



Storm Surges in Denmark: Past experiences and expectations for the future

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In November 2006 parts of the inner Danish Waters experienced the highest ever measured water levels in tide gauge records (+120 y). No lives were lost as a direct consequence of the storm surge but several towns experienced severe flooding and over 4,100 properties insurance claims were filed. Since then some local communities have dealt with the risk of future flooding; still many planners, developers and house owners continue to jeopardize lives and structures by building too low in unprotected areas. Prior to the 2006 event one local municipality had dug through an old dike to accommodate a road and parking space for tourists, leading to a flooded village. Why? Is it just about money, lack of common sense and no perception of risk, and a short collective memory?

The Danish Coastal Authority (DCA), Ministry of Transport, deals with the coast related issues in the implementation of the EU Floods Directive (2007/60/EC). A revisit to and update of several hundred years of storm surge history as a part of the directive's preliminary flood risk assessment yield invaluable insights into both the meteorological and hydrodynamic, and, societal causes of floods. Regarding the meteorology and hydrodynamic forcing a broad range of weather patterns may lead to storm surges along the 7,300 km long and very diverse Danish coastline. The most extreme imaginable water levels range from 2 m above datum in some secluded fiords to six meters in the Danish Wadden Sea. Depending on the weather patterns and on the local coastline/water compartment figuration surges may be either of a very local character, e.g. confined to the distal end of one fiord, of a regional character, e.g. one or two water compartments, or be experienced nationwide or even have a cross-national extension.

Historical accounts of either type of event and their severity will be presented, discussed and evaluated in relation to current damage potential and to future SLR. Furthermore, the frequency at which extreme events occur vary between locations and historically some years show series of flooding events leading to extended damage as local communities have not recovered from the first incidence. These successive events, such as those occurring in 1825 and 1976, cannot be disregarded when dealing with flooding hazards today.

In the past flood protection in Denmark in many places was absent or notoriously inadequate and, so it seems, this is still the case especially in places where no fatalities have previously been encountered in relation to storm surges. A hundred years ago the flooding of a town occurred as a natural thing that was a part of living close to the water. Today, however, the picture is different. More people live close to the sea and coastal towns thrive. Cheap weekend shacks have over the last couple of decades turned into luxurious holiday houses along the Danish coasts in places where, at the same time, sea level rise and more frequent flooding still lack consideration in coastal planning. Now we cannot tolerate flooding (for obvious reasons). Besides the scientific evidence of former storm surges, we still can learn from the historical responses in society to flooding events to minimize the discrepancy between peoples' perception and awareness of risk, and actions towards sound planning and flood protection practices, as well as we can learn from the 'good examples' of timely engagement in former flood protection schemes.