Coastal flooding (map 2.11)

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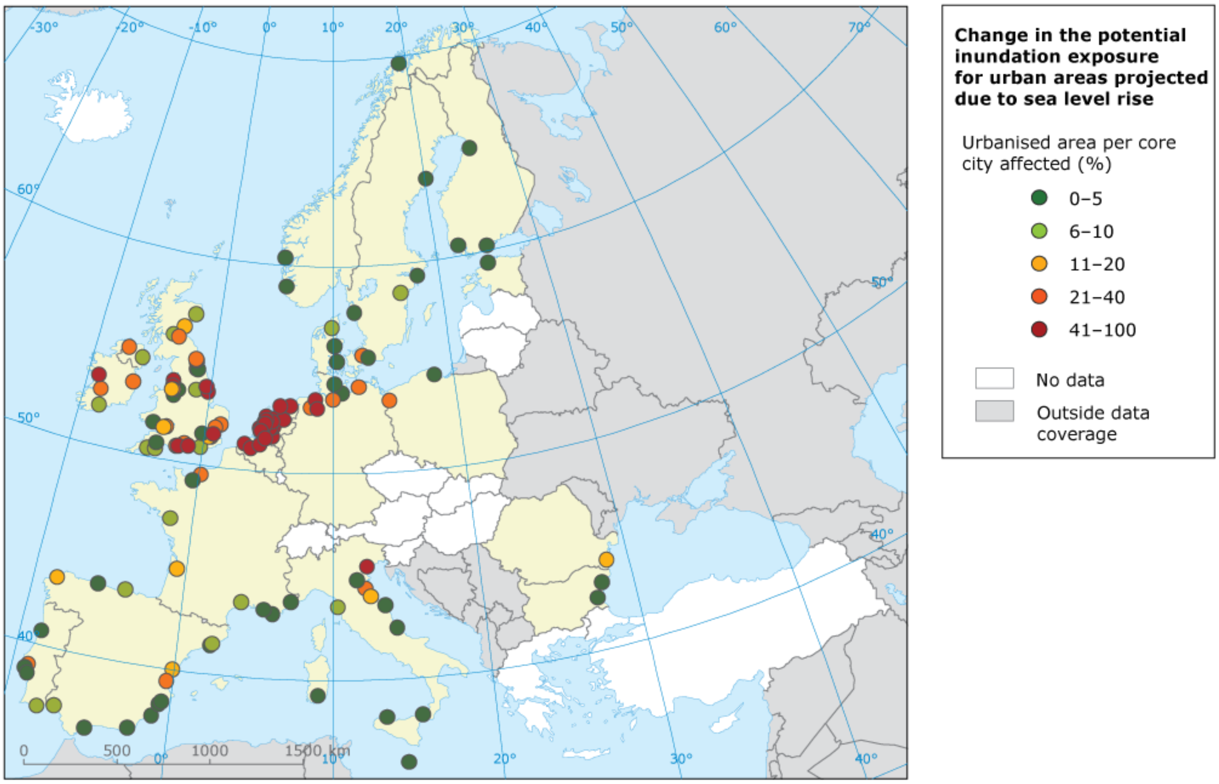

Sea level rise is not a climate change exposure indicator in global or regional climate change models, because it is rather a first level effect triggered by changes in global temperatures and regionally also by land up- and downlift. Most sea-level rise vulnerability assessments have so far focused mainly on identifying land located below elevations that would be affected by a given sea-level rise scenario (Schneider and Chen, 1980; Rowley et al., 2007). This requires use of elevation data from digital elevation models (DEMs) to identify low-lying land in coastal regions. However, sea level rise during normal tides may not be the greatest challenge for these regions, because the most recent projections range only between 0.3 and 1.8 metres (see Rahmstorf 2007, Vermeer, Rahmstorf 2009, Grinsted et al. 2009). But during severe coastal storms such additions to storm surge heights may pose a great threat. It is not clear, though, how exactly coastal storms and sea level rise interact. Furthermore, even though differences in sea level rise exist between coastal regions in Europe (as measured by altimetry data since 1992), oceanologists have so far not been able to estimate how these differences would develop until e.g. the year 2100. Therefore the recent ESPON Climate project (Greiving et al. 2011) based its coastal storm surge indicator on a uniform one metre sea level rise. This value lies in the middle range of the above cited projections (see also Nicholls, 2010) and also corresponds to the lowest vertical resolution of the European-wide available Hydro1K digital elevation model (USGS, 2010).

The map shows the projected effect of a one metre sea level rise, which in reference to recent studies (Nicholls 2010, Vermeer, Rahmstorf 2009, Grinsted et al. 2009, Rahmstorf 2007) must be considered a conservative average value for sea level changes until the year 2100. Of course a one metre sea level rise as such does not cause major problems, but when seen in conjunction with a 100 year return coastal storm surge event the effect may be more serious. As a first step the maximum storm surge heights modeled by the DIVA model (DINAST-COAST 2004) for a 100 year coastal storm surge were identified for all coastal segments in Europe. These storm surge heights were averaged per NUTS 3 region and then heightened by a one metre projected sea level rise. Using the Hydro1K digital elevation model continuous areas of $1km^2$ raster cells were then identified whose elevations are below the adjusted regional storm surge heights. These potentially flooded areas were finally overlaid onto the urban areas defined in Annex 'Defining the city area'(http://www.eea.europa.eu/publications/urban-adaptation-to-climate-change/defining-the-city-area) in order to determine the share of each city's area potentially inundated by a sea level rise adjusted coastal storm surge event. It has to be kept in mind, however, that the mediating effects of coastal defense systems could not be included in this analysis because no reliable and harmonized pan-European databases exist on this topic. Thus it must be emphasized that the map shows only the *potential* effect of a one metre sea level rise adjusted coastal storm surge event.

Data sources and reference:

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Rowley, R.J., Kostelnick, J.C., Braaten, D., Li, X., and Meisel, J., 2007, Risk of rising sea level to population and land area, *EOS, Transactions of the American Geophysical Union*, 88(9), 105, 107.

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