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# CITIES, RAIN AND RISK

## ABSTRACT BOOKLET

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# APPETIZER

## Subsidence in urban areas measured by InSAR (Sentinel1) related to flooding

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The INXCES Project

Rapid changes in the urban environment due to growth puts the urban water cycle out of balance, hence, affecting other surface and subsurface processes, such as subsidence and surface water management. Subsidence of the ground is causing risk and hazard, as well as unexpected costs. This newly, November 2018, launched tool InSARNorge is Open Access and part of the Copernicus program.

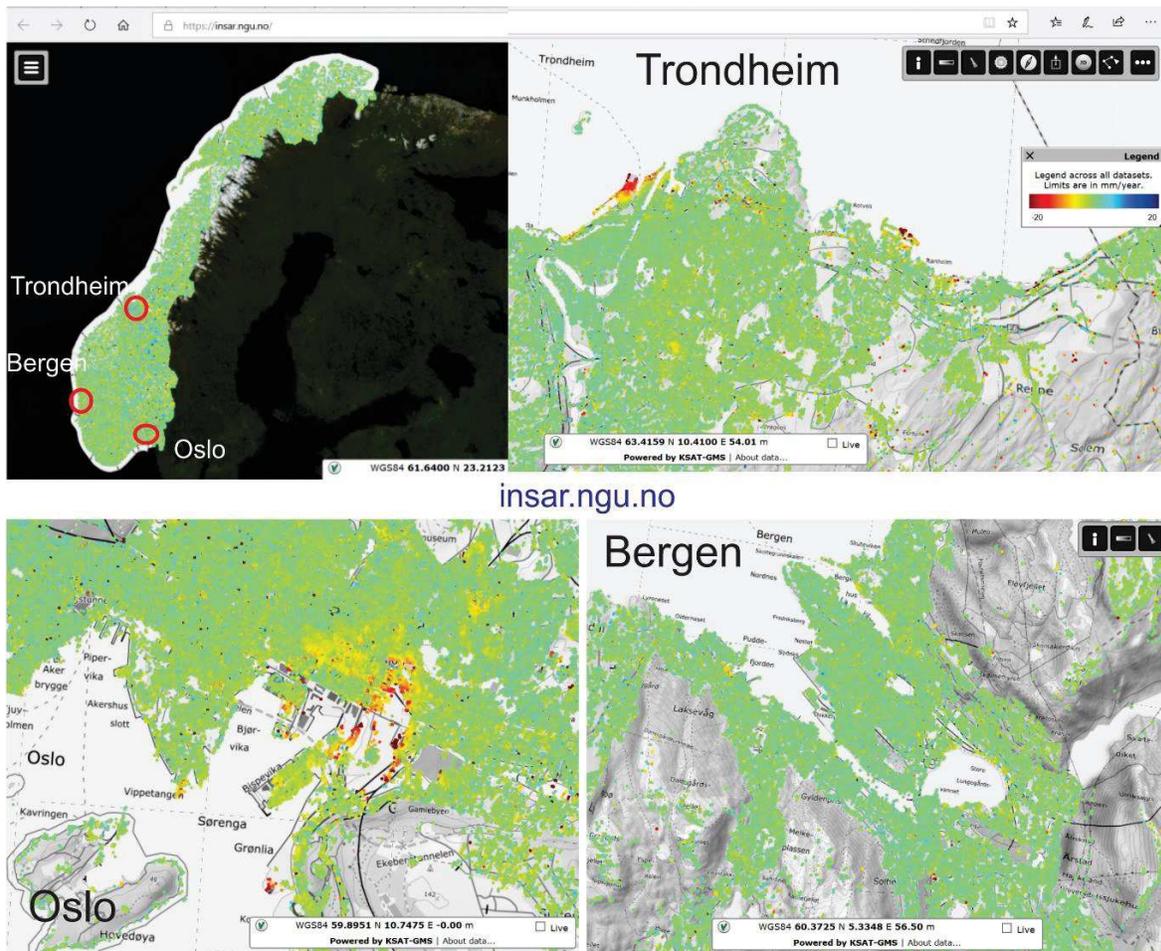


Figure: Subsidence in three cities in Norway. Some areas clearly show subsidence, indicated by red points. The Bryggen (Wharf) in Bergen has now stabilized due to mitigation, such as SuDS. [www.insar.ngu.no](http://www.insar.ngu.no)

In a recent study (Venvik et al. submitted) datasets from InSAR satellites showing subsidence are combined with data from flood modelling in two different analytical methods using ArcGIS tools to develop a risk assessment map for areas most prone to the combination of both flooding and subsidence. Applying user-centred principles, this work focuses on methods for risk assessment maps as a support tool to locate areas where mitigation of subsidence and adaptation for surface water management will be most efficient and measures can be implemented. The results of the methods for risk assessment maps show that one of the methods give significant results compared to the other method. Such method will be a helpful tool for decision-makers when prioritizing areas for measures such as Sustainable urban Drainage Systems (SuDS). The study is related to the JPI Water funded project INXCES ([www.inxc.es.eu](http://www.inxc.es.eu)).

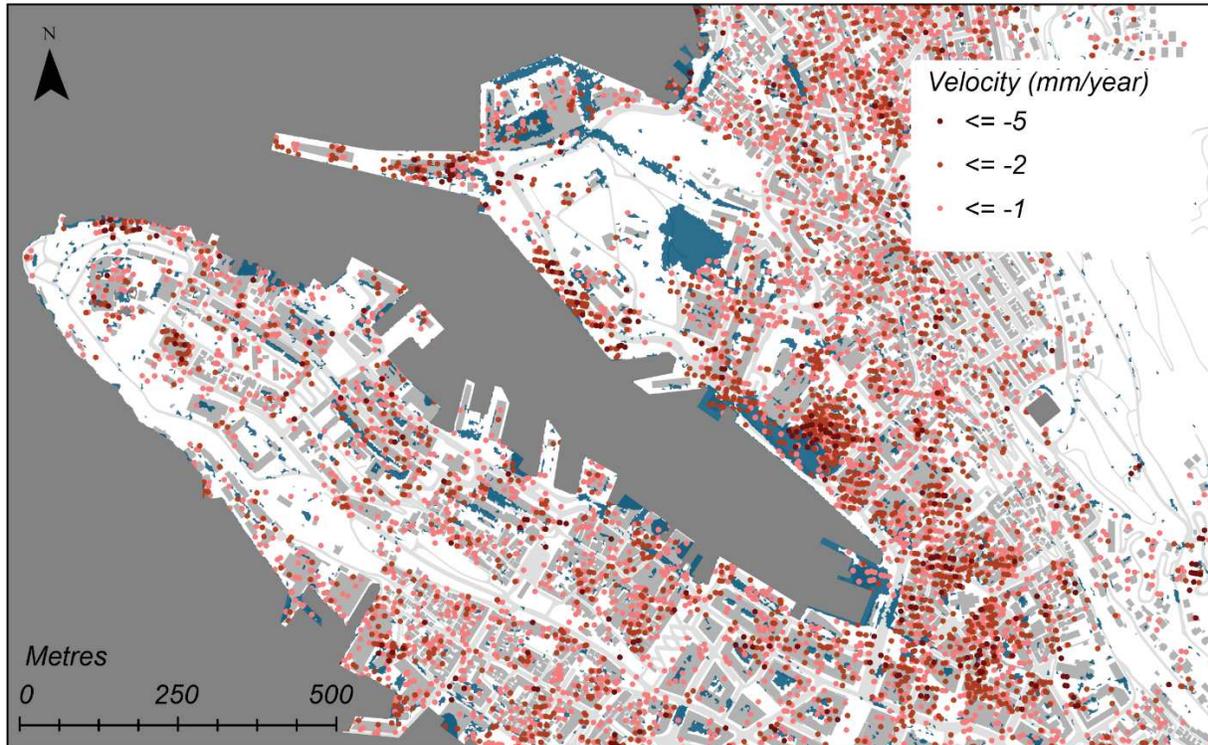


Figure: Areas of subsidence and flooding in Bergen city centre, Western Norway. The darker colour of the dot the higher average velocity (mm/year) for the subsidence. Blue color shows the flooded areas, with increasing water depth with darker colour (Venvik et al. submitted).

This is an interactive tool that can showcase multiple real situations related to different problems such as, areas prone to flooding, underground constructions, cultural heritage etc.

<https://insar.ngu.no/>

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Reference:

Venvik, G. Bang-Kittilsen, A. Boogaard, F.C. & Dehls, J. (Submitted) Risk assessment for areas prone to flooding and subsidence - a concept model with case study from Bergen, Western Norway. *Journal of Hydrological Research Special Issue*.