

Documentation: Mercury pole data (revised: 3 Feb 2015)

This document explains how to access and use the Arecibo S-band radar images of the Mercury poles. The data and support files are located in the web directory:

<http://www.naic.edu/~radarusr/Mercpole>

The contents of this directory are:

document.pdf	.....	Documentation (this document)
Image#.dat	.....	Binary image data files (# = 2a, 2b, 3a, 3b, 4, 4h, 5, 7a, 8)
Image#.gif	.....	GIF image files (" " ")
Paper.pdf	.....	Preprint of <i>Icarus</i> article containing these images
locate	.....	Pixel locator program (FORTRAN executable)
locate.f	.....	" " " (FORTRAN source code)

The image files contain uncropped versions of the images in the *Icarus* article (Icarus, 201, 37–50, 2011), where the # numbers correspond to the same figure numbers in the article. For explanations of the images see the article. (Note: Also included is a new south pole image, Image8, which was obtained from observations during 16–25 Mar 2012, when the sub-Earth longitude was 160–223°W and the sub-Earth latitude was 8.3–8.0°S.) All images are 2048×2048 pixels square, except for Image5, which is 4096×4096. The binary (.dat) files contain the image rasters in floating point (real*4, little-endian) format. The data are stored in the same order as the GIF images, with pixel (0,0) in the upper left and pixel (2047,2047) or (4095,4095) in the lower right. (Here we refer to the start pixel index as 0 rather than 1; this is the convention used by most image display software as well as the program *locate*.) The binary (.dat) files are direct-access (no record indicators) and are 4**isize***2 bytes in size, where *isize* = 2048 or 4096. The data values are dimensionless radar reflectivities expressed as radar cross section per unit surface area. Some pertinent parameters for the image files are given as follows:

Name	flim	isize	rms
Image2a	0.12	2048	0.0185
Image2b	0.12	2048	0.0160
Image3a	0.12	2048	0.0173
Image3b	0.12	2048	0.0061
Image4	0.42	2048	0.0140, 0.0116
Image4h	0.42	4096	0.0140, 0.0116
Image5	0.42	4096	0.0116
Image7a	0.34	2048	0.0203
Image8	0.34	2048	0.0095

Here *flim* is a planet coverage parameter giving the image boundaries expressed as the sine of the maximum colatitude along the vertical and horizontal longitude meridians. You need to enter both *flim* and *isize* when using the pixel locator program *locate*. The error parameter *rms* represents one noise standard deviation for the image. This error

strictly applies only to those portions of the image that are visible (within the radar horizon) on all of the dates contributing to the multi-day summed image. On the larger-scale images (4 and 5) you can see noisier wedges where the terrain is beyond the radar horizons of some of the observations. For those portions of the planet that are beyond all of the radar horizons, the data values are set to zero. (For the south pole images, Image7a and Image 8, you do not see a noisier wedge because for these cases the pixels were zeroed for terrain that was beyond the radar horizon on any of the observing dates.) For Image4, the two *rms* values quoted correspond to the left and right sides of the image, respectively, with the image spliced vertically at x-pixel 700 (see preprint). Image4h is a higher-resolution version of Image4 that I added to this web site on 6 Jan 2012; this newer version, spliced at x-pixel 1400, was added to match the resolution of Image5.

The pixel locations in planetary coordinates are not given in the data files. Instead, you can calculate the coordinates of a given pixel using the provided FORTRAN program *locate*. I have provided the source code for this program (*locate.f*) in case the compiled executable does not run on your machine.

If you have any questions or find a problem, my contact information is:

John Harmon

Email: Jharmon897@gmail.com

Phone: 509-474-0459, 787-461-3328 (cell)