Lessons to be Learnt for Hydrography After Earthquake

The news on 27 February of the earthquake in Chile measuring 8.8 on the Richter scale went all around the world and was discussed in detail everywhere. I remember, when visiting OI 2010 in London, a few days after the event, being asked by everyone I met about the earthquake effects. That is the way news about natural disasters travels around the globe in a few minutes. However, what is not known quite as quickly and usually only known by a small group of scientists and local officials in charge of getting things back to normal, are details on the impact an event like this has not only on people, property and economy but also on the natural landscape. These effects are not always evident directly after the event but become apparent as times passes.

In terms of hydrography, the earthquake significantly changed the landscape in the area between Constitucion and Lebu, some 400km apart, and to a lesser extent northward and southward of these two places. The seafloor rose in different increments, varying from several centimetres to more than a metre in some places, instantly making navigational charts out of date. Not only the depths changed but also the horizontal position of the coastline, which moved westward in increments from a few centimetres to as much as 3 metres. There are currently several studies available showing the vectors of how the continental plate moved.

The Chilean Navy Hydrographic Office has started with a comprehensive programme to re-survey some 20 nautical charts. At the same time, private survey companies have been intensively hired by ports in the area to re-survey and determine where the tidal datum is and how much draft is allowed in each port.

At the beginning, there was very little information and few records on the effect of the earthquake on the tidal datum as the tsunami that struck the coast a few hours after the tremor, destroyed the permanent tide stations in the area. Only one survived and this one belonged to my company (Desmar Ltd.) and was installed right in the area that had been strongest hit, in San Vicente Bay. Fortunately San Vicente Bay is open to the West and protected on the North by a large peninsula (Tumbes), which meant that the tsunami waves coming from the North passed outside the bay, with little impact on the inner bay. In fact, the tsunami was recorded as a series of tidal height changes, making the curve "dirty" while the tsunami affected the area, which lasted for about four hours.

After the successive changes in height had stopped, a drop of the whole tide curve could be seen on the tide record, meaning that the amount of water over the sensor was less than it had been before the earthquake or, which is the same, that the seafloor had risen.

One month after the event, the tide curves before and after the earthquake were analysed, leading to the conclusion that the seafloor had risen by 47cm at the tide gauge location.

This vertical movement of the seafloor is an indication of the energy liberated, capable of lifting the continental plaque this much. This also applies to the horizontal displacement.

In some places there are signs on the coastline showing a vertical change of up to three metres!

This catastrophic event has left many lessons to be learnt for hydrography, both from the purely technical aspects and from operational concerns. It would be outside the scope of this short article to elaborate on these considerations, however, I would like to invite readers to contact me (lsalgado@desmar.cl) to share views and experiences, which may be useful for future events.