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Conditions for Water Ice Accumulation within Craters on Mars

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Images of a Martian crater show intriguing distribution of water ice. The crater is at 71^oN, 103^oE. At the floor of this crater an almost circular region of water ice is observed while the rest of the crater floor appears defrosted. This effect was first found in the MOC image M23-01916 (Wide Angle Camera) taken during late Martian spring, at solar longitude L_s = 110^o. Two Martian years later an image taken by HRSC camera at L_s = 154^o, shows the same effect. Both images indicate that the material underneath the ice is darker than the rest of the crater floor. In this work we attempt to answer the question, whether observed distribution of ice cover on the crater floor requires nonuniform properties of the regolith. We also would like to know if this ice feature is only a seasonal phenomena or is it stable on longer timescales. We model seasonal cycle of condensation and sublimation of CO_2 and H_2O ices, within a crater at the observed location at 71^oN, 103^oE. Our simulations show, that the formation of a long lasting, or permanent ice layer in the centre of the crater is possible only when below it the regolith has thermal inertia higher than the rest of the crater. This is the case for many Martian craters where the central region is made up of old highly consolidated dune field, while the rest of the crater floor is covered by younger fine-grained deposits.