Paper ID: 27942
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SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Tools and Technology in Support of Integrated Applications (1)

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MONITORING THE GLOBAL ASTEROID IMPACT RISK

Abstract

ESA's asteroid risk list contains all known asteroids that have a non-zero chance of colliding with the Earth in the future. The possible impact locations of the asteroids in the list with a minimum diameter of 30 m were calculated. To this end, the freely available software OrbFit was utilized to find orbit solutions for each asteroid that result in a future collision with the Earth. These orbit solutions are called virtual impactors (VIs). Subsequently, the Asteroid Risk Mitigation Optimization and Research (ARMOR) tool was used to determine the impact locations for each VI taking into account orbit solution uncertainty and global impact probability. The resulting 261 impact corridors were visualized on a global map. Furthermore, the impact data were combined with Earth population data to determine the risk of direct asteroid impacts that each nation faces until 2100. These data are the global asteroid risk distribution based on observed asteroids as is known today. A ranking of the countries that exhibit highest risk was produced showing their relative risk with respect to the global risk. It becomes clear that population size is a good proxy for relative risk and India and China face the highest risk. Furthermore, small to mid-sized developing countries are especially prone to exhibit a disproportionately large impact risk. However, these countries do not have the technological capabilities to appropriately address the asteroid threat. This dilemma highlights the need for international organizations to respond to the asteroid hazard on behalf of the entire world. The Space Mission Planning and Advisory Group (SMPAG) and the International Asteroid Warning Network (IAWN) are good examples of such international efforts. Each nation should raise public awareness about the asteroid hazard and should include the asteroid threat in their natural disaster response planning. Physical impact effects are introduced into the analysis. This expands the validity of the results beyond the previously considered relative risk and allows to estimate the future absolute risk (expected casualties) that the currently known asteroids pose to the populations of the Earth. The alteration of the results based on the introduction of physical impact effects is discussed.