MEETINGS

Scientific Ocean Drilling Behind the Assessment of Geo-hazards From Submarine Slides

Barcelona, Spain, 25–27 October 2006

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Submarine slope instability represents a geohazard for its destructive potential on nearshore structures and life and offshore seabed structures. Submarine slides may bear a tsunamigenic potential and are capable of methane gas release into the seawater and atmosphere. A recent workshop sponsored by the European Science Foundation (ESF; http://www.esf.org), "Scientific Ocean Drilling Behind the Assessment of Geo-hazards From Submarine Slides," held in Barcelona, Spain, 25–27 October 2006, reviewed the current state of knowledge on submarine slope failures and how scientific drilling can improve our knowledge of the process and help to mitigate the derived risks (a report with full details of participants and program can be found at http://www.geohazards.no/IGCP511/). The workshop gathered 50 scientists and representatives of private companies, mainly from the European area, representing a wide spectrum of disciplines such as geophysics, stratigraphy, sedimentology, paleoceanography, marine geotechnology, geotechnical engineering, and tsunami modeling.

During the workshop, it was agreed that scientific drilling offers the possibility of answering a number of scientific questions, among them, (1) What is the frequency of submarine slides? (2) What was the tsunamigenic potential of past submarine slides, and what is the tsunamigenic potential of unfailed submarine slopes? (3) Do precursory phenomena of slope failure exist? (4) Can we monitor seafloor gravitational movements such as creep? (5) What makes up weak layers in midlatitude continental margins? And (6) when and under what circumstances do weak layers form? Scientific drilling also offers the possibility of testing at least two existing hypotheses on basic mechanisms of submarine slide generation and of massive releases of gas: (1) focusing of fluids and lateral transfer of stresses under variable overburden on permeable layers and (2) proving the link between methane emissions during rapid climatic changes and submarine slides.

Workshop participants agreed that both megaslides and smaller-size slides should be addressed by drilling where slope instability is recognized as a recurrent phenomenon in the stratigraphic succession. Not only sediments that have failed should be studied, but also sediments that are presently undergoing deformation and unfailed slopes should be addressed. The drilling strategies should include classical stratigraphic drilling, dedicated geotechnical drilling, and installation of borehole observatories as well as seafloor observatories.

The ideas raised during the Barcelona workshop will find a broader forum in summer 2007, during the planned IODP-MI Geologic Hazards Workshop (http://www.iodp.org/geohazards/). The broader spectrum of submarine geohazards that this workshop will challenge will eventually lead to important initiatives such as multiple expeditions or a mission proposal.

The full text of this meeting report is reproduced in the supplement to this *Eos* edition.

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AGU JOURNAL HIGHLIGHTS

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Warming oceans' effect on Earth's rotation Movement of mass on Earth's surface caused by a warmer climate will likely cause changes to the planet's rotation and affect the length of day in the future, according to a new report. *Landerer et al.* analyzed future ocean conditions predicted by the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report. The authors suggested that expected warming over the next 200 years, without taking into account other processes, will shift enough water mass closer to the Earth's axis of rotation to lead to an incremental shortening of the day. The authors also suggested that more heat will be captured by the oceans, raising the sea level and potentially changing the ocean's circulation and affecting the ocean-bottom pressure, which will transfer a significant portion of ocean mass to shallower shelf areas and away from the deep waters. They propose that while temperature and pressure changes vary according to their global location, their model shows a reduction in the length-of-day signal of approximately 0.12 milliseconds by the end of the 22nd century. (*Geophysical Research Letters*, doi:10.1029/2006GL029106, 2007)

Fluid pore pressures in debris flows Debris flows consist of rapidly moving soil material and water that show behavior between sediment-transporting floods and landslides. Interactions between porous soil material and fluids enhance debris mobility through reducing the cohesiveness of rock fragments. To study this, *McArdell et al.* set up a monitoring system in an area in Switzerland prone to storm-initiated debris flows. Through instrumentation that recorded flow velocity, pore fluid pressure, and shear stresses inside the flow, the authors in August 2005 monitored a debris flow that coursed, through a gently sloping channel, four kilometers downstream from its initiation. Their results showed that excess pore-fluid pressures are long lived in debris flows, illuminating the important role of pore fluid pressure in explaining the unusual mobility of debris flows. Though particle collisions enhance pore pressures and are likely present in rapidly sheared flows, the authors found that such mechanisms are not necessary to explain large pore pressure values. Instead, they expect that a persistent mechanism must exist to continually transfer the load from the solid phase into the fluid phase. (*Geophysical Research Letters*, doi:10.1029/2006GL029183, 2007)

Summertime European drought induced by wintertime rainfall shortages around the northern Mediterranean As human influence on climate increases, many models predict more frequent extreme weather events, such as the heatwave in Europe in the summer of 2003 which severely affected human health, vegetation productivity, and air quality. Noting that the underlying regional climate mechanisms through which this extreme event developed are poorly understood, *Vautard et al.* analyzed meteorological records spanning the past 58 years to search for undiscovered weather patterns that could help explain such heatwaves. They discovered that hot summers are preceded by winter rainfall deficits over southern Europe, creating a mass of anomalously warm dry air that spreads northward through Europe in early summer. Further, the authors found that previous winter and early spring rainfall frequency in the Mediterranean regions is correlated with summer temperature in continental Europe. Because dry soil inhibits convective cloud formation, the authors suggested that soil water contents in Europe's Mediterranean regions play a critical role in the maintenance of climate across Europe. This conclusion is also supported by numerical simulation experiments of regional atmospheric circulation. (*Geophysical Research Letters*, doi:10.1029/2006GL028001, 2007)

Seismic studies can help identify areas saturated with toxic liquid contaminants The remote detection of toxic liquids is an on-going challenge for scientists responsible for cleaning chemically contaminated sites. Dense non-aqueous phase liquids (DNAPLs) are a class of fluids which encompass several hazardous industrial contaminants including the chlorinated solvent trichloroethylene (TCE). Noting that many geophysical techniques proposed for DNAPL detection in subsurface environments lack the spatial resolution or sensitivity to detect small contaminant pools, *Ajo-Franklin et al.* used an ultrasonic measurement system to study the seismic signature of DNAPL saturation in shallow soils. By injecting TCE into water-saturated aquifer samples and monitor-