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Disturbance of deep sea environment associated with earthquake east off Izu Peninsula in December 2009

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The earthquakes which occurred east off Izu Peninsula at 23:45 JST on Dec. 17th and at 08:45 JST on Dec. 18th in 2009 are M5 class earthquakes after an interval of about 2 years and 8 months since the earthquake on April 21st in 2006 in this area of earthquake swarm activity. When the last earthquake of M5.8 occurred at 02:50 JST on April 21st in 2006, mudflow and associated disturbance of deep sea environment such as water temperature increase and so on are observed with several kind of sensors, such as video cameras, ADCP (Acoustic Doppler Current Profiler), CTD (Conductivity, Temperature and Depth) sensor and a gamma ray sensor which were attached to a multi-disciplinary cabled observatory located at a depth of 1175 m off Hatsushima Island in Sagami Bay.
During the earthquake swarm activity of this time, when the earthquake of M5.0 occurred at 23:45 on Dec. 17th in 2009, fluctuation of water current velocity that indicate mudflow was not recognized in ADCP data, whereas the muddiness was observed over about 1 hour from 00:16 in still images of seafloor.
On the other hand, when the earthquake of M5.1 occurred at 08:45 on the next day, Dec. 18th, at almost the same place, mudflow was recognized with still images, current velocity fluctuation and water temperature increase which were characteristic of mudflow. However, current velocity at 12 m in altitude above the seafloor was about 15 cm/s at maximum, which was about half velocity observed at the earthquake in 2006.
These differences are possibly associated with the fact that epicenters of earthquakes at this time are located near the coast, whereas the epicenter of last earthquake in 2006 is located about 5 km off the coast where the water depth is about 900 m.

In comparison with the earthquake in 2006, characteristic phenomena on disturbance of deep sea environment associated with the earthquake of this time are fluctuation of muddiness observed with still images and fluctuation of echo intensity observed with ADCP which reflects quantity of suspended materials in water. Both muddiness in still images and the echo intensity of ADCP began to increase 5 minute after the earthquake occurred. They decreased to usual level at about 10:00. They began to increase again remarkably at shortly after 12:00 and continued until shortly after 16:00. Whereas the increase of echo intensity in former event occurred below 30 m in altitude above the seafloor, the increase in latter event reached up to 100 m in altitude.
Increase of echo amplitude has been observed as the fluctuation associated with current velocity change which has correlation with tide since several days before the earthquake. The timing of muddiness and echo amplitude increase which occurred after 12:00 on Dec. 18th and muddiness observed after the first earthquake at 23:45 on Dec. 17th coincide well with this timing. However, echo intensity after the earthquake was remarkably stronger. These phenomena probably suggest the scatter of sediment on seafloor by earthquake.
On the other hand, gamma ray intensity which reflects accumulation of sediment on seafloor increased at about 09:00 on Dec. 18th, while fluctuation was not observed at the event after 12:00. These fluctuations indicate that sediment with big specific gravity was carried by the mudflow on

seafloor and that suspended material or sediment with small specific gravity were diffused by the flow correlated with tide, i.e. a kind of internal wave.
Based on those observational facts, as deep sea disturbance caused by the earthquake this time, while mudflow observed with the cabled observatory was not so remarkable as was observed in 20 06 probably because of the epicenter location difference, suspended material or sediment with small specific gravity scattered by earthquake were possibly transported wider area, affected with a kind of internal wave.
These would be valuable data in studying material transport process.

Keywords: east off Izu Peninsula earthquake, disturbance of deep sea environment,
off Hatsushima Island in Sagami Bay, mudflow, suspended material, sediment