

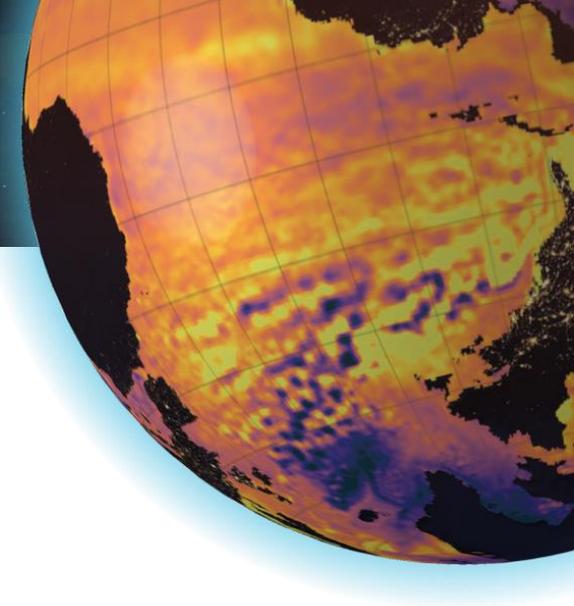
Multiscale modeling of the Scheldt-North Sea continuum and atmospheric resolution's impact on Storm Surges

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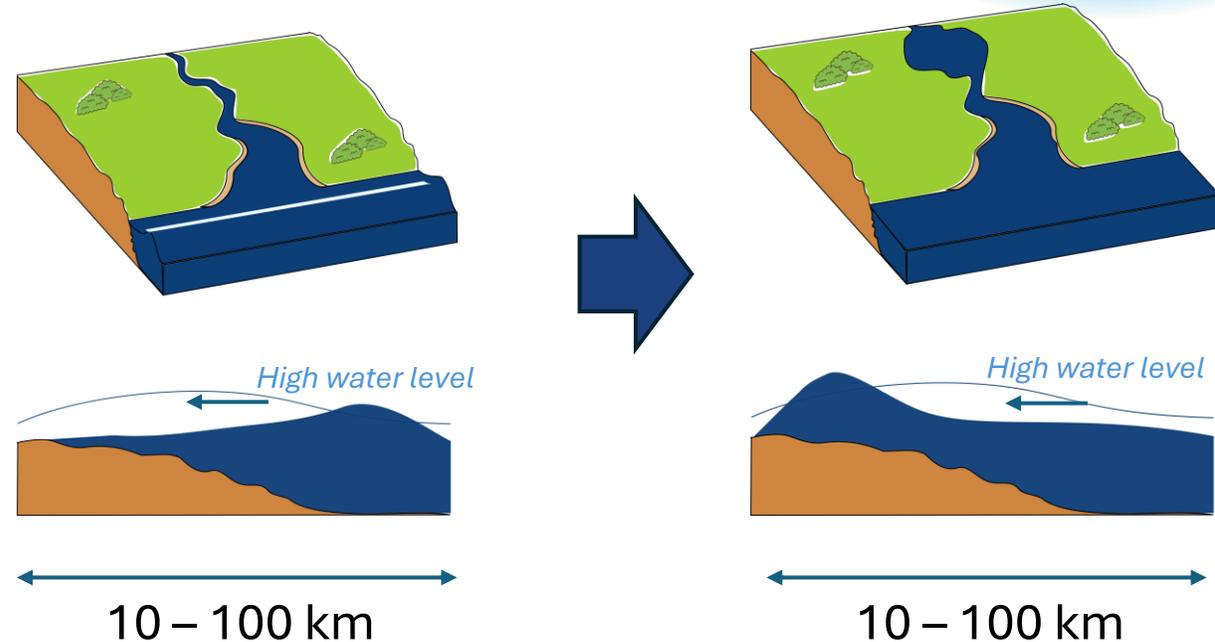


Estuaries are threatened by storm surges

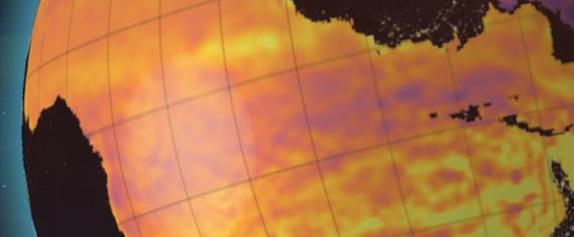
As key **transitional zones**, estuaries are particularly vulnerable to storm surge due to the combined effects of rivers discharge and offshore hydrometeorological conditions.

Funnel shaped estuary are even more vulnerable.

Need robust **storm surge models** of the land-sea continuum to enhance coastal resillience



Storm surge event are caused by high wind and low pressure pushing high water towards the coast



Scheldt-North Sea continuum is exposed to storm surge



Storm surges caused
by extra-tropical
cyclones



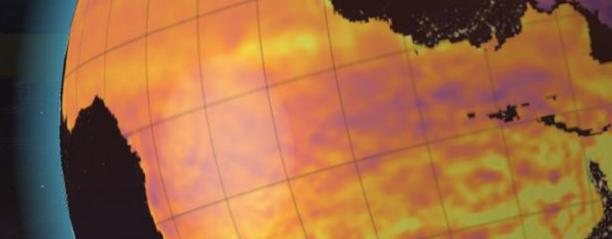
With global warming of 2°C or
above, Northern Europe is
expected to experience more
severe wind storms (*Woth et.
Al 2006*)

● Amsterdam

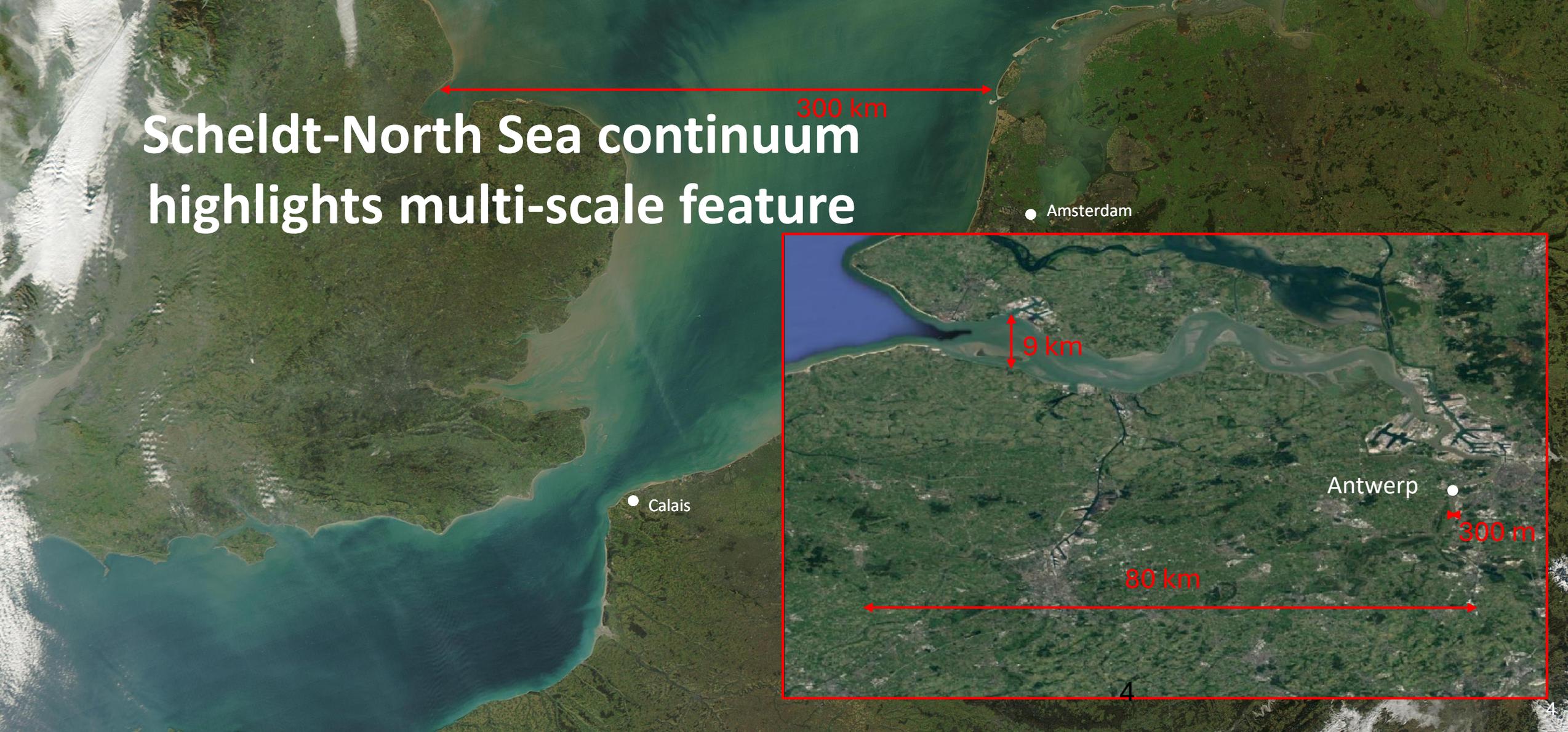
● Calais

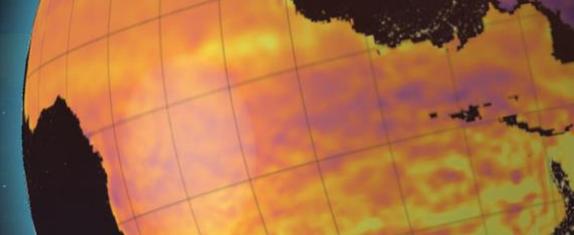
● Antwerp



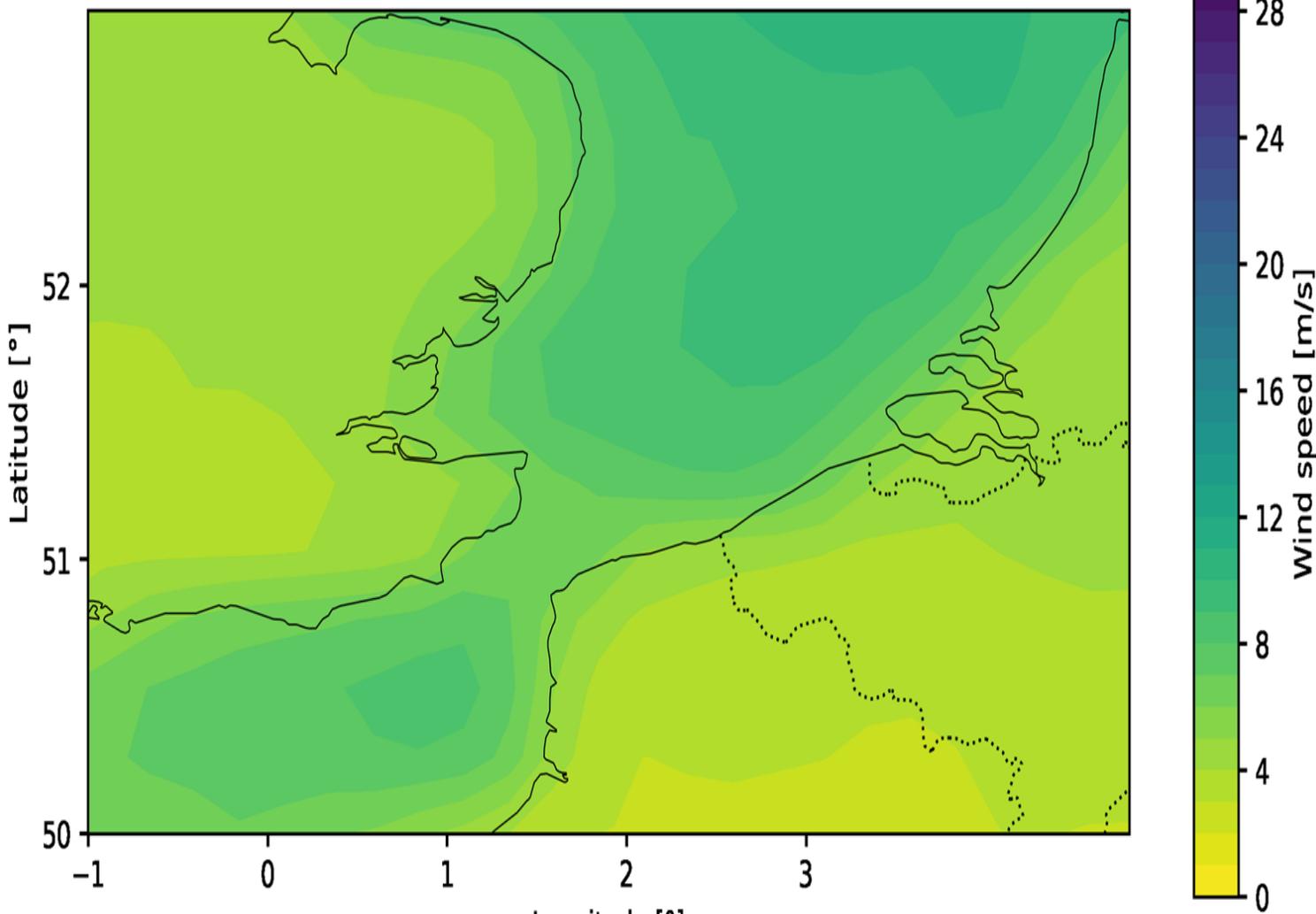


Scheldt-North Sea continuum highlights multi-scale feature

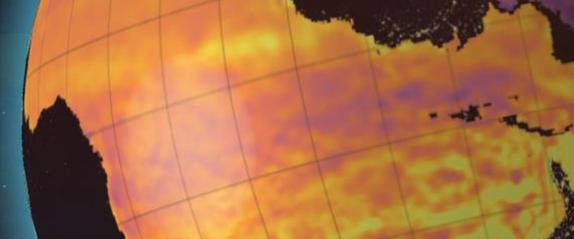




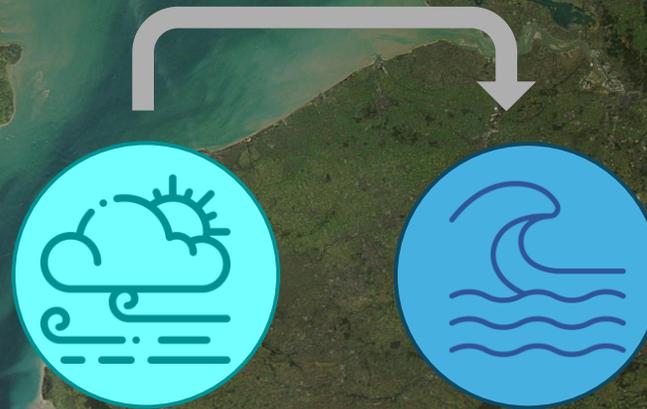
ERA 5 (~ 31 km resolution) 2013-12-04 08:00:00

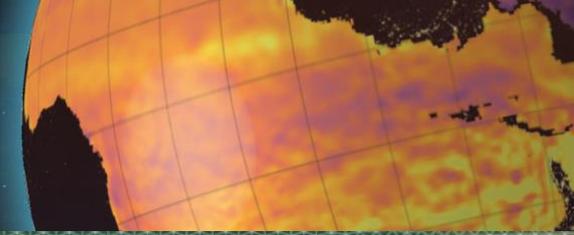


**Finer scales of
estuarine regions is
generally not matched
by global atmospheric
forcings**



What is the impact of atmospheric forcing resolution on surge model result over the Scheldt land sea continuum ?





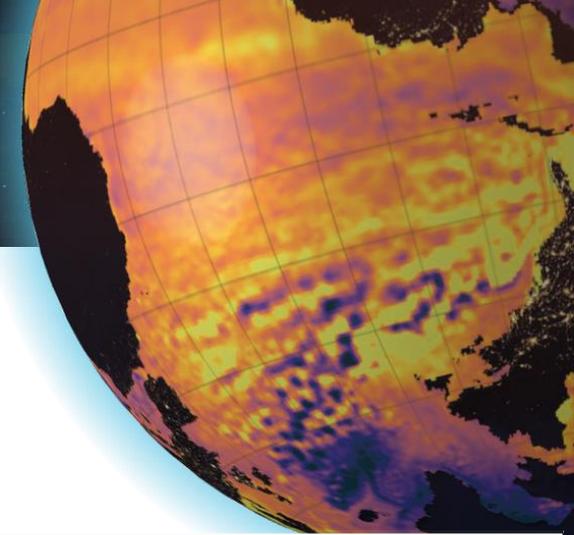
SLIM2D: depth-averaged barotropic
Wetting and drying algorithm (tidal flats)

Boundary currents:
NEMO (CMEMS) – $0.111^\circ \times 0.067$

Tides:
TPXO9.5 ($1/30^\circ$)

Unstructured mesh
20m – 2 km , 2×10^6 elements





We use MAR* as atmospheric forcing with different resolutions

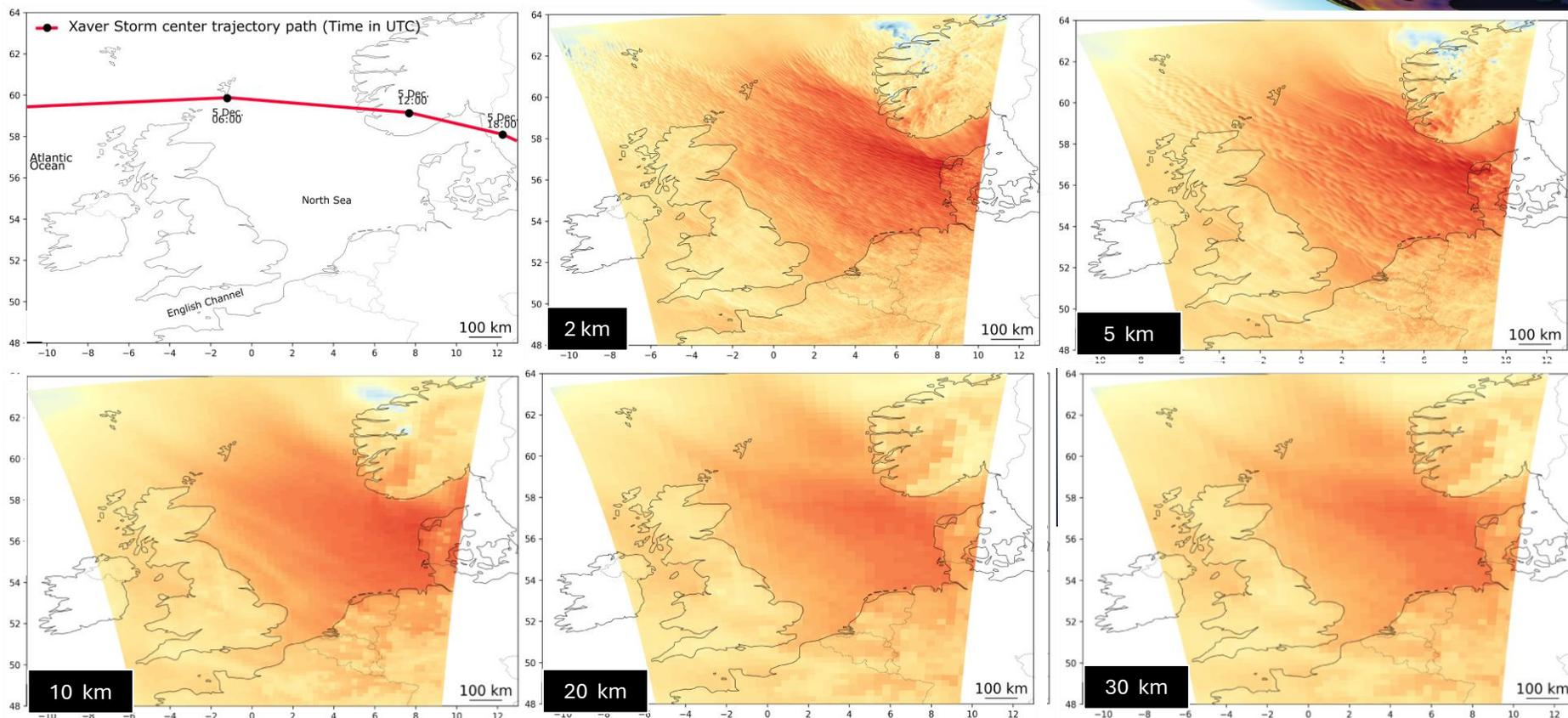
We model Xaver storm an extra-TC that occurred in December 2013 using various resolutions.

Spatial resolution:

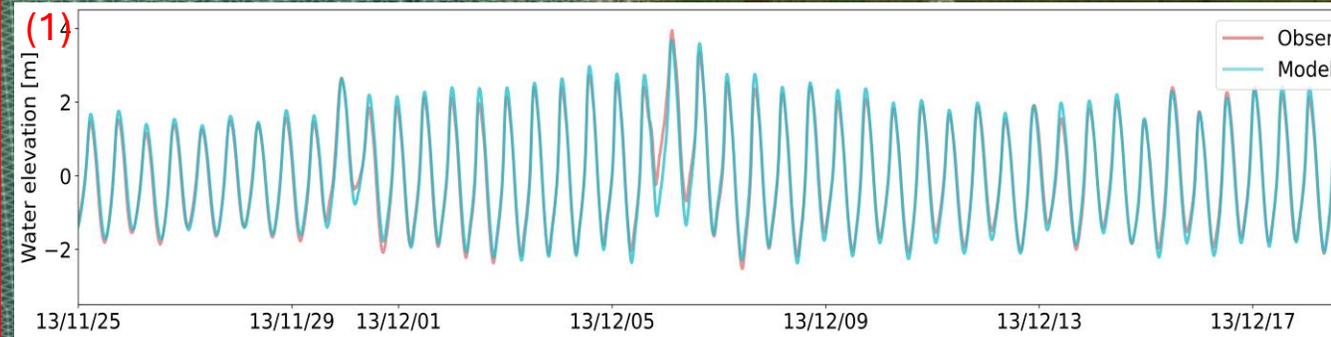
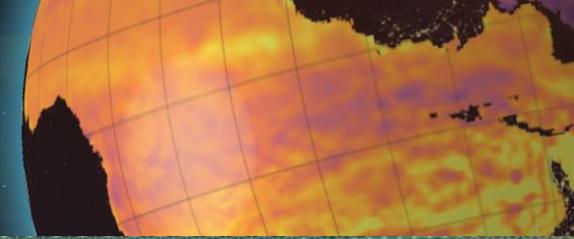
2km, 5km, 10km, 20km, 30km

Temporal resolution:

15 min, 1h, 3h, 6h



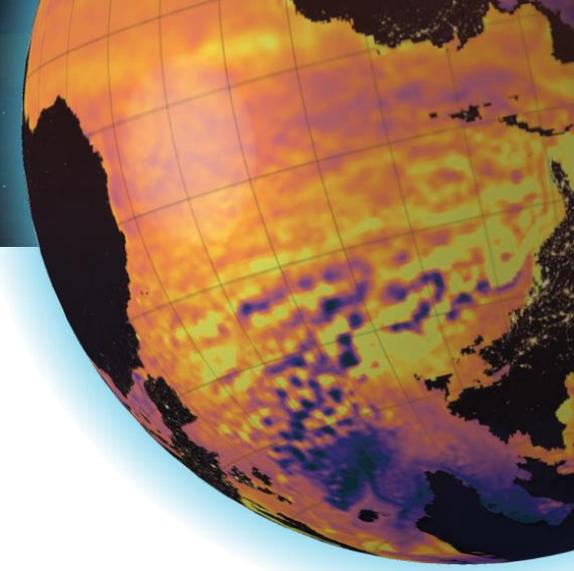
* *Modèle Atmosphérique Régional (developed at Uliège)*



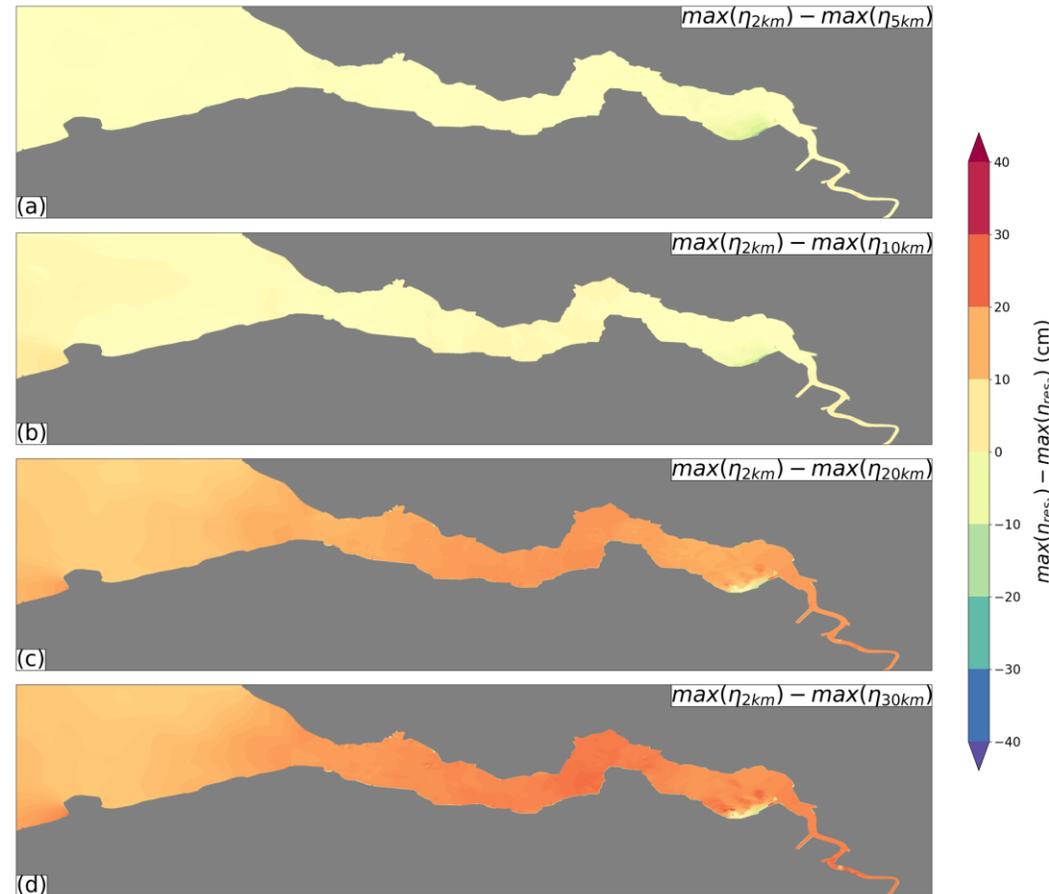
Water elevation modelled with
atmospheric forcings at 2 km
and 15 min

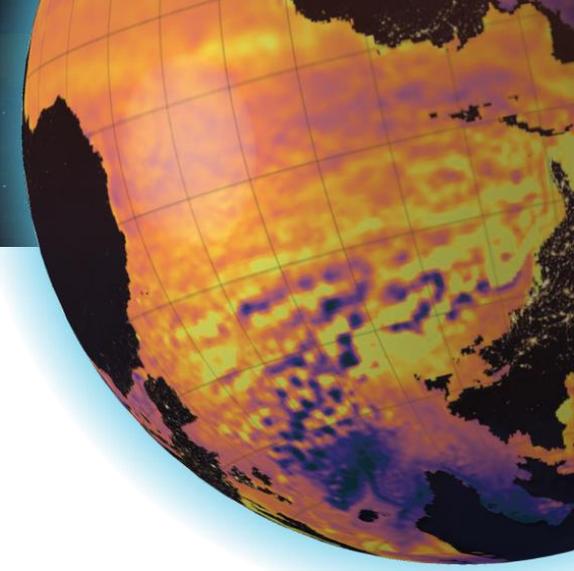
*(considered here after as
reference resolutions)*



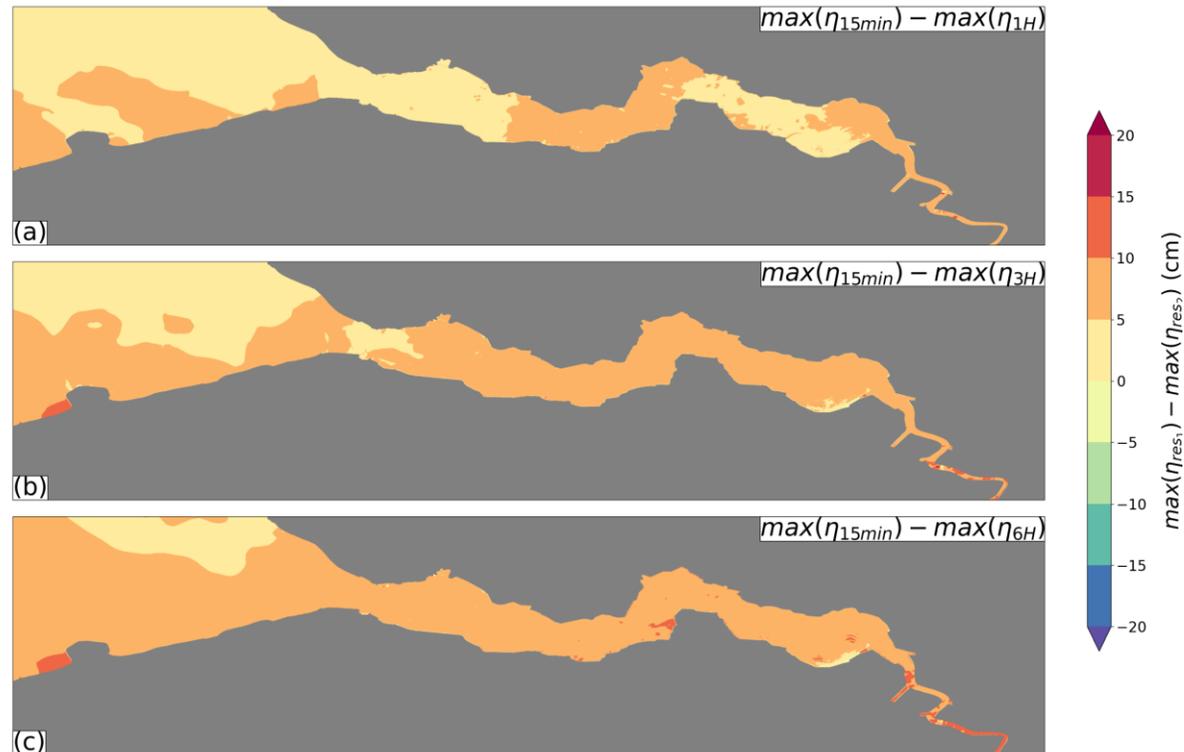


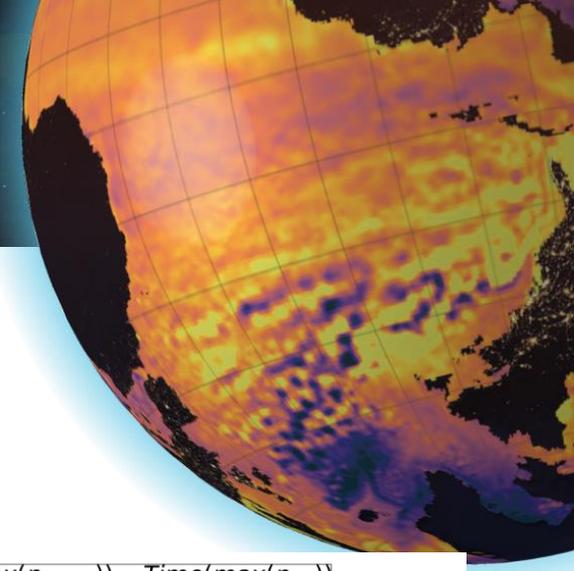
Increasing the spatial resolution of atmospheric forcing enhance peak surge results



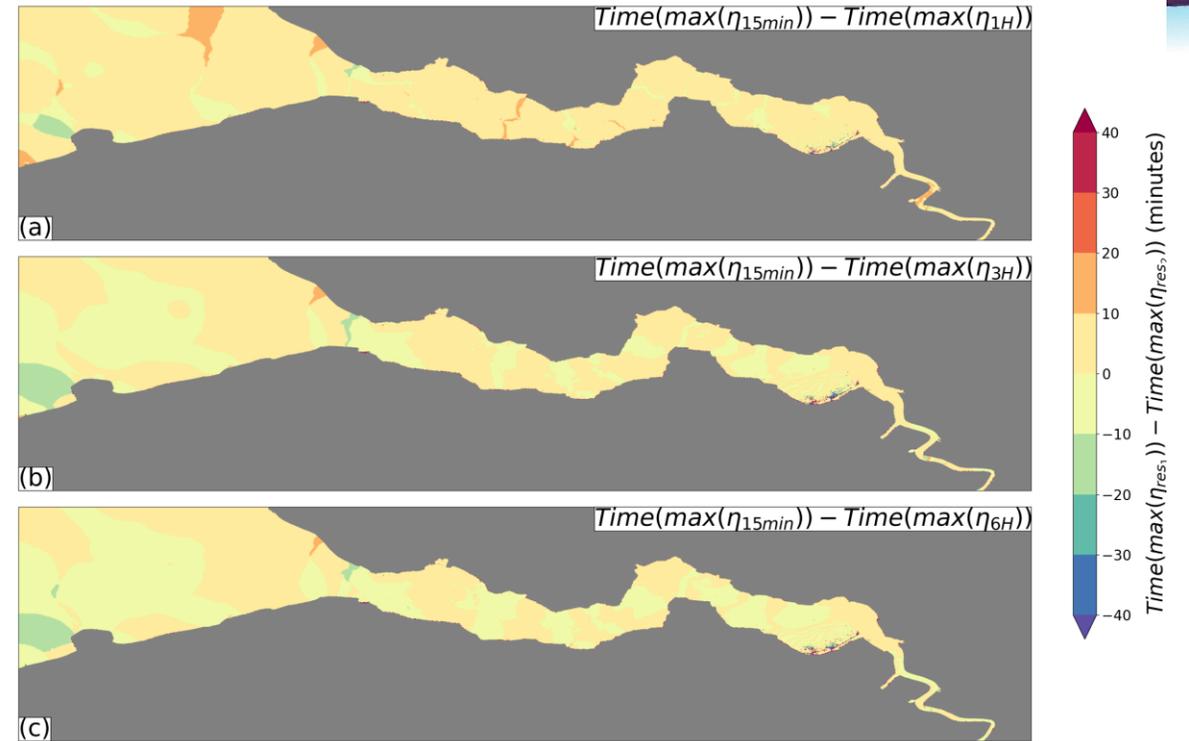
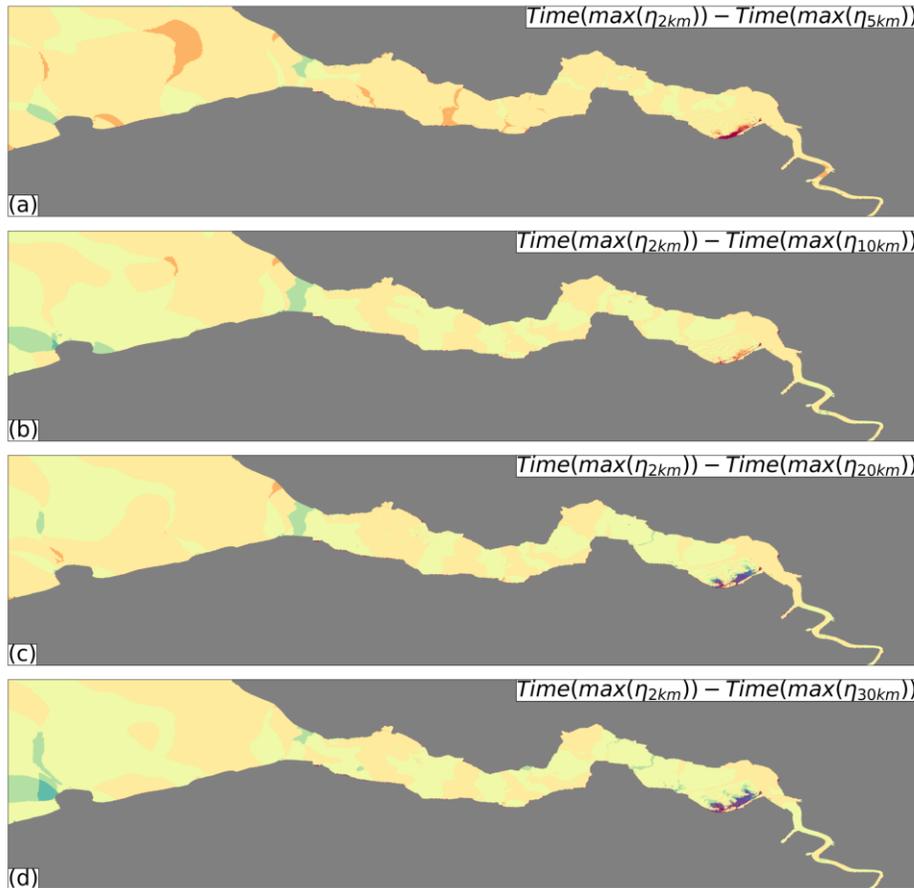


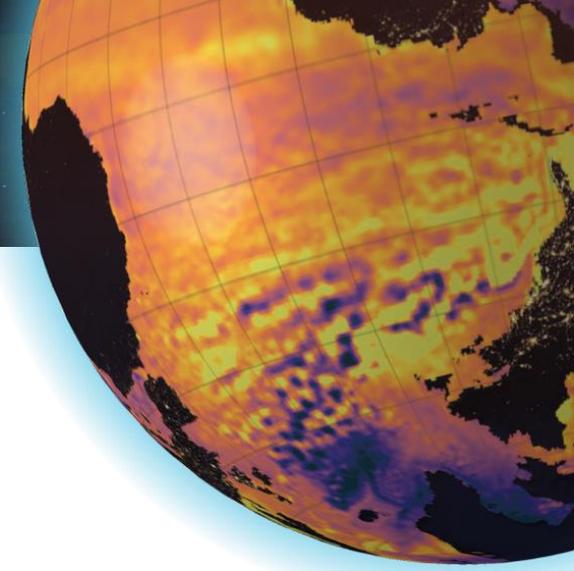
Finer temporal resolution enhances peak surge results at high spatial resolution





Peak timing is not influenced by temporal neither spatial resolution

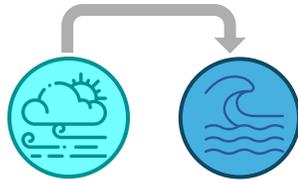




Take home messages



We aimed to understand how **atmospheric forcing resolution** impact surge model over the **Scheldt land-sea continuum**.



High resolution atmospheric forcings are needed for storm surge models, and they should **match the scale** of the hydrodynamic model of the land-sea continuum.

The effect of **spatial scale is more important** than the temporal scale to model the peak surge.

A few perspectives

Consider a **3D model**.

Look at a broader scale the **effect on the coastal region**.

Consider a better representation of the **vegetation**.



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Thank you!

