The First Automatic Survey of Impact Craters on Mars

GLOBAL MAPS OF DEPTH/DIAMETER RATIO

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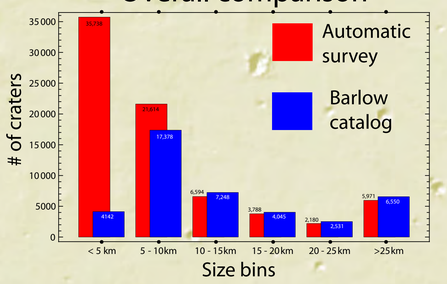
Global catalog of 75,919 impact craters on Mars has been compiled automatically by a computer algorithm using a method described in [1,2]. We compare this new catalog to widely used global catalog compiled by N. Barlow [3] which contains 42,283. One advantage of the new catalog is that it lists estimates of crater depths. This makes possible creation of global maps of depth-to-diameter ratio. The global pattern of crater depths depends on the size of the craters. Depth/diameter maps for six different crater size bins were created. Overall the results are consistent with the existence of the cryosphere at depths that decrease toward the poles. Geographical regions on Mars having, statistically, deepest craters have been identified.

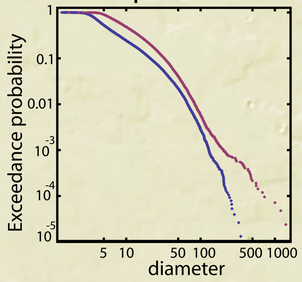
Comparison to Barlow Catalog

Comparison to Barlow catalog consists of contrasting of histograms in six crater size bins, exceedance probability curves, and crater density maps. Density maps are calculated using a moving circular window of radius 250 km. New catalog lists many more small craters.

Overall comparison



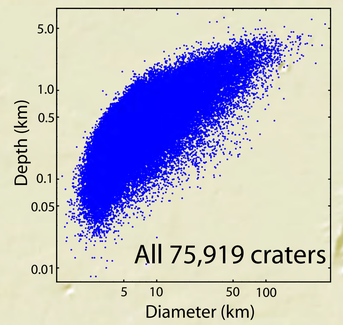
Completeness

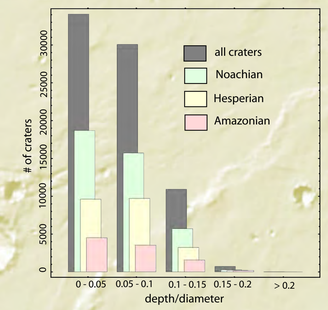


Exceedance probability, P(D>X), is a probability that a randomly chosen crater has diameter larger than X. It represent a convenient way of displaying distribution of crater sizes. A diameter at which the exceedance probability curve levels off set a limit on statistical completeness of the catalog is set by. This limit is ~3 km for the new catalog (red) and ~5 km for Barlow catalog (blue).

Depth/Diameter Maps

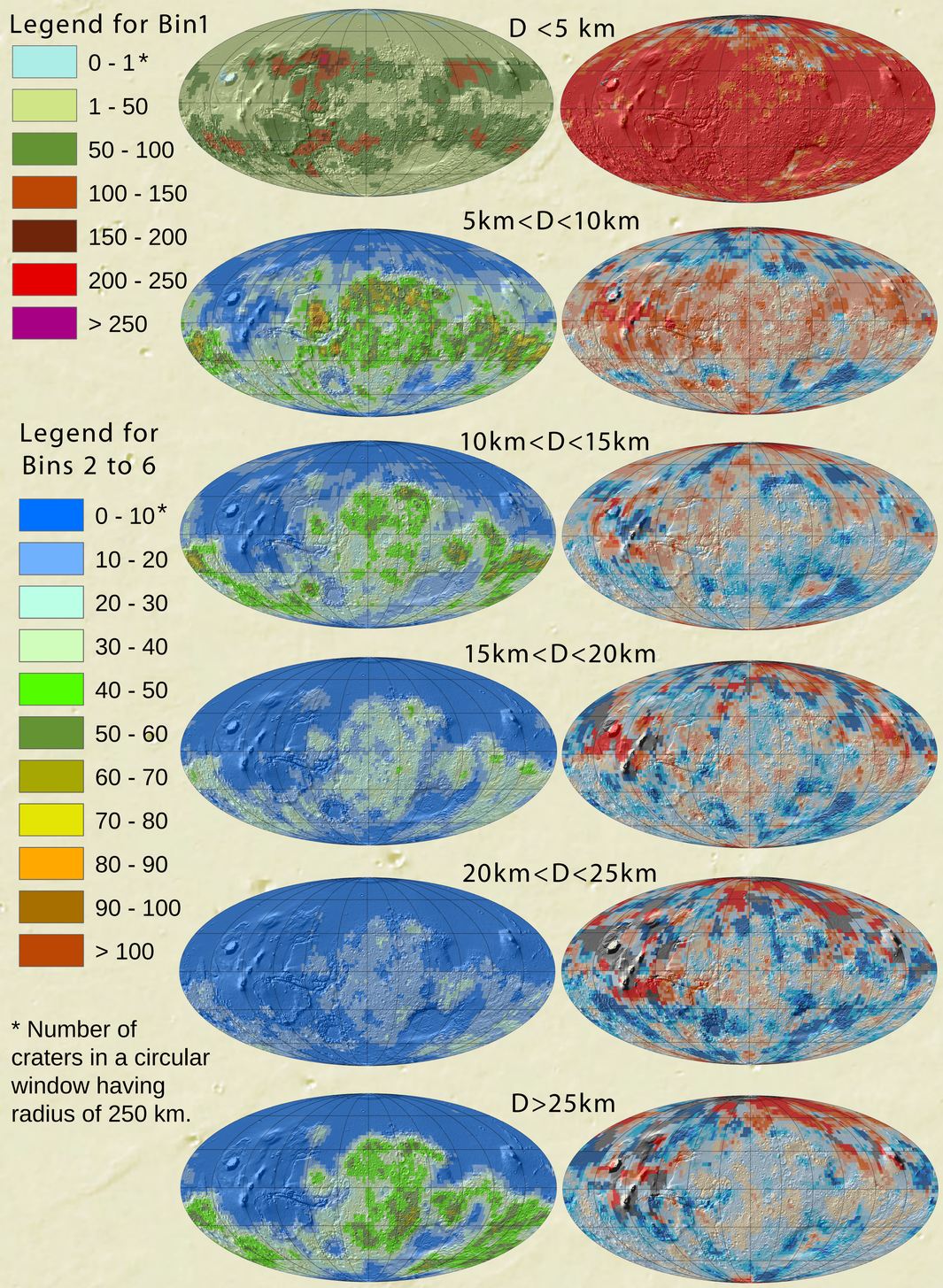
To create depth/diameter (d/D) maps craters in the catalog are divided into six size-bins. Using craters from each bin separately, maps of d/D are constructed using the moving average technique. The depth-diameter relation for all craters and distribution of d/D in surfaces of different ages are also given.





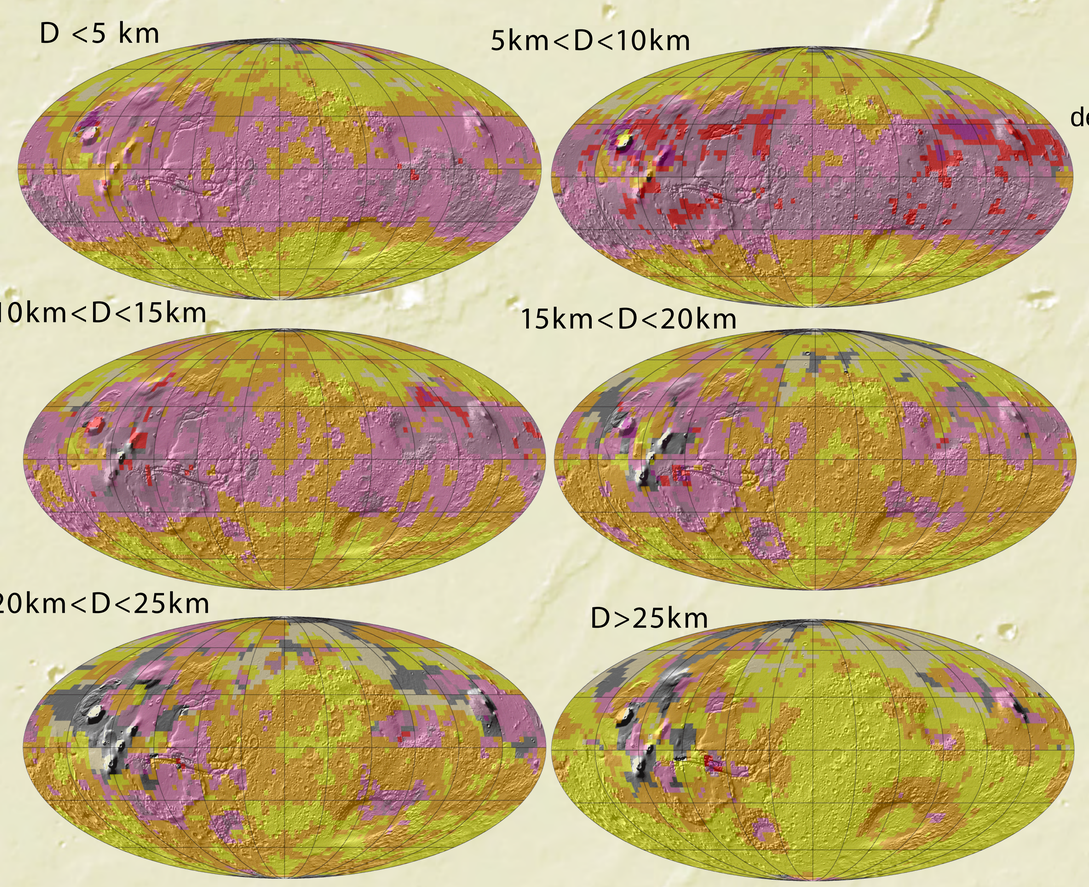
Maps of crater Density

Automatic survey Relative to Barlow



* Number of craters in a circular window having radius of 250 km.

Maps of depth/diameter ratio



Conclusions

- The new catalog demonstrates the feasibility of surveying craters by automatic means.
- An algorithm is efficient for finding small craters having simple morphology; it is less efficient for finding craters having complicated morphologies.
- The global maps of d/D reveal a distribution of crater depths on Mars. Isidis Planitia and Utopia Planitia are places were craters are statistically the deepest.
- The global pattern of d/D is consistent with the existence of the cryosphere at latitude-dependent depth.

References: [1] *Stepinski, T. F. et al. (2007) LPSC XXXVIII, Abstract #1338.*
[2] *Stepinski, T.F. et al. (2007) Icarus, submitted.*
[3] *Barlow, N.G., (1988) Icarus, 75(2), pp. 285- 305.*

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