Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05878, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05878
EGU General Assembly 2008

The effects of measuring errors on Earth gravity model recovered by SST-LL

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The Earth gravity field model up to degree 100 is recovered by range and rang rate observations between two low-orbit satellites based on dynamic integral approach. The effects of non-conservative force error, inter-satellite range error and range rate error on Earth gravity model accuracy are analyzed by simulated calculation. Some conclusions are as following: (1) The max satellite position and velocity errors caused by the non-conservative force error of 10-9 ms-2 are 0.03m and 0.05mm/s respectively for one dayąŕs arc length, which are less than the errors in POD. It is shown that the accelerometer on-board with accuracy of 10-9 ms-2 is sufficient for POD. (2) The inter-satellite range is sensitive to satellite disturbing force, including conservative force and non- conservative force. Even a non-conservative force error of 10-9 ms-2 can cause centimeter level inter-satellite range error, which is larger than range observation noise. The inter-satellite range rate, however, is less sensitive to disturbing force. The same non-conservative force error can only cause micro/s level range rate error, which is the same level with range rate observation noise. Therefore the accuracy of on-board accelerometer should be better than 10-9 ms-2 for satellite gravimetry in LL-SST mode. (3) The gravity model error caused by inter-satellite range rate error of 1ęÌm/s and the one caused by accelerometer error of 10-9m/s2 are at the same level. It indicates that the accuracy of range rate measurement should be coincide with the accuracy of non-conservative force measurement. It is less helpful for improving an Earth gravity model to only enhance the range rate observation accuracy. Thus, if the accuracy of accelerometer is 10-9m/s2, the accuracy of range rate in KBR system should be 1um/s. While the accelerometer accuracy being 5ąÁ10-10m/s2, the accu-

racy of KBR should be 0.5ęÌm/s. (4) It is useful for recovering gravity to increase the distance between two low-orbit satellites. If the inter-satellite distance changes from 230km to 460km, the accumulated error of geoid undulation decreases by 40 percent. In this case manufacturing KBR system and controlling the satellite become more difficult and the accuracy of inter-satellite range rate decreases. (5) Although the range is very sensitive to the Earth gravity, the range rate will contribute more to the Earth gravity field recovering due to the effect of non-conservative force measurement error in practice.