J057-010 Room: C513 Time: May 29 11:30-11:45

Lithospheric stress due to ice mass change and its implication to the March 25, 1998 Balleny Island earthquake

Seiji Tsuboi[1], Masaki Kanao[2], Erik Ivins[3], Thomas James[4]

[1] Yokohama City Univ., [2] NIPR, [3] JPL, [4] GSC

A large Mw=8.1 earthquake occurred off the northeast coast of Antarctica near the Balleny Island region on March 25, 1998. This event was one of the largest intraplate earthquakes ever recorded. It is argued by various authors that the subevents aligned along the nodal plane trending east-west direction, which indicates that the earthquake occurred along this east-west, left-lateral, strike-slip fault. Although the earthquake is located near transform faults of Australian-Antarctic ridge, this fault mechanism does not match with the strike of those transform faults. Also the northeast-southwest compression in hypocenter area is opposite to the stress orientation of the earthquakes that occurred along the transform faults. Thus it is implausible to relate the fault mechanism of this earthquake to the plate motion of nearby transform faults.

Tsuboi et al (2000) have shown that this fault mechanism is consistent with the crustal motion of the Antarctica derived from the Earth's response to present-day and past ice mass changes in Antarctica (James and Ivins, 1998).

Here, we quantitaively examine the regional earthquake potential associated with postglacial rebound of the Antarctic lithosphere. We calculate the stress change caused by the ice mass change in the same manner as those calculated in James and Ivins (1998) with the viscosity 10^21 Pa sec, and 120 km thick elastic lithosphere. We then calculate a change in the effective Coulomb stresses. This is similar to the procedure adopted by modelers of earthquake stress transfer and adapted to lithospheric rebound by Wu and Hasegawa (1996). The stress changes occur in a background tectonic stress orientation at 75 degrees east.

Our results show that the Coulomb stress change becomes significantly negative (promoting seismicity) around the 1998 earthquake region, which indicates that the ice mass change can be a possible cause of the earthquake. Our results also imply that the thickness of the lithosphere can be an important parameter to the quantification of the stress change caused by the ice mass change.