VIRS Animated Visualization
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Description:

The Mercury Atmospheric and Surface Composition Spectrometer (MASCS) Visible and InfraRed Spectrograph (VIRS) animation products are a visualization tool to help contextualize and analyze specific individual VIRS reflectance data on Mercury's surface.

The animations were originally developed using Calibrated Data Records (CDRs), utilizing radiance data from VIRS and converting the data to photometrically normalized data before the creation of Derived Data Records (DDRs), and before the Applied Coherent Technology (ACT)-Quick Map interactive visualization tool (http://messenger.jhuapl.edu/Explore/Quick-Map-Orbital-Data.html) became fully operational. The animations provide useful detailed information in the context of time-sequenced surface observations.

The animations are provided as-is, and do not present sophisticated analysis. It is recommended that any quantitative analysis on the data be performed using the DDRs available via PDS.

Each VIRS DDR observation has its own animation, with one frame for each VIRS spectrum acquired on the sun-illuminated surface. Each frame has 5 views, shown in the Figure below.

1) This is the image section showing the VIRS footprint placed on a background color map from the Mercury Dual Imaging System (MDIS). This background map is the "GlobalColor_equi_64ppd.1000.750.430" image, which is a 3-color global composite of the 1000 nm, 750 nm, and 430 nm filters of MDIS in the red, green, and blue channels respectively, with a resolution of 64 pixels per degree. Overprinted on the map is a rectangular representation of the VIRS footprint (which is actually a lozenge shape representing the true ground-smeared circle of the VIRS field of view (FOV) as described in VIRS_CDR_DDR_DAP_SIS.PDF, located in the DOCUMENT directory). The footprint is color-coded by reflectance at 750 nm (where blue is a reflectance of 0.015, and red & white are a reflectance of 0.075). Similarly-color-coded outlines of preceding and following footprints are also shown, as is a 1° latitude and longitude grid showing the orthogonal projection of the map.

2) This section shows various metadata about the spectrum all taken from the DDR: Observation number, spectrum number, dimensions on the surface of the VIRS footprint, center latitude and longitude of the VIRS footprint, viewing geometry (i = incidence angle, e = emission angle, a = phase angle), and instrument temperatures (VT is visible detector temperature, NT is near-IR detector temperature).

3) This section shows the VIRS reflectance spectrum in green, normalized at 450 nm co-plotted with the normalized Mercury mean spectrum (black). Different Mercury mean spectra were calculated from tens of thousands of samples across the planet depending on the time and special

circumstances of the VIRS data acquisition. Examples: 1) In the first orbit year, many thousands of spectra were taken with VIRS binning set to 2 (i.e., every 2 spectral pixels were binned together). A "binned by 2" mean Mercury spectrum was derived for this data. 2) There was a spacecraft event that resulted in a slight shift of the calibration on day 260 of 2011. Data that was taken before this time use a slightly shifted version of the Mercury mean spectrum. This section also shows the current footprint's spectrum ratioed to mean Mercury in red. Individual spectra have a variable offset applied to the NIR spectrum to create a more linear progression from VIS to NIR detector results. This compensates empirically for a never-completely-solved occasional offset between the response of the two detectors.

4) This section shows the photometrically normalized footprint reflectance spectrum (green) and mean Mercury spectrum (black). Photometric normalization changes the effective incidence, emission, and phase angles of the observed spectrum to 45°, 45°, and 90°, respectively.

5) This section shows a pair of parameter plots with VIRS spectral unit fields (derived from IZENBERGETAL2014; see REF.CAT in the DOCUMENT directory) for each spectrum in the observation. The top plot compares reflectance at 575 nm with the UV-VIS ratio (310 nm / 390 nm). The bottom plot compares the VIS-NIR ratio (415 nm / 750 nm) to the UV-VIS ratio. The field shows a point for every spectrum in the observation, with the current footprint's parameters noted in cyan.

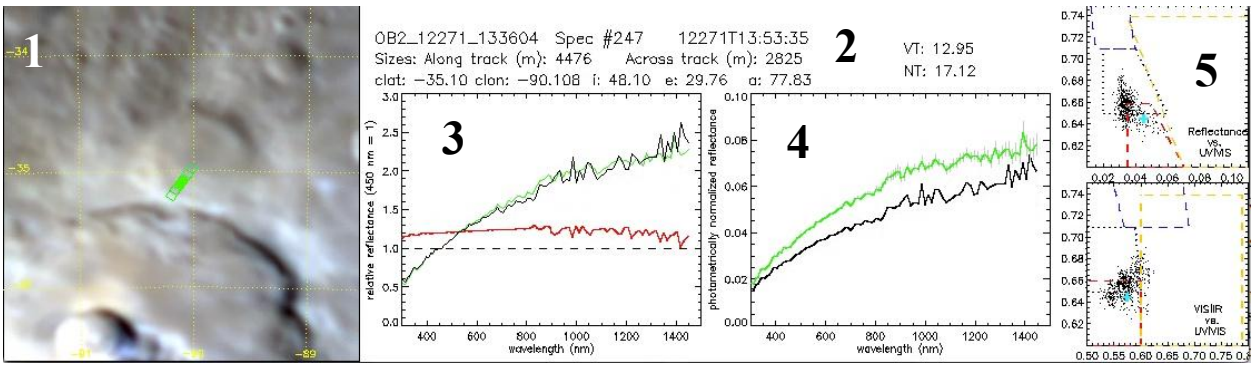

Figure: Frame grab from VIRS movie with 5 views numbered as described above.

Nomenclature:
The VIRS visualization file nomenclature follows that of the CDRs and DDRs:

XXX_YYDOY_HHMMSS_DDR_video.mp4
or
XXX_YYDOY_HHMMSS_PHT__DDR_video.mp4

XXX = Mercury mission phase
- MF1, MF2 – Mercury flyby 1 and 2
- ORB – Primary mission
- OB2-OB5 – Subsequent orbit years

YYDOY = Year and day of year of the VIRS observation
- YY – from 11 to 15 for 2011 to 2015
- DOY – day of year (1 to 365 or 366)

HHMMSS = Start time (hour, minute, second) of the VIRS observation
PHT_ = Designation of photometric observation, targeting one of about a dozen points on Mercury repeatedly to get a variety of photometric angles. Each of these observations has 36 spectra.