Recent Mars results that have gotten press attention

- Distribution of near-surface ground ice accessible by astronauts (Piqueux et al., 2019)
- Anomalous abundance of atmospheric O2 (Trainer et al., 2019)

Distribution of ground ice derived from thermal-inertia analysis (Piqueux et al., 2019)

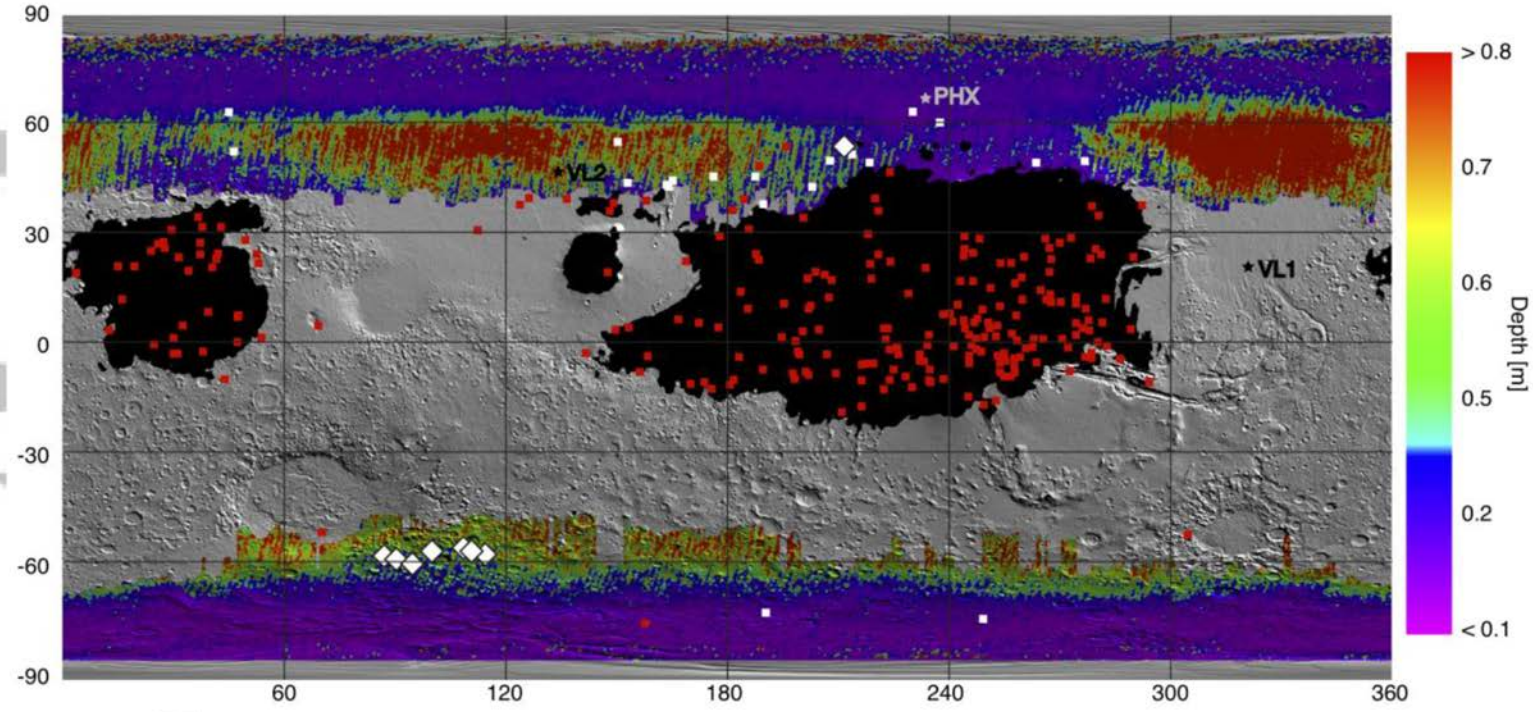
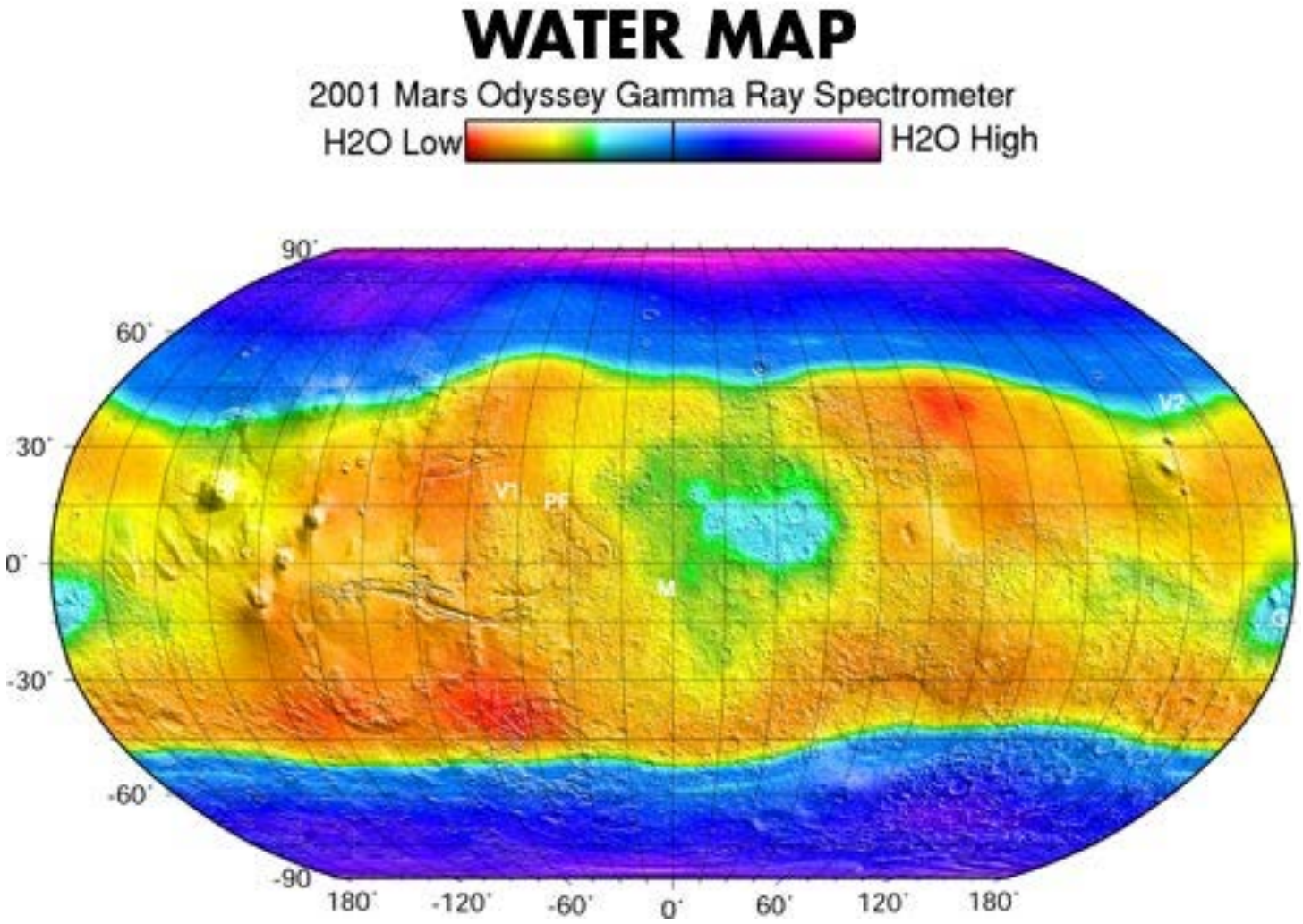
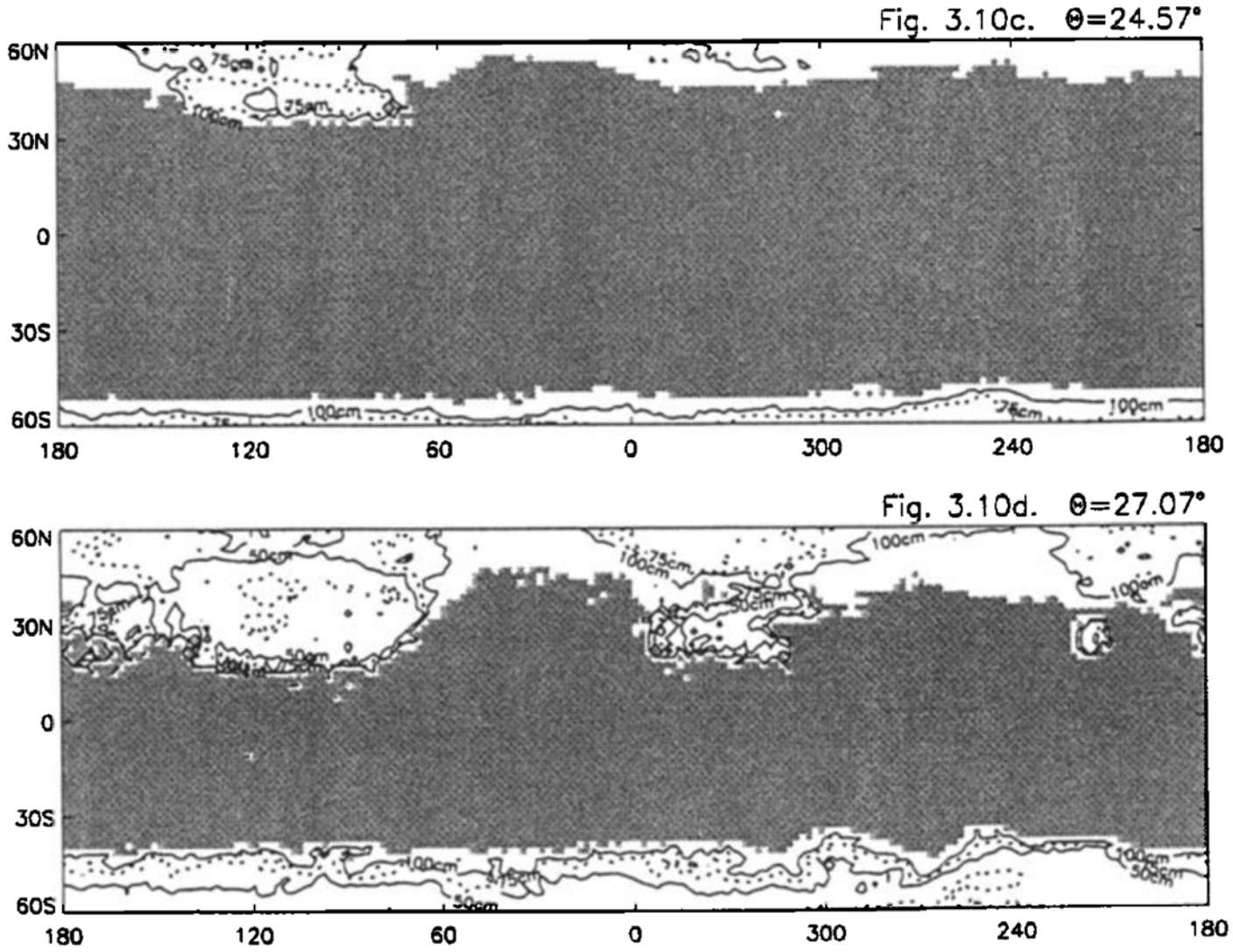


Figure 3. Depth to the top of the water ice table *d* derived from MCS data. Background is a MOLA shaded relief. Low thermal inertia regions unsuitable for landing are masked out. PHX, VL1, and VL2 indicate the landing site locations for Phoenix, Viking Lander 1, Viking Lander

Water-ice distribution derived from GRS neutron data (Feldman, Boynton, many papers)



Predicted distribution of ground ice at different values of obliquity (Mellon and Jakosky, 1995)



Variations in O2 content of atmosphere (Trainer et al., 2019)

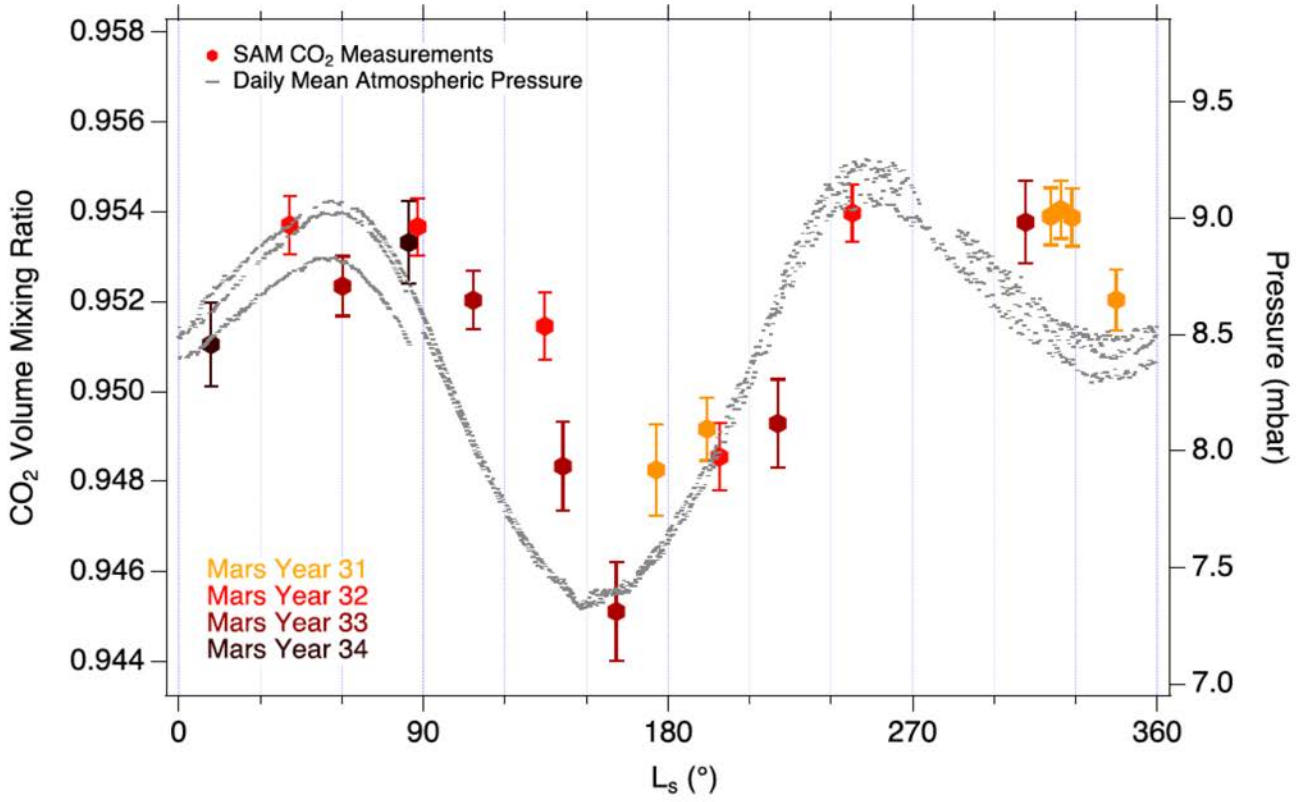
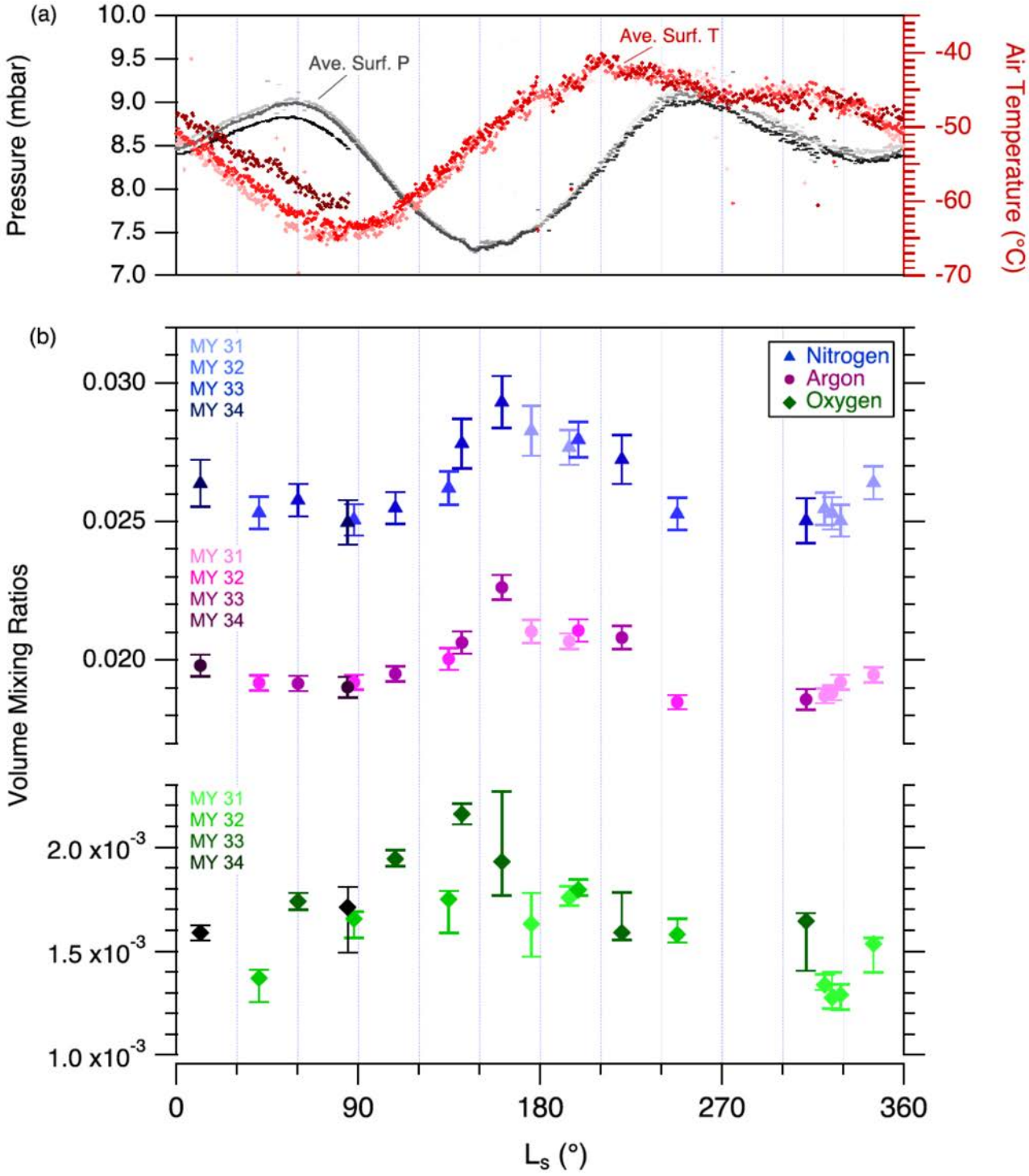
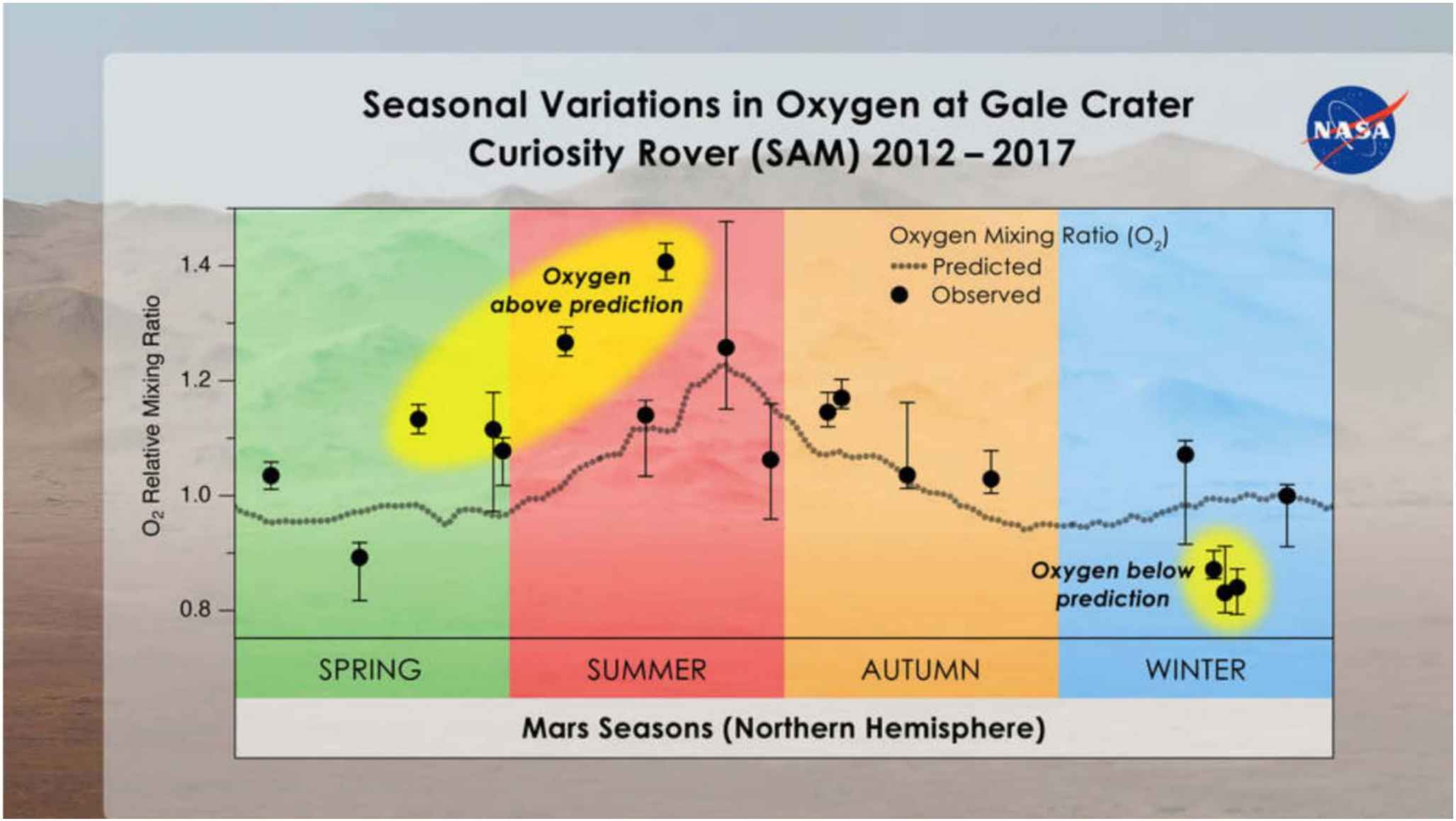


Figure 5. SAM measurements of the CO_2 volume mixing ratio (symbols, left axis). The color scale is matched to Mars year, with tones going from lighter to darker as the points move from Mars year 31 to 34. The error bars on individual points are derived from the uncertainties on the trace gas measurements as described in the text. The daily mean pressure at the surface pressure (gray dashes, right axis), indicating the general pressure cycle on Mars. The vertical axes are set so that the minimum and maximum points in each data set are aligned allowing for visual comparison of the trends. An average CO_2 mixing ratio of 95.1% ± 0.3% is derived from these data.


(a)
Pressure (mbar)
10.0
9.5
9.0
8.5
8.0
7.5
7.0
Ave. Surf. P
Ave. Surf. T
-40
-50
-60
-70
Air Temperature (°C)
(b)
Volume Mixing Ratios
MY 31
MY 32
MY 33
MY 34
Nitrogen
Argon
Oxygen
0.030
0.025
0.020
2.0 x10-3
1.5 x10-3
1.0 x10-3
0
90
180
270
360
Ls (°)


Seasonal Variations in Oxygen at Gale Crater
Curiosity Rover (SAM) 2012 – 2017
NASA
Oxygen Mixing Ratio (O_2)
Predicted
Observed
Oxygen above prediction
Oxygen below prediction
O_2 Relative Mixing Ratio
1.4
1.2
1.0
0.8
SPRING
SUMMER
AUTUMN
WINTER
Mars Seasons (Northern Hemisphere)

“Traditional” scheme for photochemical production of O2

$$CO_2 + h\nu \rightarrow CO + O,$$

$$H_2O + h\nu \rightarrow H + OH,$$

$$OH + O \rightarrow H + O_2,$$

$$O + O + M \rightarrow O_2 + M,$$

- Simple photochemical scheme is too simple
- Possible reactions involving perchlorates or H2O2?
- Exchange with soil?
- It’s a photochemical problem, unrelated to “breathable” O2!