



Assessment of Recent Coastal Flooding in Alexandria and Future Outlook for the Nile Delta

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Similar to most of the world's low-lying coastlines, the coastal zone of the Nile-Delta is mainly affected by wave-dominated coastal processes including effects due to storm-surges. Erosion of the delta coastline increased greatly after constructing the Aswan-High-Dam in 1964 which continued with more rates during winter storms. A review of major coastal protective structures which were implemented 1980 to 2007 is briefed by Fanos (1995) and Ismail (2007). Winter storms, particularly in 2003, 2006 and recently in December 2010 hit the delta coastline and rapidly raised water levels and caused losses of land and property.

At a global scale, climate changes effects are accelerated as demonstrated in autumn 2010 when the storm Becky reached the Santander Bay, Spain. The peak of nearshore significant wave height was about 8 m, the storm surge reached 0.6m, with tidal level of 90% of the tidal range. This storm reflects at least a 20-year return period event as indicated by EU-Theseus-project team.

The recent coastal flooding in Alexandria on December 12, 2010 on the Nile Delta Coastline is a striking example of the severity of more progressive events. Egypt was hit by strong winds, exacerbated by heavy precipitation, up to 60 km/hr with a surge of over 1.0m. More than 4.0m waves forced the closure of Alexandria main harbor. This storm left a pronounced mark on shorelines as well as the low land between the two river Nile promontories, Rosetta and Damietta.

To assess the adequacy of current coastal defense, a review was made of the data for wave heights and storm surge for the Nile Delta coastline, locations of damaged/undamaged sites as well as the type of existing protection systems and cross-shore profiles at these sites. The maximum reported significant- wave height is about 2.5 to 3.0m for NW/NWW waves. Reported values of storm-surge on the Delta coast are from 40 to 50cm. The tidal range varies from 40 to 60cm at Alexandria. An analysis, based on the equations developed by the Dutch-Engineers on storm-surge in Zuider-Zee (Wiegel, 2005), yielded a storm-surge 0.7 to 1.5m. This range coincides with the measured value of 1.2m provided by Egypt-Navy.

The storm impacts were intensified in places where shorefront development (marina) and shoreline structures (groins) exist. Along the coastal freeway, some buildings, cars/buses/trucks, and boats were damaged and flooded by combined actions of winds and waves. The damage mechanisms were direct-wave & wind forces, wave run-up, and sand over wash. Luckily , where a submerged breakwater is located in 5.0m water depth, 600m offshore, the damage was nil on the short sandy beach.

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