DEVELOPING A UNIFIED TES AND MCS RELATIONAL DATABASE

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Introduction:

The Thermal Emission Spectrometer (TES) instrument on-board the Mars Global Surveyor (MGS) provides thermal infrared spectra of the column abundance of dust in the Martian atmosphere. The Mars Climate Sounder (MCS) on-board the Mars Reconnaissance Orbiter (MRO) provides atmospheric dust abundance through limb sounding observations. Our project is to develop a single relational database that will allow both datasets to be stored and queried within a single architecture, and provide the added feature of being able to visualize the data in a geographic information system (GIS).

Database Architecture:

We will be using numerical Python (Numpy) along with the open-source SpatiaLite geo-database container. A Python program has been written to read in the two instrument datasets. The program populates a single, shared SpatiaLite database with high-level metadata that can be used as a filter for the full-resolution acquisitions from each instrument. Rather than redundantly storing the full-resolution data in the SpatiaLite database, a separate program will first query the metadatabase before reading the matching full-resolution data from its native PDS format. This will spare us from having to store two versions (PDS and SpatiaLite) of the two datasets.

At a minimum, our metadatabase will track values of observation time and longitude/latitude observation locations:

```
SELECT UTC,SURF_LON,SURF_LAT from MCS LIMIT 4;
1.        00:00:14.579|-27.59672|31.30929
2.        00:01:22.163|-28.25098|35.83298
3.        00:01:54.930|-48.32672|11.85129
4.        00:02:31.794|-28.80349|39.46898
```

Each entry in the metadatabase is linked to the PDS formatted data that it originated from. The metadatabase can be queried to obtain the short list of full-resolution data products that will contain data that matches the query filter:

```
SELECT DISTINCT DATA from MCS where PROFILE_LAT between -
5 and 17 and PROFILE_LON between -130 and -113 LIMIT 4;
1.
2.        MROM_2107/DATA/2015/201507/20150701/2015070104_DDR.TAB
3.        MROM_2107/DATA/2015/201507/20150701/2015070116_DDR.TAB
4.        MROM_2107/DATA/2015/201507/20150702/2015070204_DDR.TAB
5.        MROM_2107/DATA/2015/201507/20150702/2015070216_DDR.TAB
```

Geospatial Columns:

We will take advantage of the spatial columns that are unique to geo-databases, such as SpatiaLite, to facilitate the visualization of our metadata and to perform geometric queries. The figure below shows the open-source QGIS application being used to visualize the observations that match the DISTINCT DATA query above. With the help of an MDIM overlay, we can make an interactive map that shows where our short list of data products is located.