Underwater Landslides

Many of us have seen footage or photos of landslides on earth, but what about submarine landslides? What makes them so important and how do they occur?

Landslides on earth such as the Oso, WA landslides fall under the category of debris flows and are driven by gravity acting on sediments (Figure 1). The sediments can hydroplane, just like car tires on water, leading to what can be a massive movement of land downslope. These pose several dangers to communities as they can dam rivers leading to flooding, bury entire towns, and block roadways and travel leading to a reduction in infrastructure.

Figure 1. Google Earth images of the Oso landslide area. Left: You can see the Oso landslide scar in 2013. Right: You can see the Oso area has been reactivated and covered the town and dammed parts of the River in 2014.

Underwater or more properly coined submarine landslides are debris flows as well and can be generated via earthquakes, storm surge, and sediment loading (Figure 2). Earthquakes can cause liquefaction, when sediment becomes a fluid, destabilizing the slope. Storm surge can increase the amount of pore space between grains leading to failure of the slope. Sediment load occurs when too much sediment is deposited onto the edge of a slope leading to failure. Failure of slopes pose a threat because they can generate tsunamis if they volume of sediment is large enough to displace water significantly. Recent research has highlighted the role of gas hydrates in inducing slope failure. Gas hydrates such as methane can become unstable leading to a blow out, which would trigger slope failure.

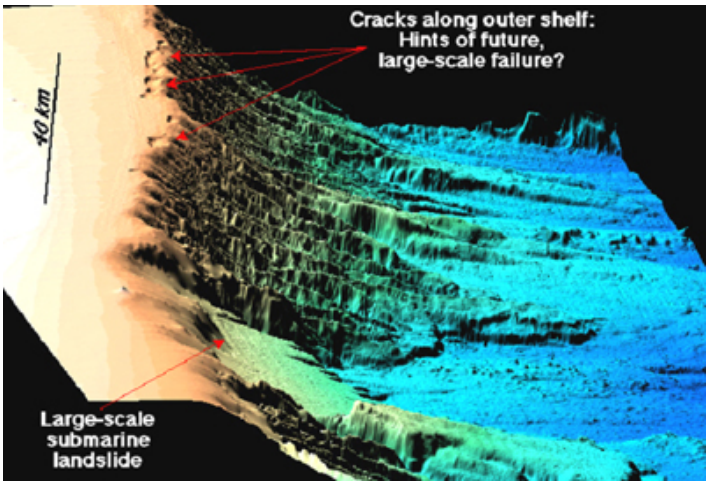

Figure 2. Image of the Albemarle-Currituck submarine landslide along the edge of the continental shelf on the eastern edge of North America offshore North Carolina. Image from Neal Driscoll.