DEVELOPMENT OF CALCULATION CODE FOR IMPACTS OF SMALL BODEIS ON EARLY EARTH.

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Introduction: The evolution of atmosphere and ocean on the Earth is significantly influenced by the impact of small planetary bodies. The modified atmosphere and ocean could change the surface environment greatly, in particular, in Heavy Bombardment age. The most realistic numerical simulations, Shuvalov (2009) [1] and Shuvalov et al. (2014) [2], estimate the escape mass of air, impactor and target by impacts of small bodies. They used an Eulerian code and assumed a rock material as the target of impacts. The change of amount of ocean by those impacts has not been considered.

In this study, we aim to develop an advanced numerical Lagrangian code for simulation of impacts of small bodies because it is meaningful to compare the results of Lagrangian codes to those of Eulerian codes. Also, we assume the target as rock and/or ocean and consider the oceanic erosion.

Method: We employ a new Lagrangian hydrocode in Hosono et al. (2013) [3], Density Independent Smoothed Particles Hydrodynamics (DISPH), and improve the code for such a simulation. For smaller calculational load and better calculational results, unequal-mass particles and equal-separation arrangement are used to construct the boundaries between the atmosphere and ocean/land.

Results: In some tests, it is shown that we can change the mass of particles even in the range of 2000 times with DISPH to express quite different values of density. This result is a highly significant for us to simulate the impacts of small planetary bodies more realistically. We will show the results of convergence of the resolution and discuss the escape mass of the atmosphere and ocean.

References:

[1] Shuvalov V. V. (2009) *Meteoritics and Planetary Science, 44,* 1095. [2] Shuvalov V. V. et al. (2014) *Planetary and Space Science, 98,* 120. [3] Hosono N., Saitoh T. R. and Makino J. (2013) *Publ. Astron. Soc. Japan, 65,* 108.