IMPACT MELT AND ITS INTERACTION WITH HYDROCARBONS ON TITAN.

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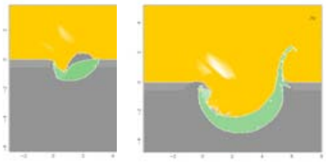
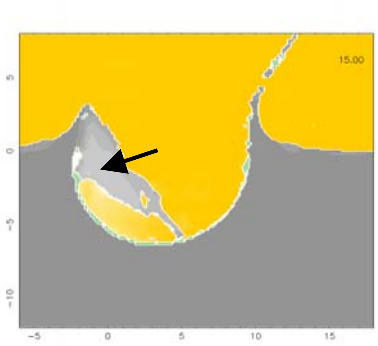
Impact melt within the crater. To define impact melt we carry out numerical simulations of cometary impacts onto Titan surface. We use the 3D version of SOVA (Shuvalov et al., 1999) complemented by the ANEOS equation of state (Thompson and Lauson, 1972) for ice (Pierazzo, pers. comm.). The calculations model 2 km in diameter spherical comet made of ice without porosity striking Titan's surface at angles of 45° and 30° from the surface with velocities of 7 and 15 km/s (the last one may be too high for Titan). The target consists of a porous layer with linear increase of porosity from 40% in the top layer to solid ice with density of 1.14 g/cm3 at depth of 800 m. Special tracers mark an upper 100 m of the target to model evolution of this carbon-rich layer and its possible interaction with impact melt within the crater. Tracer technique method (Pierazzo et al., 1997) allows to estimate melt production from the value of peak shock pressure. We need compression ~5.8 Gpa to melt non-porous ice or only ~2.5 Gpa to melt an ice with 20% porosity. By assuming that all the melt remains in the crater, however, we overestimate the value of melted material in the crater, as this doesn't take into account melt ejection. To receive an amount of melt within the crater we continue the simulations till the maximum volume of transient cavity (20-30 s after an impact). As usual this second method underestimate the melt production, because during the crater growth the melt is mixed with unmelted material and final average temperature is lower. To avoid this mixing we used special procedure and define molten material as another one (but with the same equation of state) and also applied tracer particles to define final temperature of target material. This procedure allows us to diminish mixing and to receive more reliable temperature distribution within the melt sheet. Figure 1 shows the first second after an impact. Exactly during this time shock pressure is high enough to melt the target (melt is represented by green color in the Figure). Melt retained in the crater ranges from 2-6% of the crater volume. Finally we have a rather thin layer of melt lining the crater cavity. This layer may be twice as thick, if some contaminants are present in the ice, decreasing the melt temperature down to 176 K. The ratio of melt volume to crater volume is less than 3% for all impact angles and velocities.





The fate of the top layer of the target is of great importance, because it may be organic rich top layer material subjected to shock compression above 0.5 GPa is ejected from the crater as solid, liquid or vapor are shown with high velocity. But ejecta is decelerated by dense Titan atmosphere rather quickly and will be deposited not far from the impact site onto the cold icy surface. Rather small, but the most interesting portion of ejecta is the material, sited initially close to impact point, but in upward direction (shown in Fig.1 with an arrow). In oblique impact this material is subjected to rather small compression and, hence, has small velocity in the direction of growing crater. In a few seconds after an impact it begins to drop down and may be in contact with water inside the growing crater. We use special technique to describe the motion of this material. Continuous medium is disrupted into the particles of various size (from microns up to 10 cm for solid material and up to 1 cm for melt). Then, the motion of these particles and their interaction with gas flow and molten layer is modeled numerically in the frame of two-phase hydrodynamics.

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