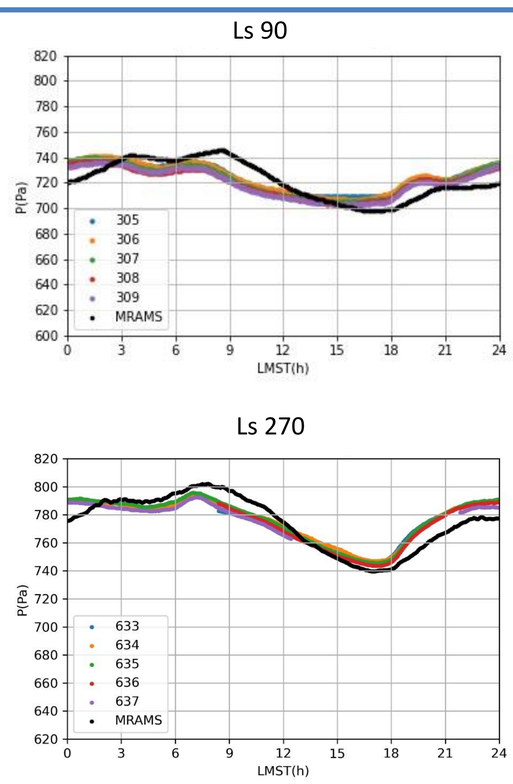




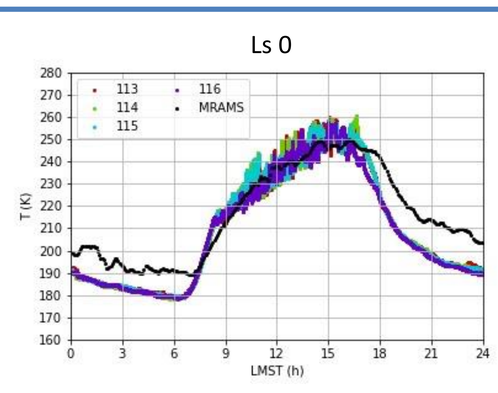
TWINS vs MRAMS

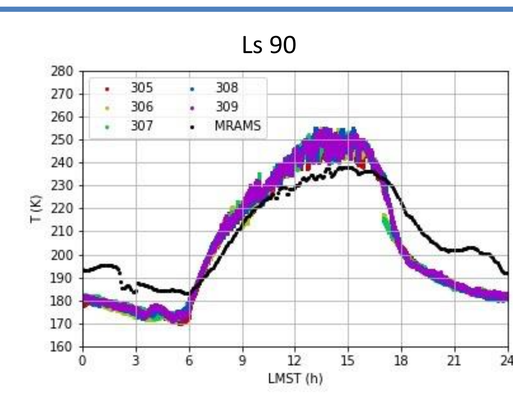
PRESSURE

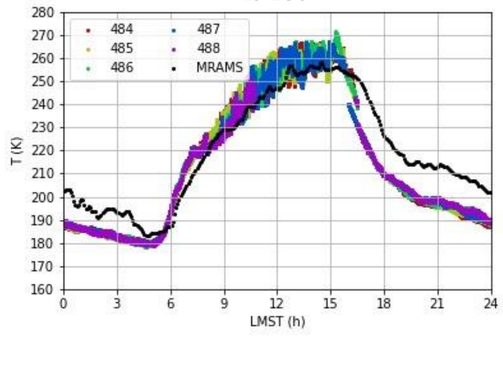


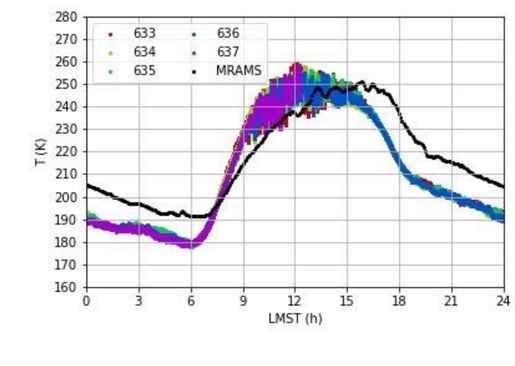


TEMPERATURE









Conclusions

- First ever weather network on Mars
- The good fit between the simulations and observations is indicative that the model MRAMS satisfactorily recreates the essential features both in Gale Crater and Elysium Planitia (Mars).
- Pressure decay as the rover Curiosity climbs Mt.Sharp
- Pressure is bigger at Gale crater (-4,500 m) due to elevation changes vs Elysium Planitia (-2,600 m)
- Ruíz-Pérez et al. (2022). Interpretation of the Meteo Environment Changes Experienced By MSL During Mission Traverse. In preparation
- Ruíz-Pérez et al. (2022), The meteo of Elysium Planitia (Mars) as determined from InSight observations and MRAMS. In preparation