GLOBAL CRATER CATALOGUES OF THE MOON, MARS AND PHOBOS. L. Bandeira[1], G. Salamunićcar[2] and T.M. Hare[3], [1]CERENA/IST/UL, Lisbon, Portugal, lpcbandeira@ist.utl.pt, [2]Ivana Zajca 8, HR-47000 Karlovac, Croatia, gsc@ieee.org, [3]Astrogeology/USGS, Flagstaff, AZ, USA, thare@usgs.gov

Introduction: In a large majority of lunar and planetary surface images, impact craters are the most abundant geological features. Therefore, it is not surprising that crater detection algorithms (CDAs) are one of the most studied subjects of image processing and analysis in lunar and planetary science [1]. By applying an integrated/ hybrid CDA that exploits the use of digital elevation models (DEMs) and optical images, three global crater catalogues were constructed for the Moon, Mars and the small Martian moon Phobos. The accuracy of the catalogues is ensured by double-checking each crater: (1) in some cases with CDA and a person; and (2) in another cases with two different people/teams. Thanks to this approach, the detections obtained by the CDA were all manually verified and each crater from the resulting catalogue has double confirmation that it is a crater indeed. The result is the Moon crater catalogue LU78287GT, currently the most complete global catalogue for the Moon, contains 78,287 craters [2]; the Mars crater catalogue MA132843GT contains 132,843 craters [1,3] and PH9224GT, currently the most complete global catalogue for Phobos, contains 9,224 craters [4]. These catalogues have been compiled by Goran Salamunićcar and his team for the last several years, but only now have been converted to a more convenient format (GIS shapefiles) so that interested scientists can access and integrate them in their own projects. The catalogues will be redistributed using U.S. Geological Survey's data portal called Astropedia (http://astrogeology.usgs.gov/search). The possible applications of these catalogues include cartography, age estimations, comparison and evaluation of the different production functions, the possibility of comparing a large number of craters from different planetary bodies (e.g. depth/diameter ratio and 2D profiles), and the evaluation of CDAs.

Moon Global Crater Catalogue: This catalogue was constructed by combining manually gathered catalogues [5-8] with the detections of an hybrid CDA, which utilizes topography reconstructed from optical images and DEMs obtained directly from sensors including the Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera, LRO Lunar Orbiter Laser Altimeter (LOLA), KAGUYA (SELENE) Laser Altimeter (LALT) and Chandrayaan-1 Moon Mineralogy Mapper (M^3). LU78287GT is globally complete for ~D≥8 km, and provides latitude, longitude, and diameter for each crater. By contrast, for the Moon the most complete previous catalogue contains 14,923 craters [6].

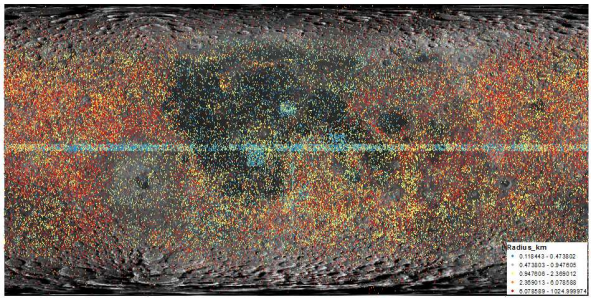

Fig. 1: Moon Global Crater Catalogue, LU78287GT.

Mars Global Crater Catalogue: For Mars, 57,633 craters from the manually assembled catalogues [9] (including catalogues by Barlow, Rodionova, Boyce, and Kuzmin) and 75,210 additional craters identified using several CDAs (including catalogue by Stepinski) have been merged into the MA132843GT catalogue. This catalogue is complete up to ~D≥2 km.

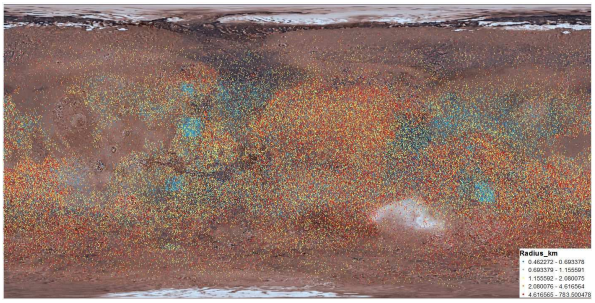

Fig. 2: Mars Global Crater Catalogue, MA132843GT.

Phobos Global Crater Catalogue: Taking advantage of the newly released datasets of Phobos [10], including the global DEM upsampled to a 1/4° resolution and global optical image mosaics released at a 1/16° and 1/40° resolutions [11], it was possible to apply a hybrid CDA and detect 9,224 Phobos craters. This catalogue is globally complete for ~D≥50 m.

Conversion: Prior to release of the original crater catalogues, we wanted to convert them into a GIS-ready format. We used the original formatted XML-based catalogue to extract only the unique ID, Latitude, Longitude, and the crater's radius in degrees. Once converted to the GIS point shapefile, an additional field was added to hold the radius of each crater in kilometers. Previous versions of the Mars and Lunar catalogues contained other fields (e.g., depth). Because this was not included for all craters in the most recent versions, this information was not integrated into the current GIS release but maybe added in future versions.

The catalogues are documented with the required metadata and compressed into a single zip format per planetary body and can be downloaded from the Astropedia online data portal [12].

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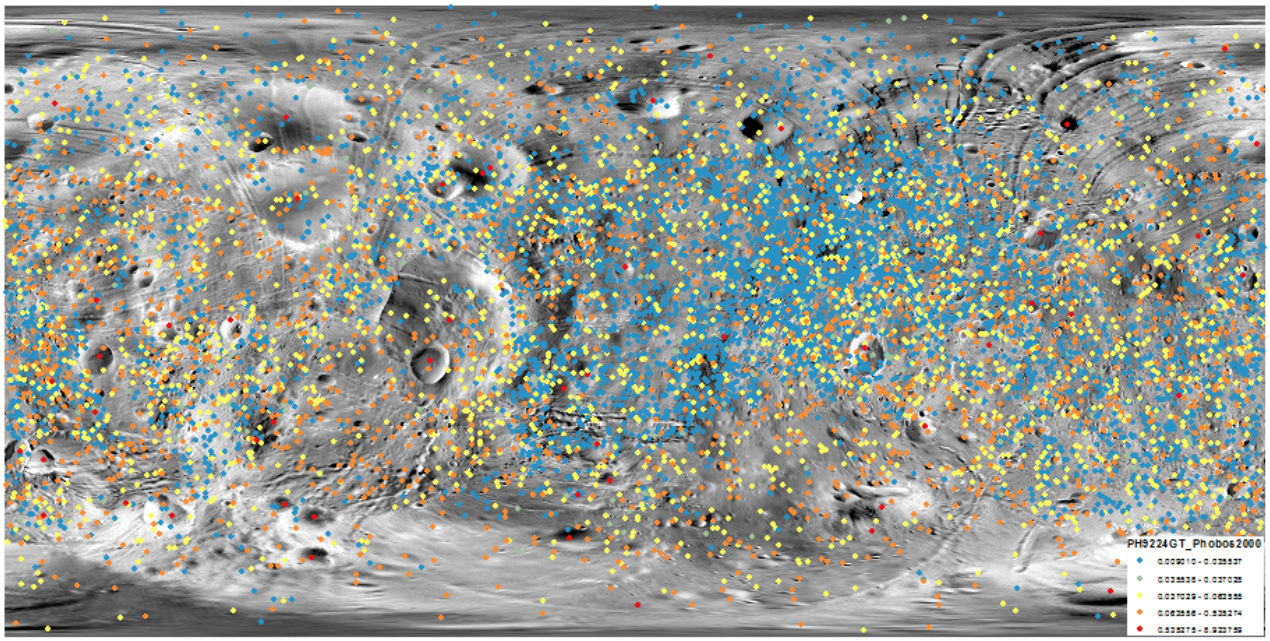

Fig. 3: Phobos Global Crater Catalogue, PH9224GT.