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Change in the sea surface height observed by satellite altimetry from Jason-1 and TOPEX/Poseidon before and after the Sumatra earthquake

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1. Introduction: Several tracks of Jason-1 and TOPEX/Poseidon pass through the source region of the Sumatra earthquake of December 26, 2004. These satellites are under operation in 10-day periodic orbits and are used to measure the sea surface height (SSH). We compared the SSH in these tracks before and after the earthquake.
2. Data and Methods: We used datasets on the SSH whose errors in relation to geoid height, ocean tides, and atmospheric pressure were corrected using fixed models and methods. We used data of sampling points at which SSH both before and after the main shock were available in December 6, 2003 - January 15, 2005.
3. Results: The observations revealed that the SSH in the zonal region between the arc islands and the trench axis, extending from Nicobar Islands to the west coast of Northern Sumatra, is greater than that before the main shock by a maximum of 0.2-0.3 m. SSH after the main shock is smaller than that before it by a maximum of 0.2-0.4 m in the zonal region between off east of Northern Sumatra and Nicobar Islands. These values are larger than typical oceanological change in these regions. **4. Discussions:** The redistribution of mass accompanied by a huge earthquake could alter the gravity field and the geoid height, which nearly equals the average SSH, so that it could be detected by satellite altimetry [1]. Following the example of the 1964 Alaska earthquake, the change in geoid height in the source region of the M9 class earthquake is estimated to the order of centimeters [2]. The observed change in the SSH in the source region of the Sumatra earthquake (0.2-0.4 m) is more than 10 times the estimated change of the M9 class earthquake. It is necessary to further discuss from different viewpoints in order to explore the rationale behind the change in the SSH obtained by satellite altimetry before and after the Sumatra earthquake.

Keywords: Sumatra earthquake, satellite altimetry, sea surface height anomaly, gravity field, geoid change

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