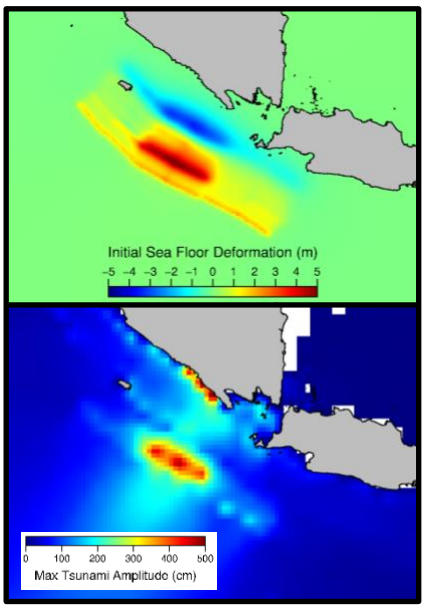
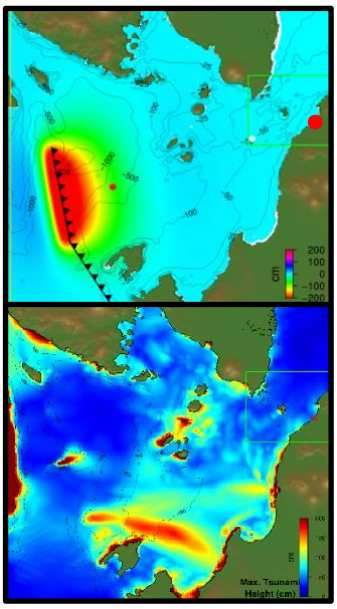
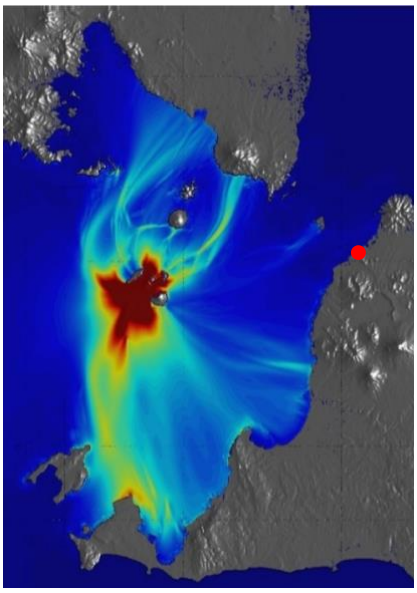
TSUNAMI HAZARDS IN THE SUNDA STRAIT

SUNDA STRAIT, INDONESIA







(left) Initial seafloor deformation and maximum amplitude from a M_W 9.2 earthquake on the Sunda Megathrust. **(middle)** Initial seafloor deformation and maximum amplitude from a M_W 7.6 earthquake on the Sunda Fault **(right)** Maximum tsunami amplitude from the December 2018 landslide/flank collapse tsunami caused by the eruption of Anak Krakatau volcano.

PROJECT INFORMATION:

Location: Sunda Strait, Indonesia

Client: Arup Consultants, Shell Oil

Project Date: 2018-2019

SCOPE OF WORK:

- Review of historical tsunami events
- Tsunami source characterization
- High resolution numerical modelling of tsunami inundation and currents

PROJECT DESCRIPTION:

We investigated the tsunami hazard at a proposed LNG facility to be developed near Merak on the west coast of Java in the Sunda Strait. In 1883, Merak experienced ~35 m tsunami runup caused by the eruption and subsequent caldera collapse of the Krakatoa Volcano. Besides the potential volcanic tsunami hazard, this site is also vulnerable to tsunami generated on nearby crustal faults such as the Sunda Fault which runs across the Sunda Strait or by large ruptures on the Sunda Subduction Zone which runs offshore of the western coast of Sumatra and across the entrance of the Sunda Strait.

We first conducted a sensitivity study for moderate magnitude (Mw 8.6) subduction zone events situated in the vicinity of the Sunda Strait. Using identical tsunami sources positioned at different locations relative to the entrance to the Sunda Strait we showed that the severity of the tsunami effects at the study site depended heavily on the location of the tsunami source with the strongest tsunami effects caused by sources able to project wave energy in to the Straits. For sources located outside this window, the tsunami effects at the site were significantly reduced.

We then considered larger magnitude subduction zone sources. As with the sensitivity study, it was again seen that the location of the tsunami source relative to the Straits entrance was critical in determining the severity of the tsunami effects. The strongest tsunami effects were caused by a M_W 9.2 earthquake with a maximum slip of ~40 m and a deformation area extending over 600 km and across the entire entrance to the Sunda Strait. This event produced maximum run up of approximately 500 cm at the study site and wave amplitudes of+250 and -200 cm at the offshore vessel location.

For the volcanic landslide/flank collapse sources, we first devised a source model that replicated the effects of the December 2018 event at Anak Krakatoa, however, this event did not cause an appreciable tsunami at Merak, with tsunami heights of the order of +/- 50 cm. We then varied the source model orienting it towards the northwest in order to project the most wave energy towards the Study Site. This resulted in tsunami amplitudes of +100 cm and -50 cm at the study site. Our modelling suggests that a Krakatoa based source would ned to be much larger than what occurred in December 2018 to produce damaging effects at the study site. However, historical precedent suggests that the time until the next such eruption could be hundreds of years away.