Overview
The MSL/REMS package recorded environmental conditions [1] at or near the times of 7 of the 8 atmospheric observations conducted by the MSL/SAM instrument suite in the first 100 sols. We present timing information for each SAM atmospheric observation, along with REMS pressure and temperature conditions at the times of each ingestion of an atmospheric event. These data are crucial for estimating relative humidities from SAM/TLS, and for estimating SAM/QMS count rates as a function of variable atmospheric pressure.

SAM ingestion
Times for each atmospheric sample intake are given in the table. Two intake ports were used [2]. One port allows atmospheric gas to flow only to the TLS instrument, Atmospheric gases introduced through the other port can flow to both the QMS and TLS instruments. Microvalves along the gas manifold are used to direct and control the flow of the gas to the specific instruments. The first SAM experiment (Sol 18 21:00–21:08) is not listed, because REMS was powered off and there were no REMS observations within 10 hours of the Sol 18 ingest.

REMS data
We used coincident REMS measurements or interpolated data separated by no more than an hour from the intake events. The table lists REMS measurements of pressure, air temperature, and ground temperature for each event. Uncertainties in the table include true environmental variation during the ingestion, statistical errors, systematic errors, and interpolation error, especially given the transient variability seen at the typical times of SAM sample ingestions (uncertainty in the plots do not include systematic errors other than offsets between ATS 1 and 2, or PS 1 and 2).

Applications
Ingest atmospheric conditions are useful both for interpreting SAM measurements, as well as for planning future observation sequences. For example, water vapor mixing ratios derived from SAM can be converted to relative humidities, using the REMS pressure/temperature data. These data will be complementary to REMS humidity data. Initial analysis of SAM and REMS pressure data suggests that significant systematic sources of error can be quantified by comparing data from both instruments [3].

The sample pressure of a SAM/QMS atmospheric aliquot can be reduced by the sample volume expansion within the gas handling system prior to measurement. A pressure decrease is also seen when trying to measure signals at m/z values where the full pressure range of the detector. But atmospheric pressure saturates the detector. But seasonal change causes Plan pressure levels to vary, and SAM measurements are planned for different points during the diurnal cycle [3]. A roughly linear relationship between atmospheric pressure and count rate can then be used to determine optimal volume expansion ratios needed to prevent SAM/QMS measurements from saturating.

References

Abbreviations
MSL = Mars Science Laboratory
REMS = Rover Environmental Monitoring Station
AT = REMS Atmospheric Temperature Sensor
PS = REMS Pressure Sensor
ATS = REMS Atmospheric Temperature Sensor
SAM = Sample Analysis at Mars instrument suite
TLS = SAM Tunable Laser Spectrometer
LPS = SAM Quadrupole Mass Spectrometer
MST = Local mean solar time at Gale Crater
SCLK = Spacecraft clock time

All plots: Vertical light red bars indicate SAM ingest events, with times shown in LMST and spacecraft clock time (SCLK) in seconds. REMS data product versions used in this analysis ranged from version P3 to version PS. Further gains in accuracy are expected as improvements are made in REMS calibration.