MONITORING IN SITU PORE PRESSURES FOR PREDICTION OF SLOPE FAILURE ON THE PRODELTA SLOPE OF THE FRASER RIVER DELTA, CANADA

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The Fraser River Delta is located in the Georgia Basin, a densely populated marine basin that is subject to significant pressure from multiple uses such as transportation, utilities, coastal infrastructure and fisheries. The submarine part of the delta consists of 5-8 km wide tidal flats and a delta slope with an average slope of 1.5 degrees. Slope stability is an important concern for the safety of port infrastructure and for tsunami risk. Previous work has shown that the slope shows abundant evidence for historic slope failure. New multibeam sonar data is used to re-examine previously-described slope failure features including: (1) an area of frequent liquefaction failure at the active distributary channel mouth; (2) a distributary mouth canyon, submarine channel and debris lobe system; (3) an area of shallow rotational slide blocks or creep ridges; and (4) a large, older slope failure to the south of the main distributary channel. In an effort to better understand the mechanisms of slope failure on the Fraser River delta slope, a program to measure the response of pore fluids to dynamic loading by tides, storm waves and earthquakes has been developed to take advantage of the VENUS submarine cabled observatory to be constructed in the Georgia Basin between 2003 and 2005. The VENUS infrastructure consists of cables that will provide power and two-way, high speed communications, seafloor instrument arrays, a data archive and distribution center and an operations center. Pore pressure time series data can be used to derive the fluid and mechanical properties of the sediment column. The data can also be filtered to remove the tidal signal and the residual variations used to detect the pore pressure response to short time-scale events, such as seismic events. A preliminary
data set obtained from a borehole located near the delta front shows a large tidal signal. When tides are removed, the data show a long term, probably seasonal trend in residual pore pressure that may be related to groundwater flow through the delta. Shorter period pore pressure fluctuations may be related to non-tidal water level changes due to wind-forcing. Only small seismic events (M < 4) have occurred since initiation of this time series and no response is visible in the record.