Rivers, Wetlands and Inundation: in Cama-flood, in Jules and in Reality

HS09: Advances in Large-scale River Modeling: Developments and Applications

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Simon Dadson, Univ. Oxford & UKCEH
Dai Yamazaki, Univ. Tokyo

with huge thanks to colleagues at
UKCEH Wallingford and UKCEH Bangor, UK Met Office and NOC Liverpool, Many others.

https://www.tobymarthews.com/

For more information: @UK_CEH , @UKCEHPapers

UK Centre for Ecology & Hydrology

17th September 2025 @ Space Park Leicester/ University of Leicester

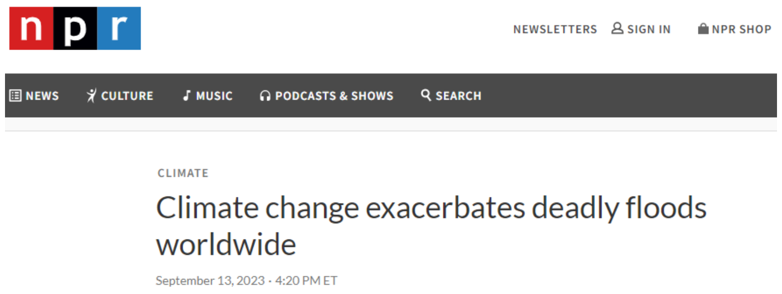
About UKCEH, the UK Centre for Ecology & Hydrology

- Founded 2000, we are spread across 5 sites and specialise in terrestrial and freshwater ecosystems research.

I work at the Wallingford site

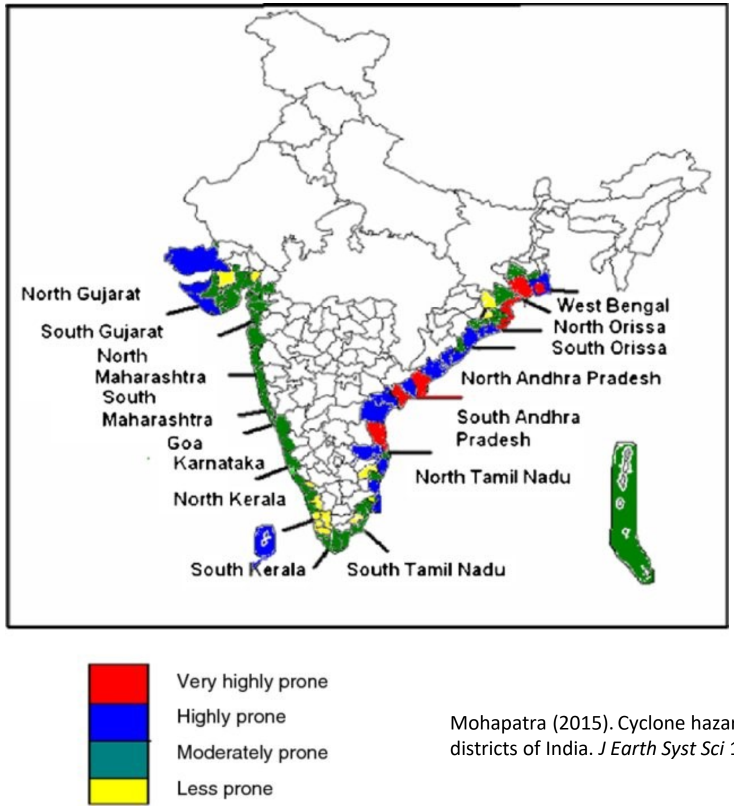
https://www.ceh.ac.uk @UK_CEH @UKCEHPapers

Flooding is important

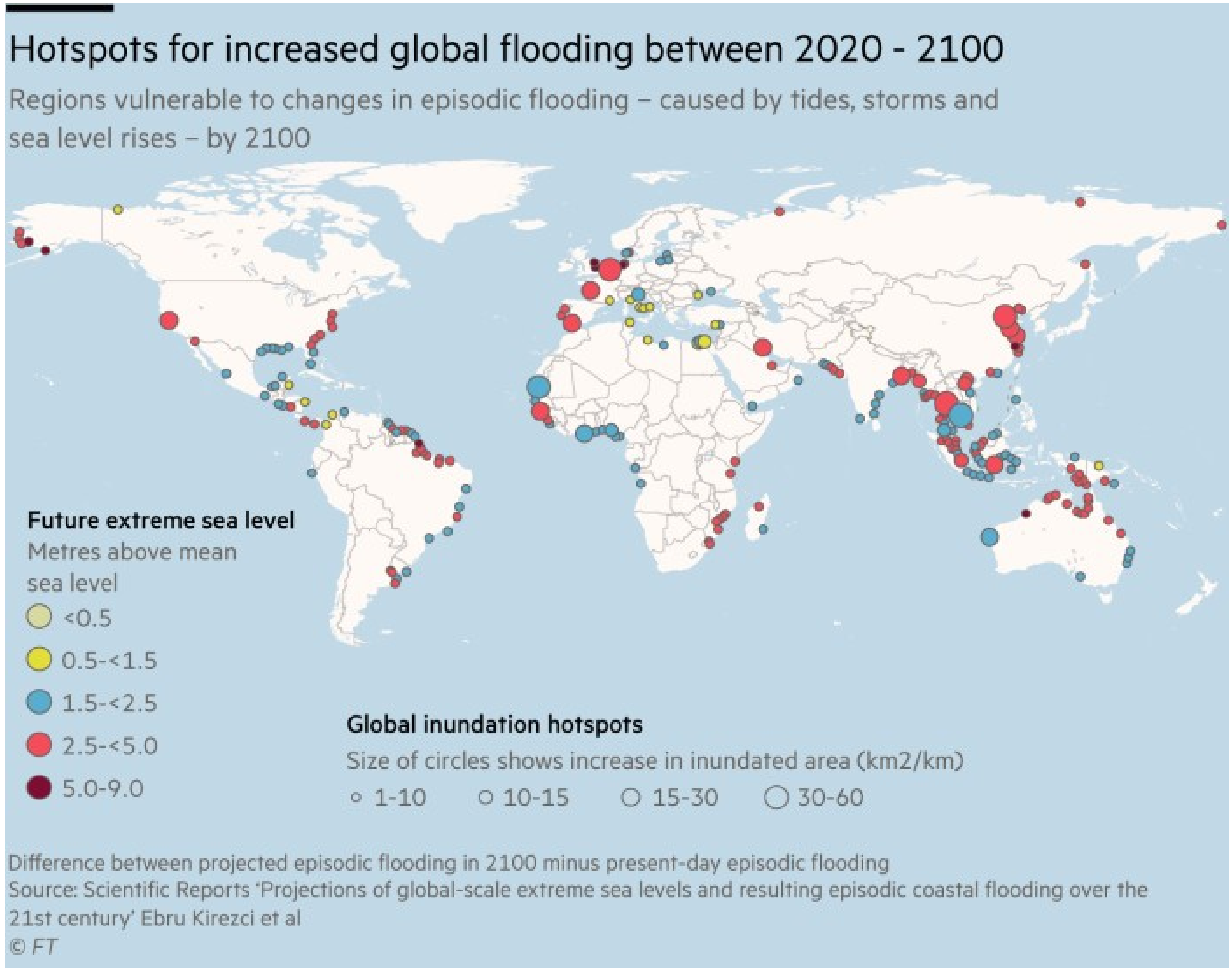


It is very clear that flooding and related extreme events are happening with increasing frequency around the world.

Coastal flooding especially is a major global issue.

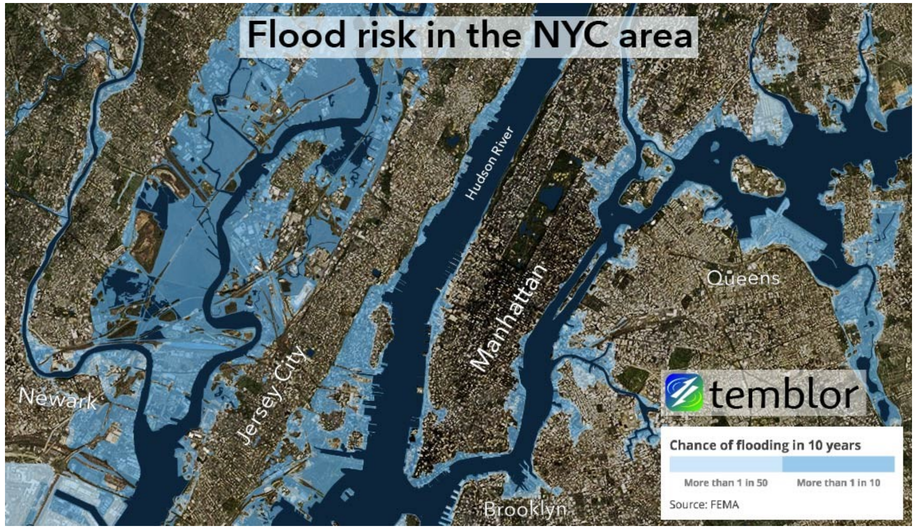


Mohapatra (2015). Cyclone hazard proneness of districts of India. *J Earth Syst Sci* 124

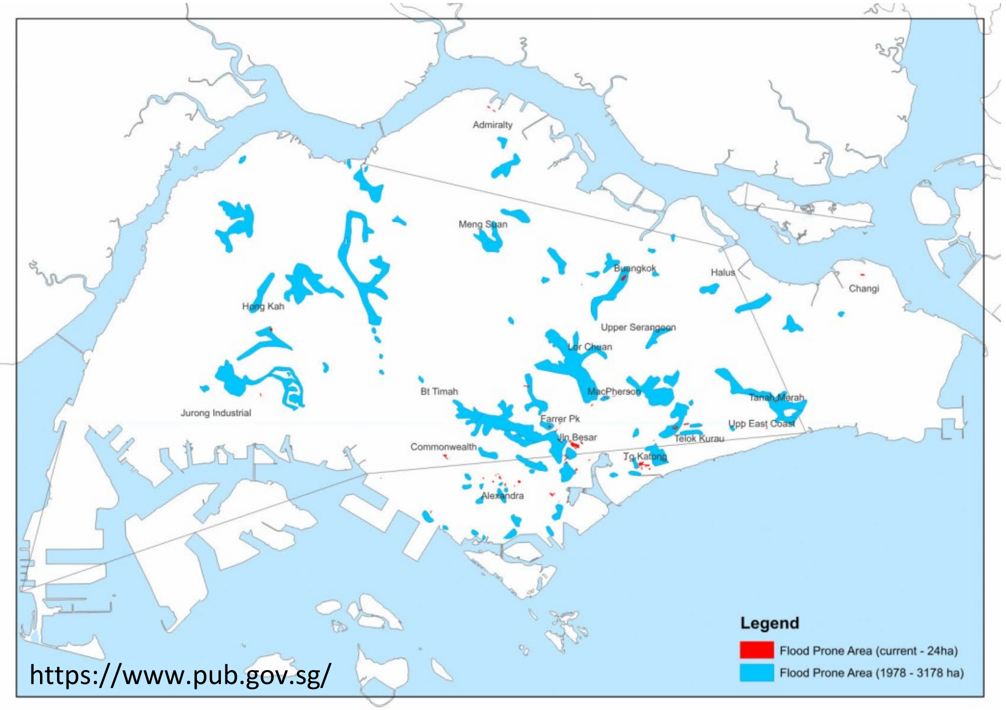


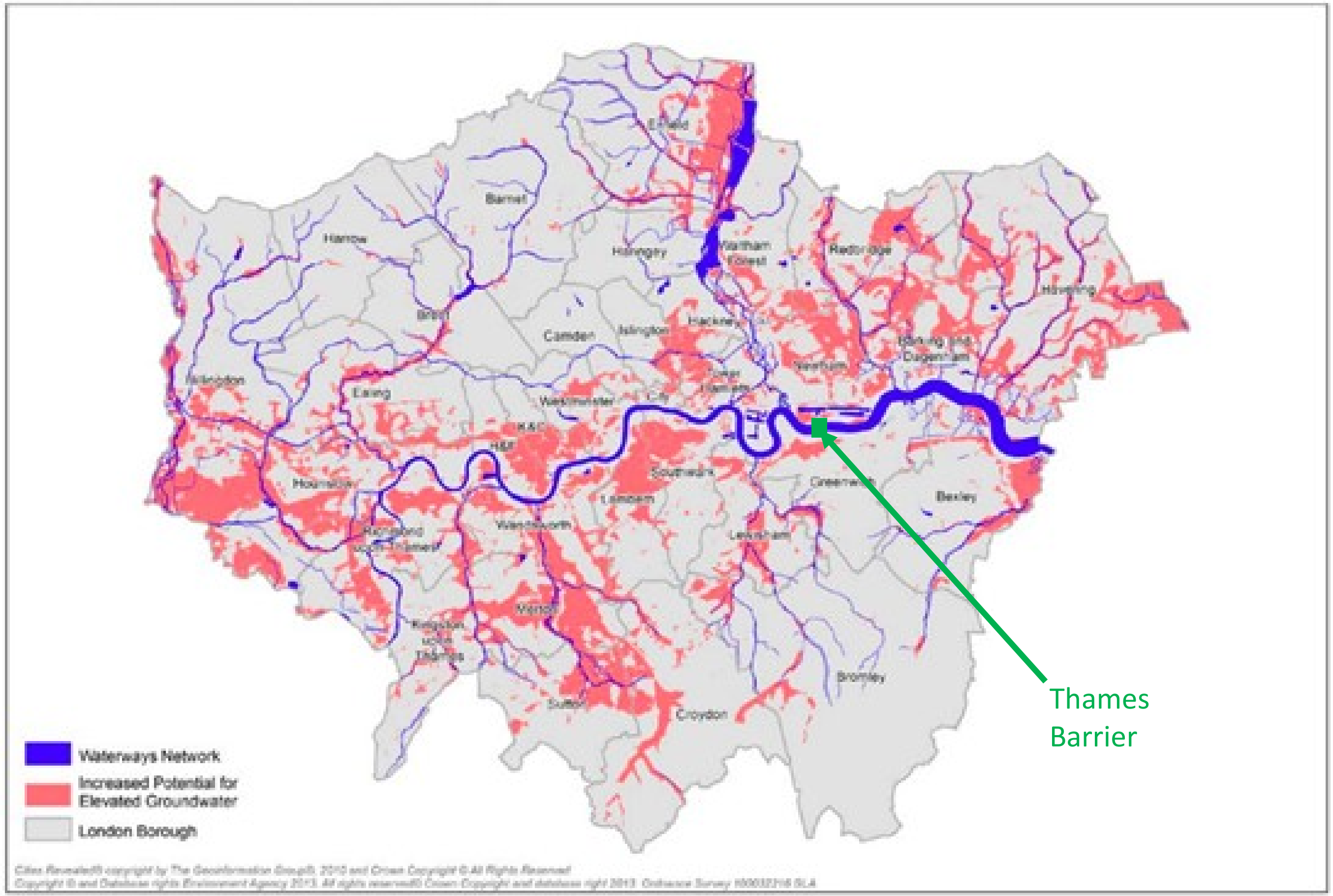
Flooding is important

Flood risk maps for New York (FEMA) and London (Regional Flood Risk Appraisal 2018).



Maps are readily available nowadays for many other cities like Miami, Bangkok, Singapore, etc..

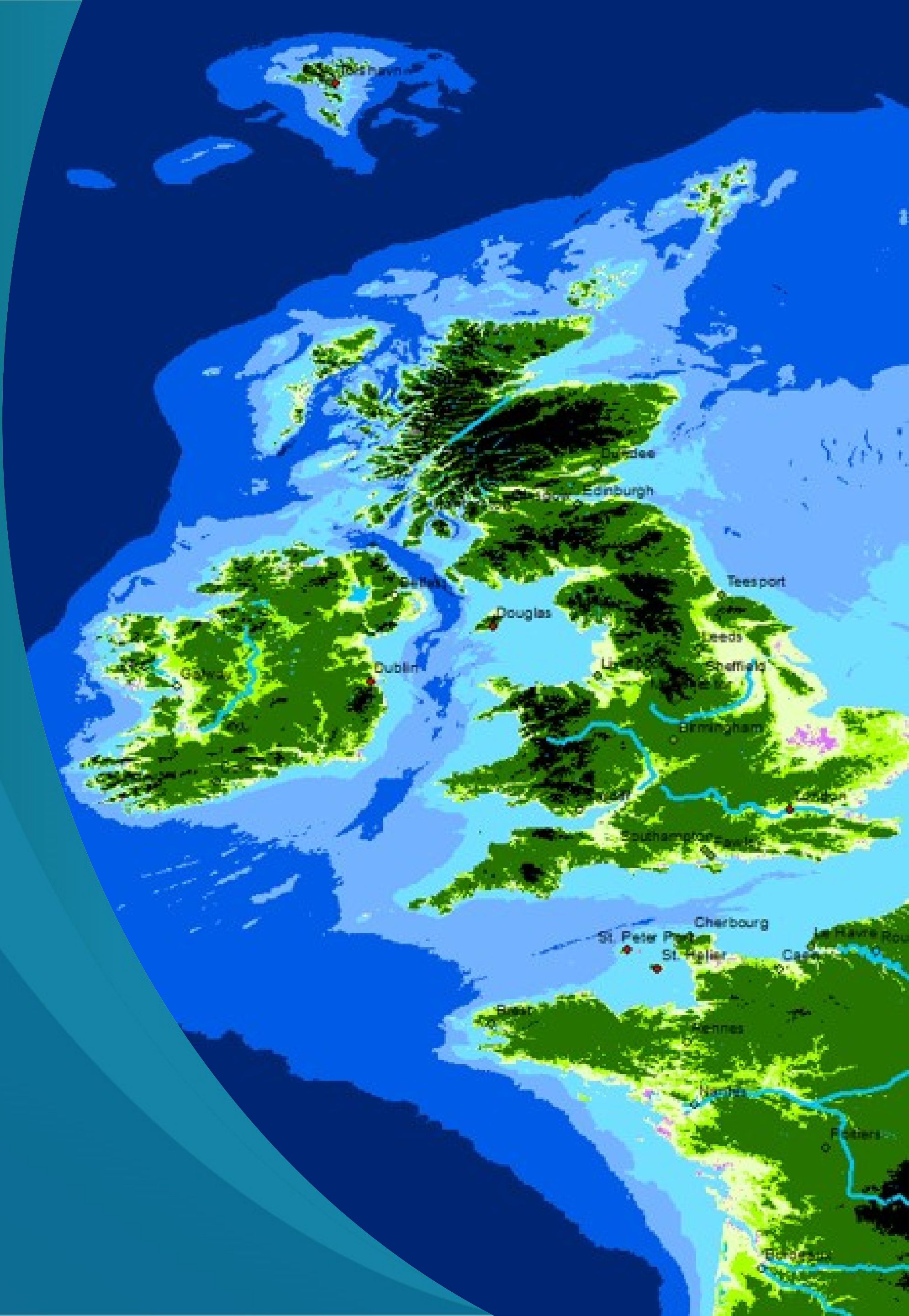




1. River, inundation, coastal and ocean modelling: Hydro-JULES and CHAMFER

2. UKCEH Modelling approaches

3. Sea surges require more thought



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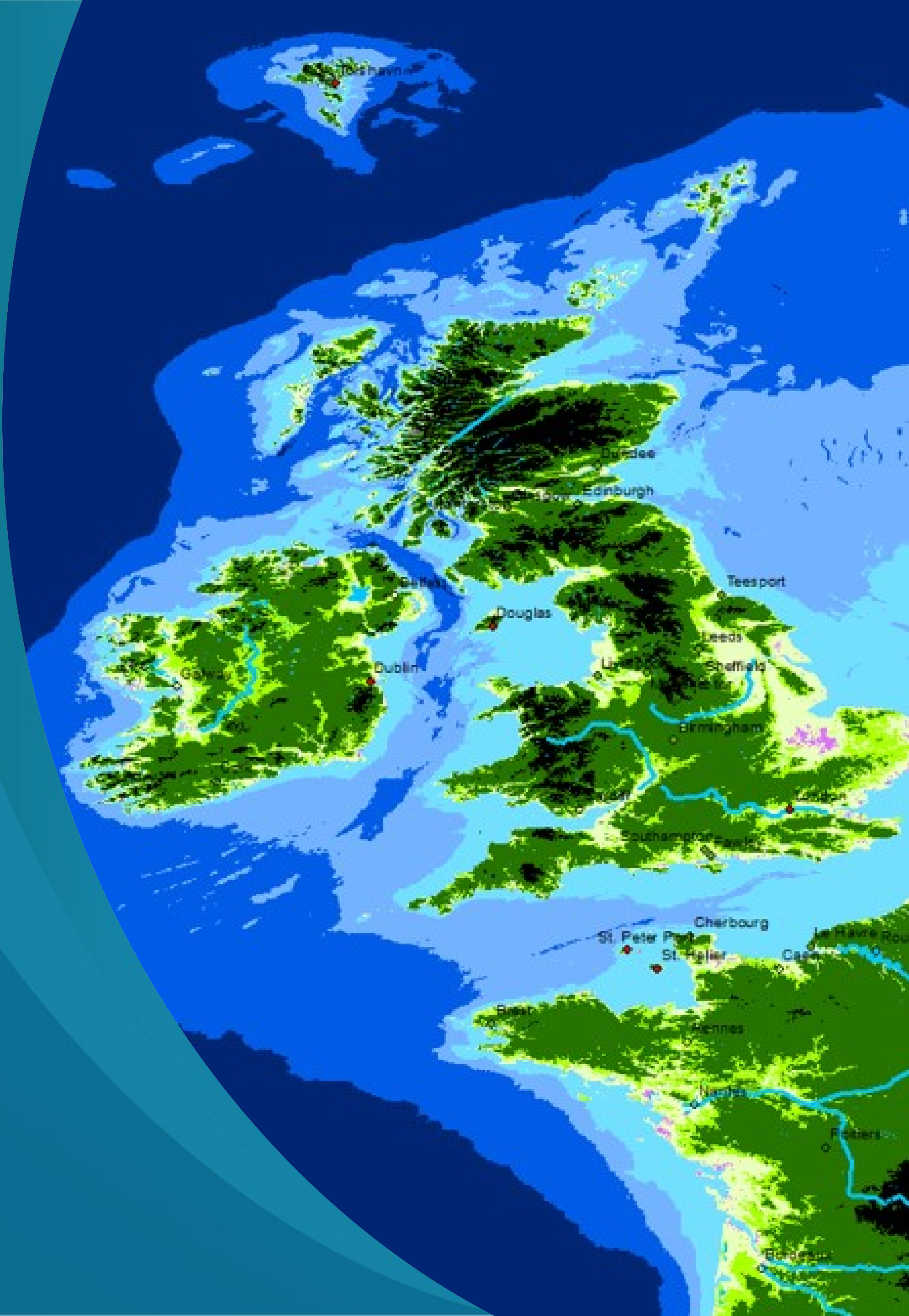

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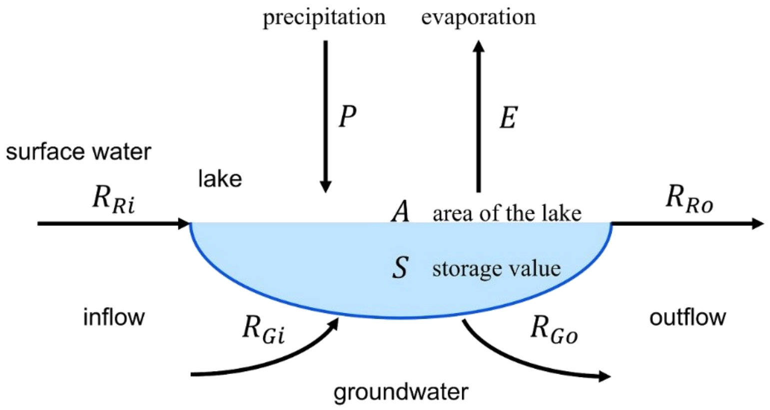
Modelling inundation

We are using the JULES land surface model to predict the consequences of different hydrological regimes in terms of inundation and the management of hydro-resources.

Much of my work benefits from **UK National Capability funding**, where the focus is on quantifying impacts as we (try to) move towards a net zero world.

As with all land surface models, JULES calculates a water balance at each of its gridcells, which includes all the main movements of water into and out of that location.
Inundation then happens as a consequence of these flow variables.



JULES

Joint UK Land Environment Simulator

JULES (the Joint UK Land Environment Simulator https://jules.jchmr.org/) is a community land surface model that is used both as a standalone model and as the land surface component in *the Met Office Unified Model* (Momentum Framework).

Met Office

JULES is a core component of both the UK Met Office's modelling infrastructure and UKRI/NERC's Earth System Modelling Strategy.

Types of inundation

Inundation is divided into several different types.

A good example comes from the CHaRIM project in Belize (2016): Three types of flooding: PLUVIAL (left), FLUVIAL (middle) and COASTAL (right).

In the *JULES* model, we have fluvial and pluvial flooding (to reasonable accuracy), but no coastal inundation is possible. Part of the CHAMFER project is to add the capability to simulate coastal inundation.

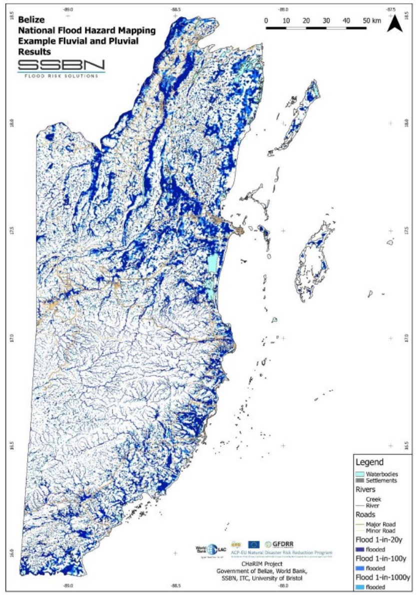


Figure 9 – Final fluvial and pluvial results for Belize NFHM. Note, only 3 return periods out of 10 shown for clarity.

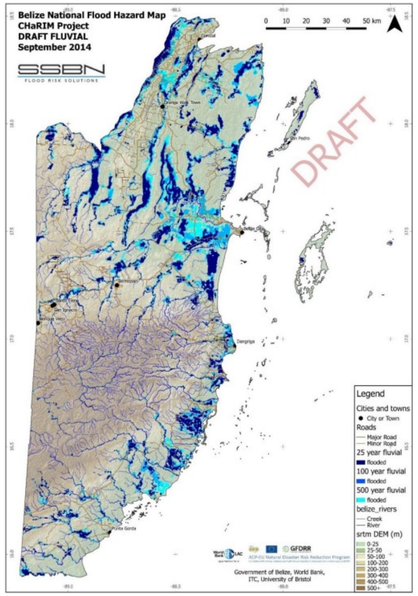


Figure 8 – Draft Fluvial (no pluvial or coastal) National Flood Hazard results for Belize.

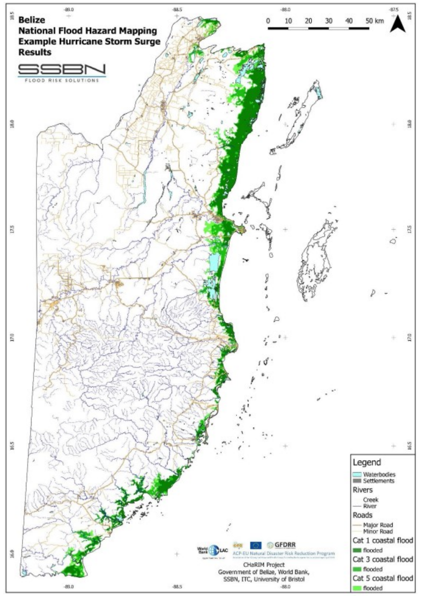
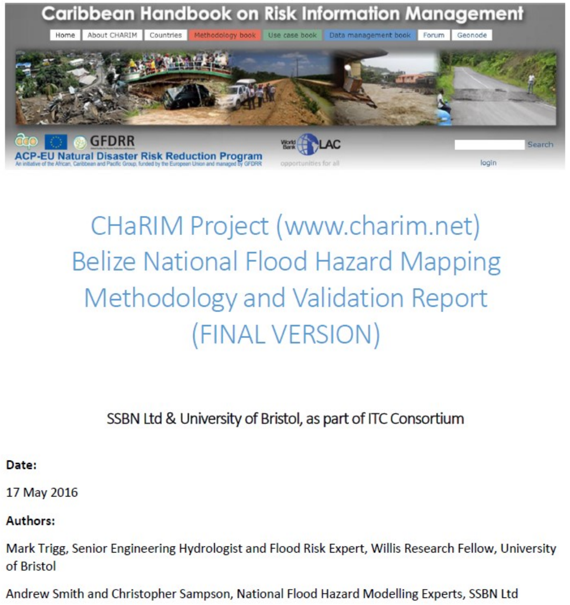


Figure 10 – Final coastal flood results for Belize NFHM. Note, only 3 out of 5 categories shown for clarity.


Caribbean Handbook on Risk Information Management

ACP-EU Natural Disaster Risk Reduction Program

CHaRIM Project (www.charim.net)
Belize National Flood Hazard Mapping
Methodology and Validation Report
(FINAL VERSION)

SSBN Ltd & University of Bristol, as part of ITC Consortium

Date:

17 May 2016

Authors:

Mark Trigg, Senior Engineering Hydrologist and Flood Risk Expert, Willis Research Fellow, University of Bristol

Andrew Smith and Christopher Sampson, National Flood Hazard Modelling Experts, SSBN Ltd

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Aside:

Water spreading on the land surface is currently simulated in a few different ways in JULES:

- The **overbank inundation** that comes out of the river routing scheme
- **Lake tiles** are open water on the land surface (Helen Johnson's work), but are simulated completely separately from the rivers (even though of course all lakes are in reality sections of rivers)
- Heather Rumbold has presented about the **irrigation scheme**, but this is also separate and driven by agriculture
- The Water Availability duRing Drought (WARD) project at UKCEH is looking at **water resources** in general.

In my opinion, at some point we need to bring these together a little more!

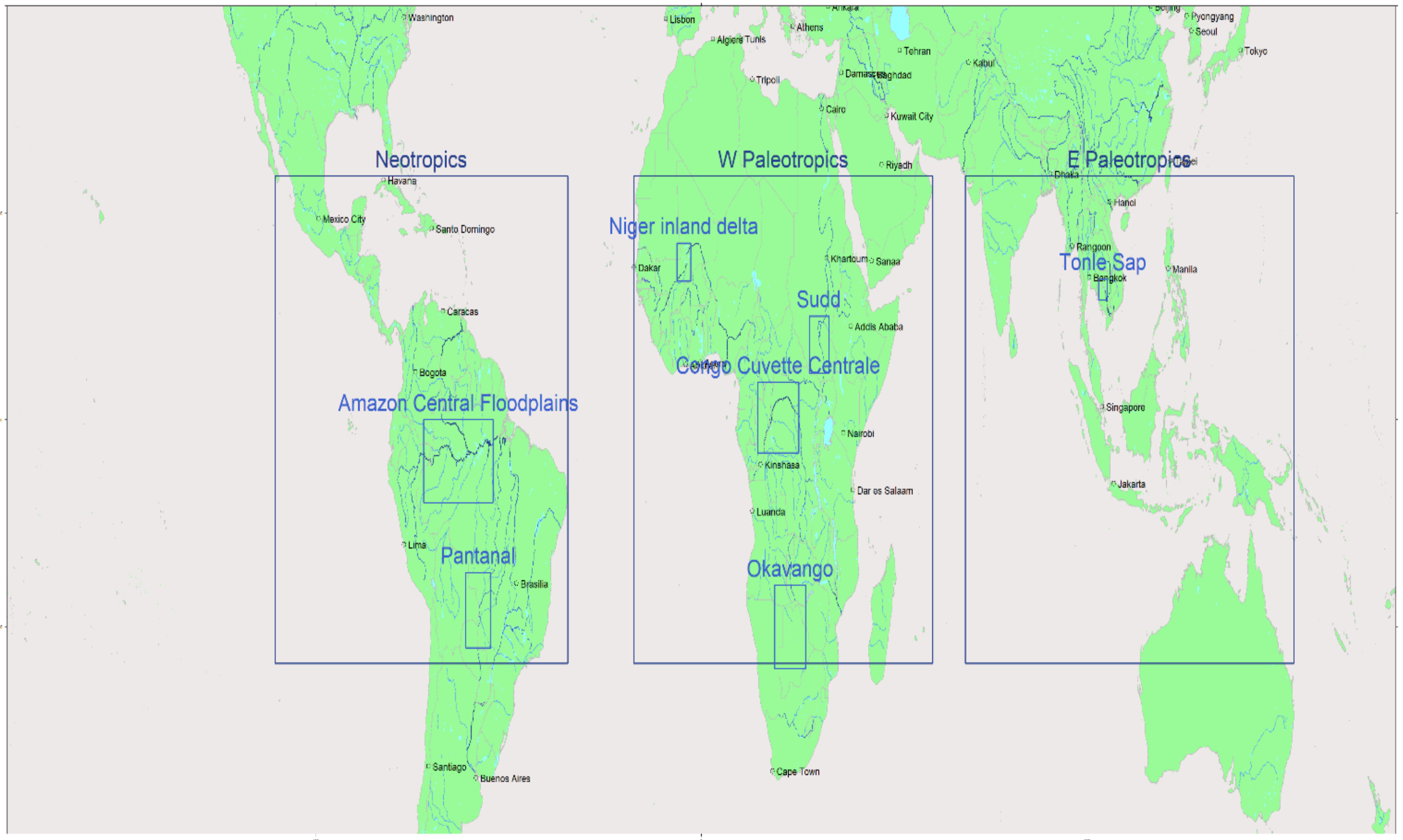
Types of inundation

Back in 2022, in the *Hydro-JULES* project, we applied CaMa-Flood to predict inundation in several global wetlands.

We got good predictions from this project, but we had to restrict ourselves to:

(i) Inland wetlands (no coastal inundation)
and
(ii) Tropical wetlands (no ice or permafrost).

In the current *CHAMFER* project, an opportunity has arisen to tackle the first of these limitations.



Hydro-JULES

Hydrol. Earth Syst. Sci., 26, 3151–3175, 2022
https://doi.org/10.5194/hess-26-3151-2022

Hydrology and Earth System Sciences
Open Access
EGU

Inundation prediction in tropical wetlands from JULES-CaMa-Flood global land surface simulations

Toby R. Marthews[1], Simon J. Dadson[1,2], Douglas B. Clark[1], Eleanor M. Blyth[1], Garry D. Hayman[1], Dai Yamazaki[3], Olivia R. E. Becher[2], Alberto Martínez-de la Torre[1,4], Catherine Prigent[5], and Carlos Jiménez[6]

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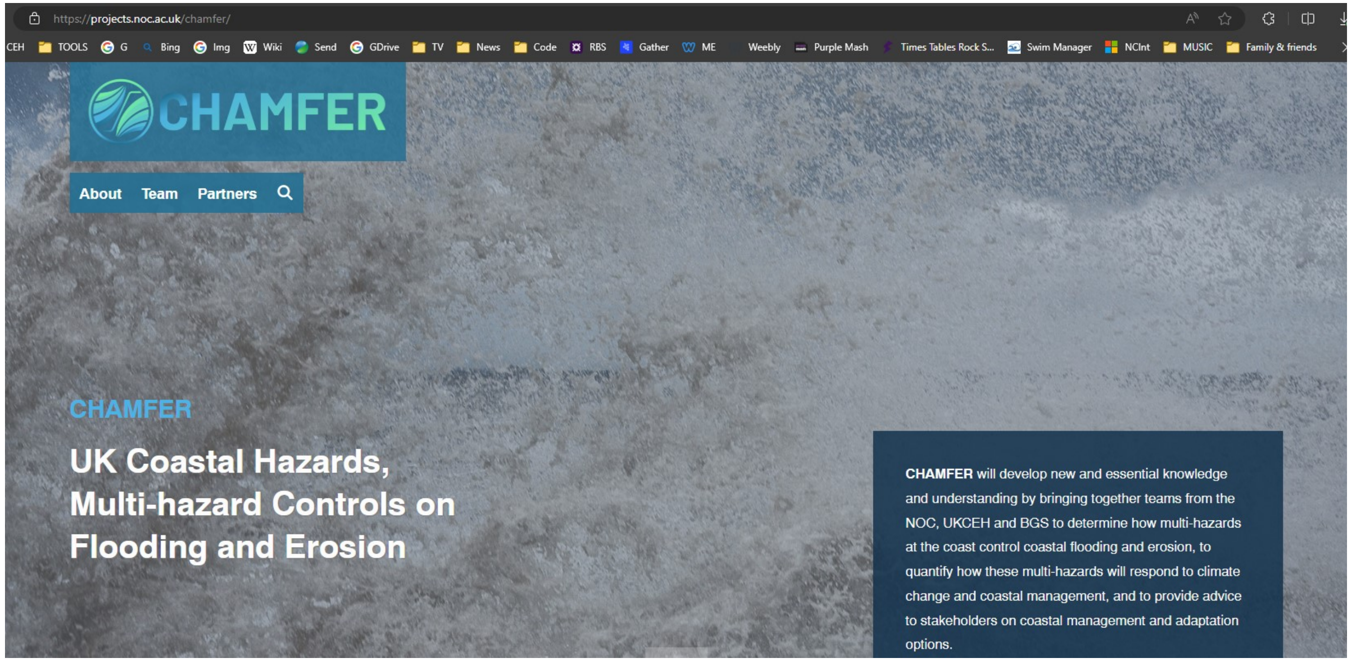
[4]Meteorological Surveillance and Forecasting Group, DT Catalonia,

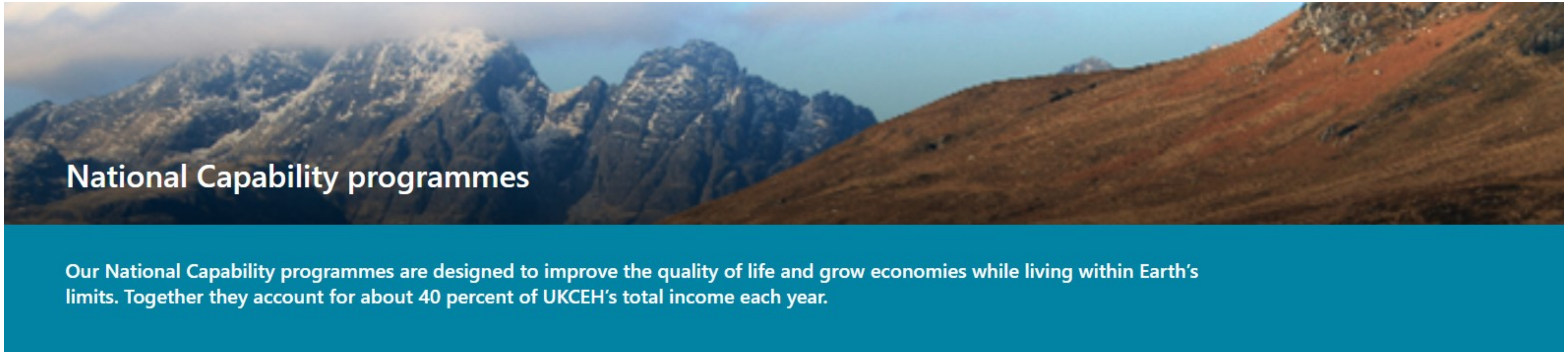
Project CHAMFER

CHAMFER is a UK National Capability project (UK Coastal HAzards - Multi-hazard controls on Flooding and ERosion).
https://projects.noc.ac.uk/chamfer/

Modelling the coastal zone of the UK at 500m resolution.



National Oceanography Centre



Project CHAMFER

UK CEH | National Oceanography Centre | Met Office | BGS British Geological Survey

Project is a consortium led by Laurent Amoudry at NOC Liverpool.

National Oceanography Centre


Laurent Amoudry


Michela de Dominicis

Met Office


Ségolène Berthou

Momentum
The Unified Earth Environment Prediction Framework

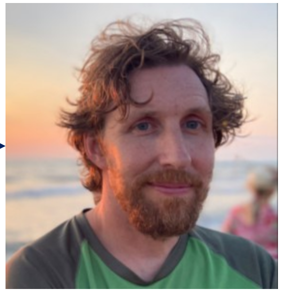
UK Centre for Ecology & Hydrology

Bangor


Angus Garbutt


Joanna Harley

Wallingford


Toby Marthews


Douglas Clark

Project duration: 2022-2026

CHAMFER will develop new and essential knowledge and understanding by bringing together teams from the NOC, UKCEH and BGS to determine how multi-hazards at the coast control coastal flooding and erosion, to quantify how these multi-hazards will respond to climate change and coastal management, and to provide advice to stakeholders on coastal management and adaptation options.

Project CHAMFER

UK CEH

National Oceanography Centre

Met Office

BGS British Geological Survey

CHAMFER has a very strong connection to stakeholders, with whom we meet regularly.

Environment Agency

Climate Change Committee

Met Office

SEPA Scottish Environment Protection Agency Buidheann Dìon Àrainneachd na h-Alba

Cyfoeth Naturiol Cymru Natural Resources Wales

JBA consulting

RMS

SMMR Sustainable Management of UK Marine Resources

Government Departments

Coastal groups

Coastal Partnerships Network

NATURAL ENGLAND

NatureScot Scotland's Nature Agency Buidheann Nàdair na h-Alba

MOTT MACDONALD

eDF

PEEL PORTS GROUP Group Marine

THE LIGHTHILL RISK NETWORK

JNCC

ECMWF

SMI

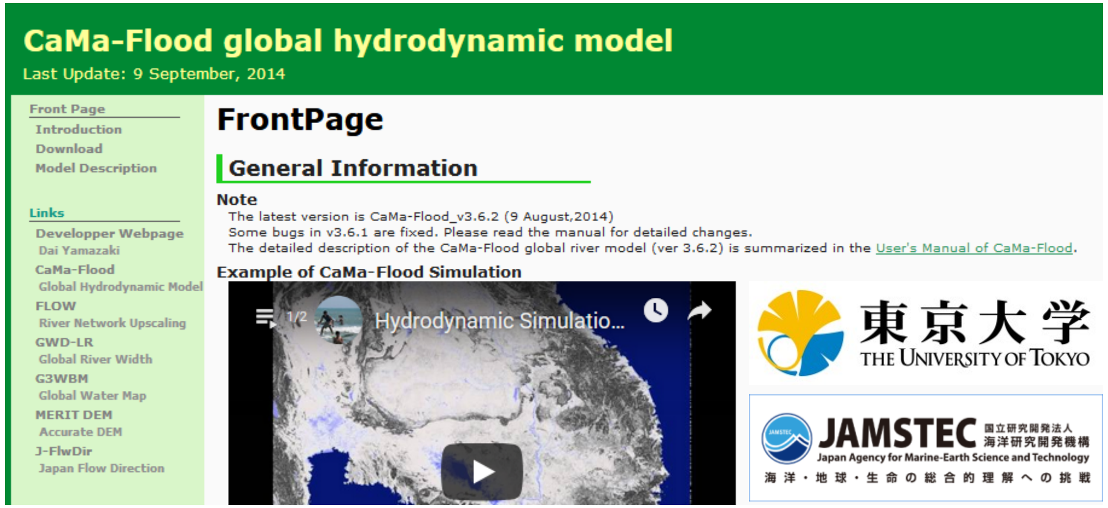
renewableUK

River flow

Following on from previous work, our approach is to use the well-tested global hydrodynamic model *CaMa-Flood*. This is a necessary 'upgrade' from the current river models in *JULES* (called *TRIP* and *RFM (=River Flow Model)*).

A key part of this upgrade is moving from a kinematic wave model (used by *RFM*) to a local inertial approximation where only the convective acceleration term is neglected (de Almeida & Bates 2013).

de Almeida GAM & Bates P (2013). Applicability of the local inertial approximation of the shallow water equations to flood modelling. *Water Resources Research* 49:4833-4844.



CaMa-Flood is a Global Hydrodynamic model developed by Dai Yamazaki at Univ. Tokyo. It is the only open-source global river routing model based on the local inertial approximation of the Saint Venant equations.

Crucially, this version of the Saint Venant equations includes *backwater effects*, i.e. temporary reversals of flow in river branches.

This is something we need to be able to model coastal inundation: NEMO communicates the height of the sea wall to JULES (via Oasis), but then the river routing scheme in JULES must be able to allow that water to travel upstream to produce inundation. This is not possible with RFM because it follows the kinematic wave equation that assumes no flow reversals.

Various Forms of the Momentum Equation

$$\frac{1}{A}\frac{\partial Q}{\partial t} + \frac{1}{A}\frac{\partial}{\partial x}\left(\frac{Q^2}{A}\right) + g\frac{\partial y}{\partial x} - g(S_o - S_f) = 0$$

Local acceleration term | Convective acceleration term | Pressure force term | Gravity force term | Friction force term

RFM

$$\cancel{\frac{\partial V}{\partial t}} + \cancel{V\frac{\partial V}{\partial x}} + \cancel{g\frac{\partial y}{\partial x}} - g(S_o - S_f) = 0$$

Kinematic Wave

Diffusion Wave

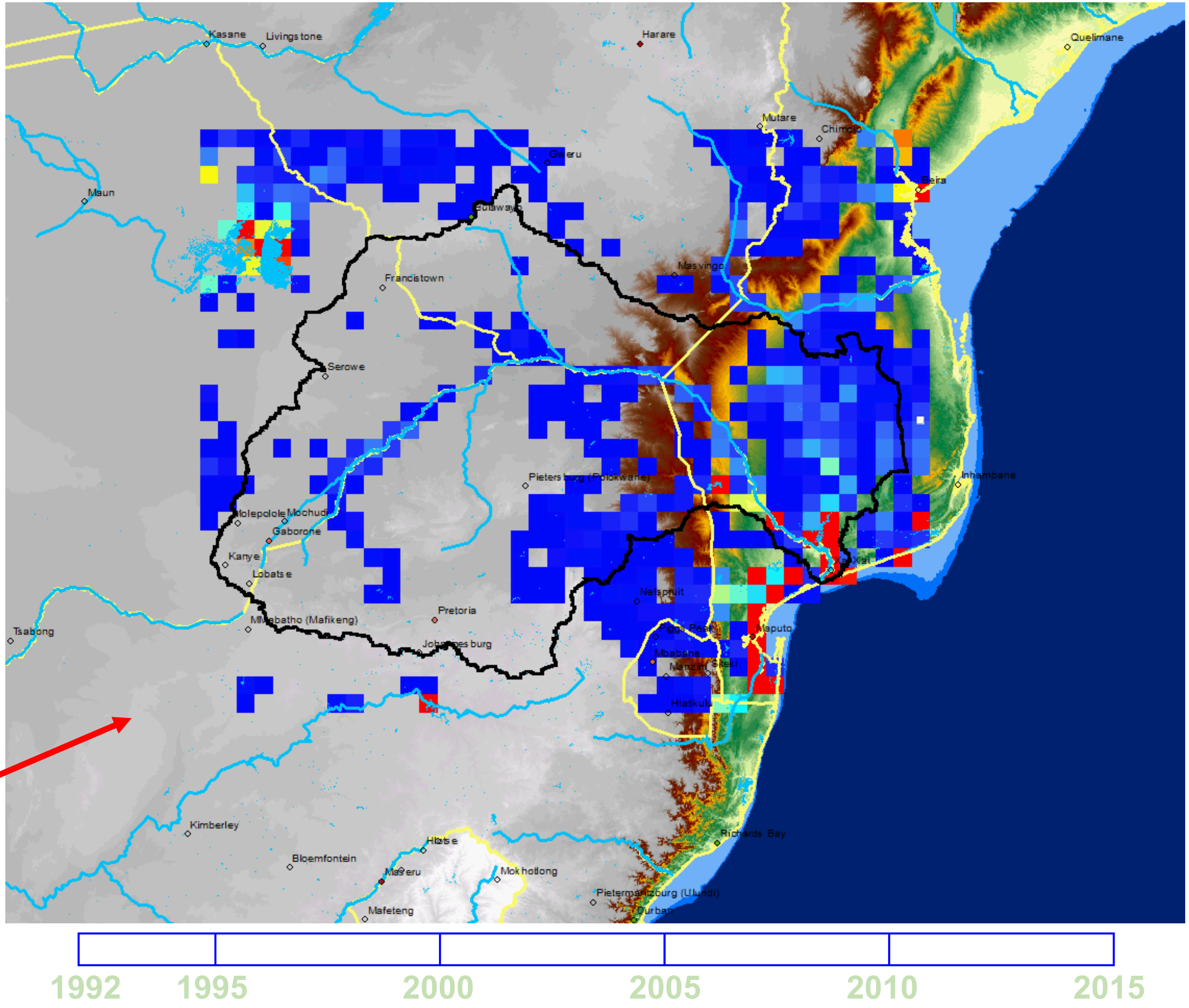
Dynamic Wave

Limpopo river basin, Southern Africa

As an example, I generated surface inundation data for the Limpopo river basin in Southern Africa. Here are 22 years of data showing seasonal ebb and flow.

Generated using the CaMa-Flood global hydrodynamics model, driven by JULES runoffs (animation by ArcGIS).

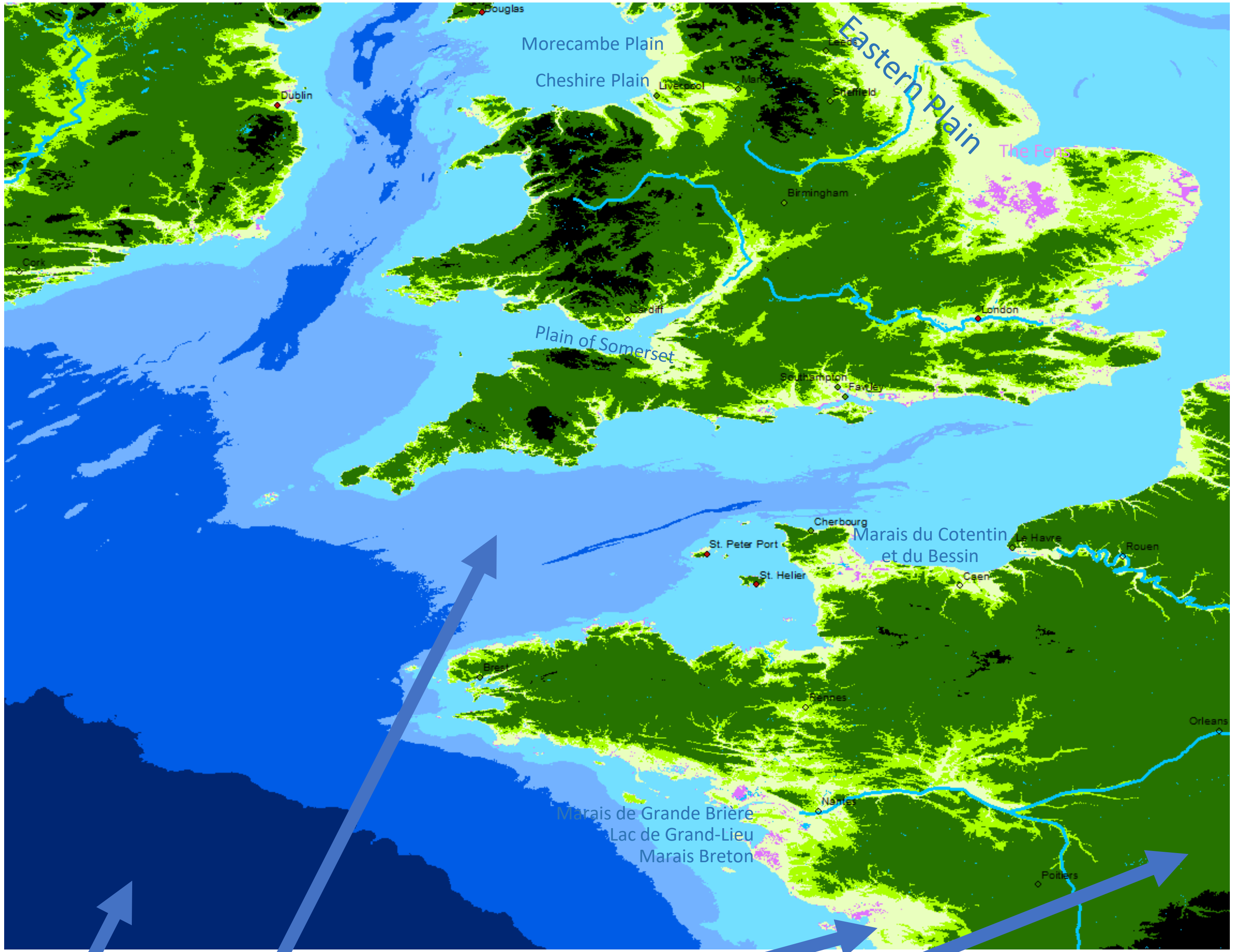
n.b. this is CaMa-Flood code *integrated into the JULES model*, not run separately.



Focus on COASTS

- Don't forget about the coast, though.
- Approximately one third of the UK population lives within 10 km of the coast (Hadley 2009)
- Additionally, 200 million people worldwide live along coastlines less than 5 m above sea level, and it is estimated that this figure could increase to 400 to 500 million by the end of the 21st century.

In the UK, responsibility for coastal zone research is divided between UKCEH and NOC.



UKCEH

National Oceanography Centre

UPLANDS / PIEDMONT (>60 m asl)

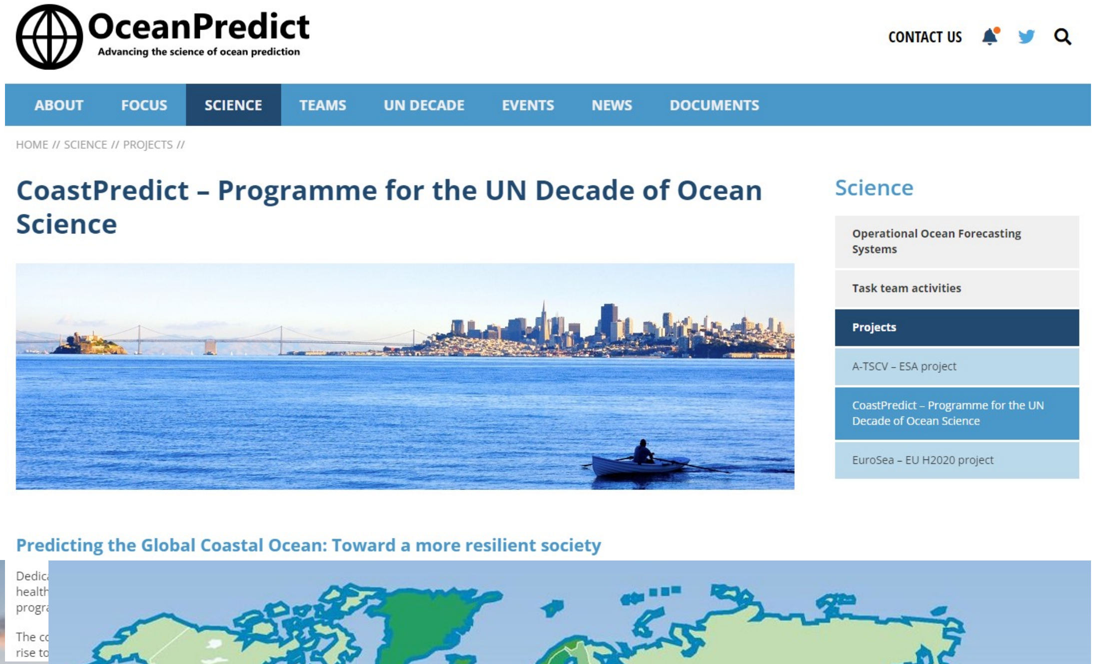
COASTAL PLAIN (yellow <30 m asl; light green <60 m asl)

COASTAL OCEAN / SHELF SEAS (light blue <60 m depth; middle <100 m; dark <200 m

OCEANIC ZONE (>200 m depth)

Focus on COASTS

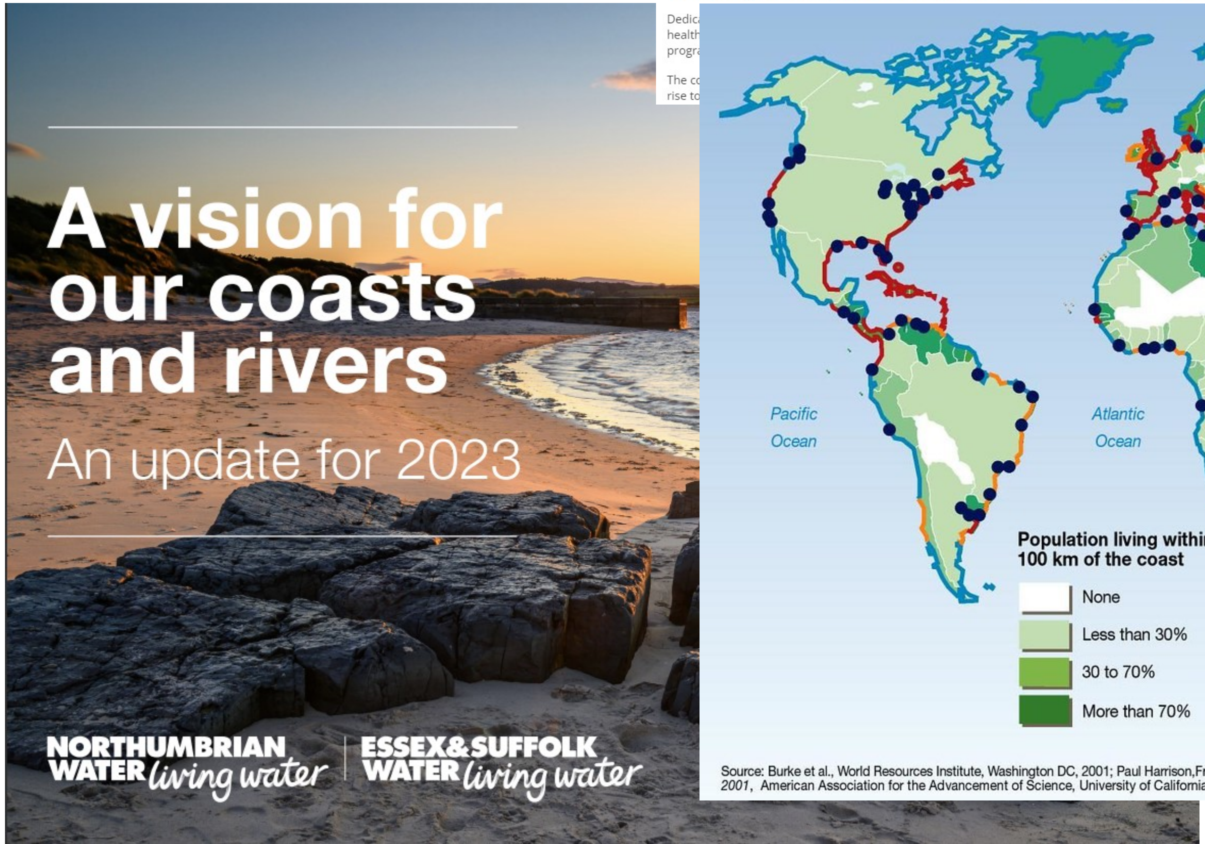
In the last few years, new regional, national and international programmes have highlighted the importance of the coastal zone (both the coastal plain and the coastal ocean).

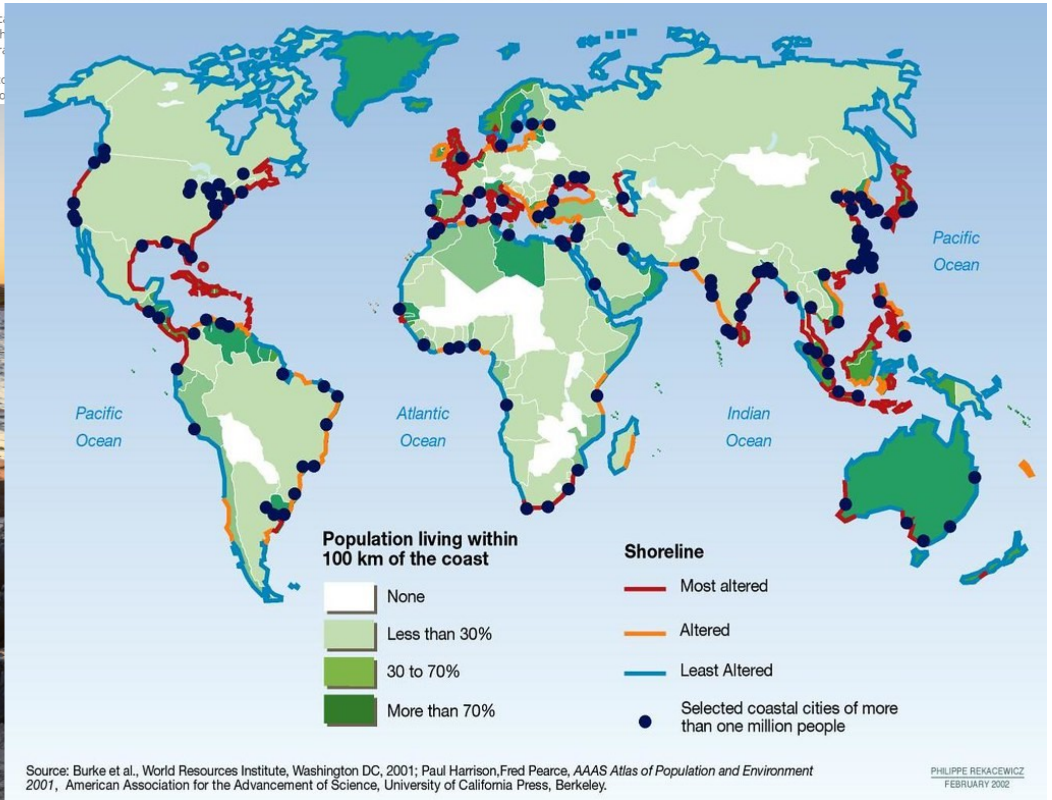


FLOOD 2023 & COAST

floodandcoast.com

Flood & Coast 24



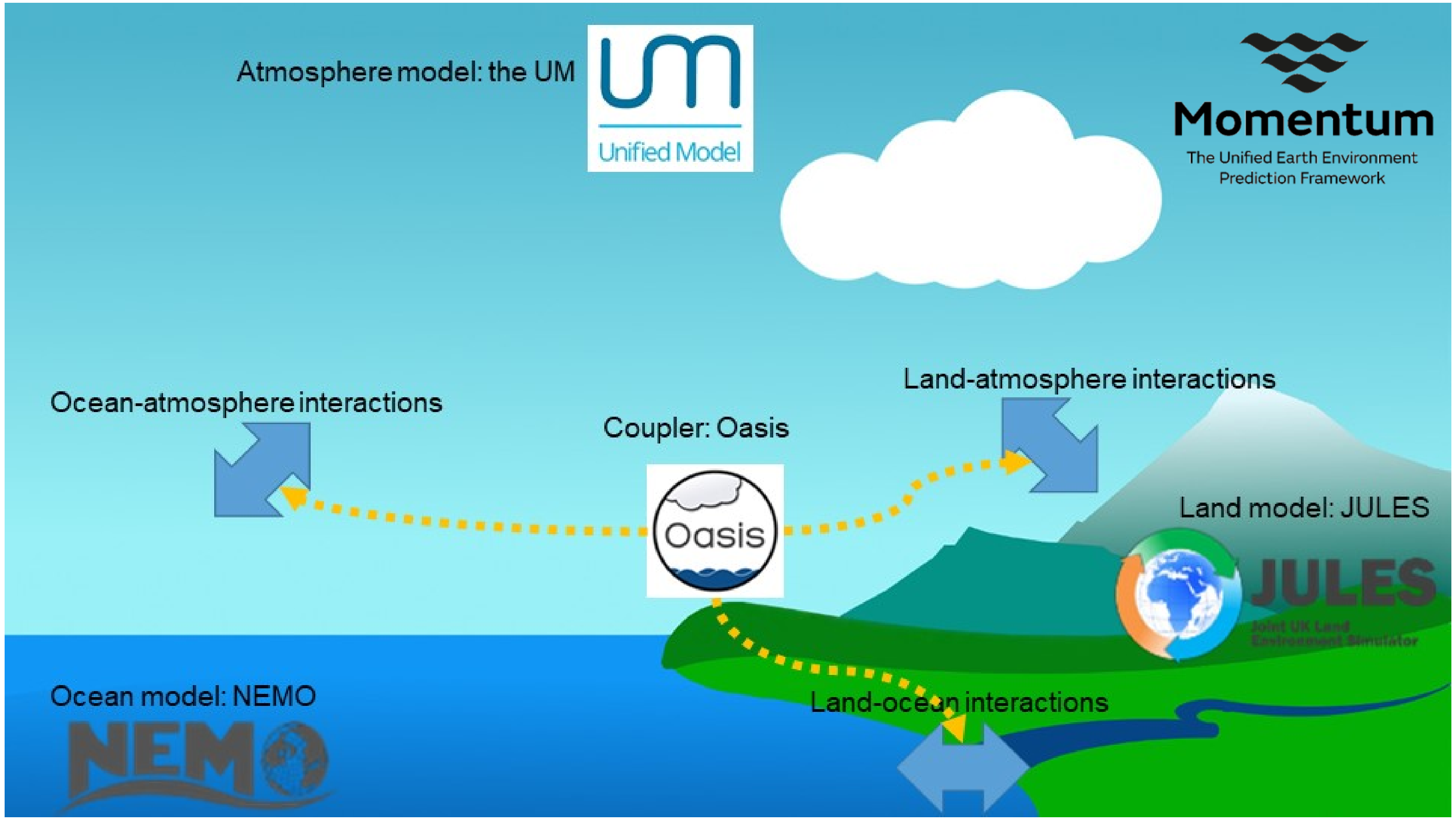


Coupled modelling

To make this work really well, we need a **coupled model**.

Three ***top-level divisions***: atmosphere, land and ocean.

At the UK Met Office, the coupling arrangements of the *Momentum* family of models reflect this: the family is composed of an atmosphere model (the UM), an ocean model (NEMO) and a land model (JULES), with exchange of information between these three main models synchronised by a coupler (OASIS).



(In the US, the Community Earth System Model (CESM) follows a similar approach, with different component models).

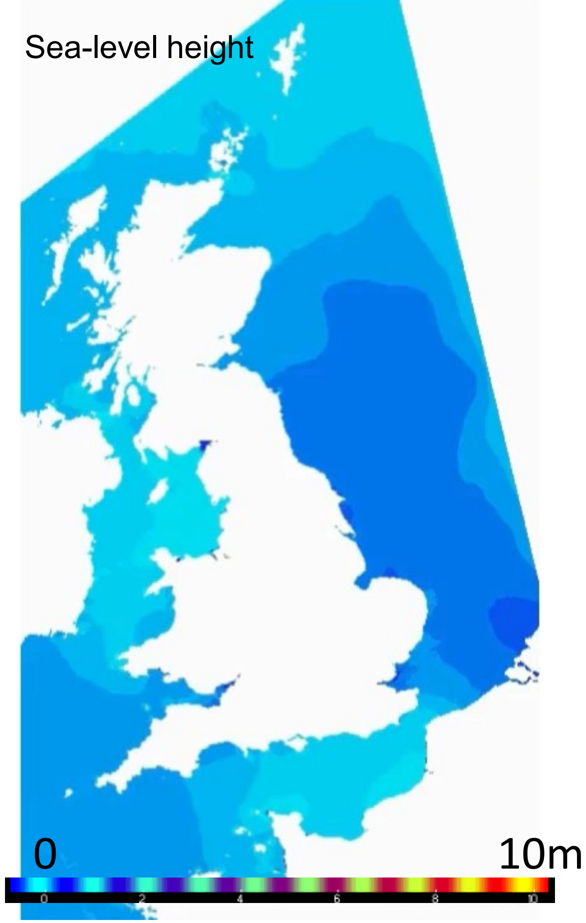
Marthews TR, Wiggins M & Garbutt A (2023). The land-ocean interface in land surface models. *UKCEH Report*.

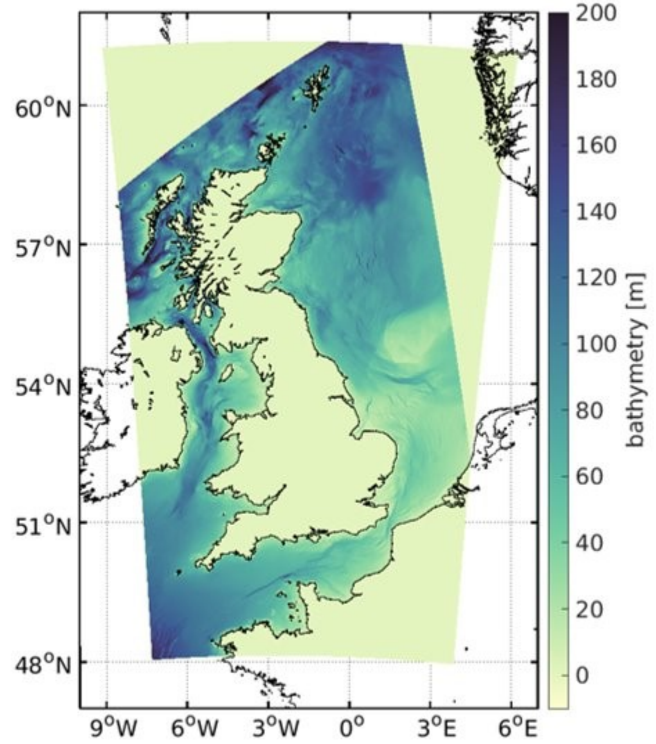
Coupled modelling

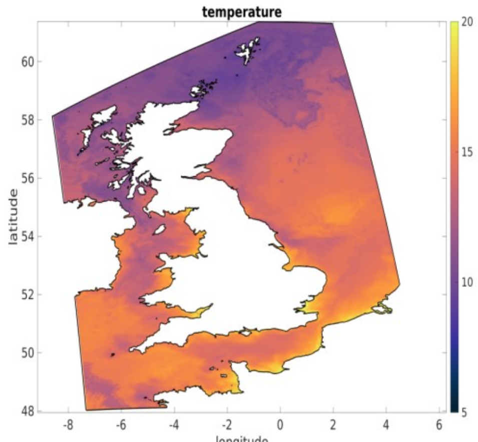
However, coupled models need lots of data!

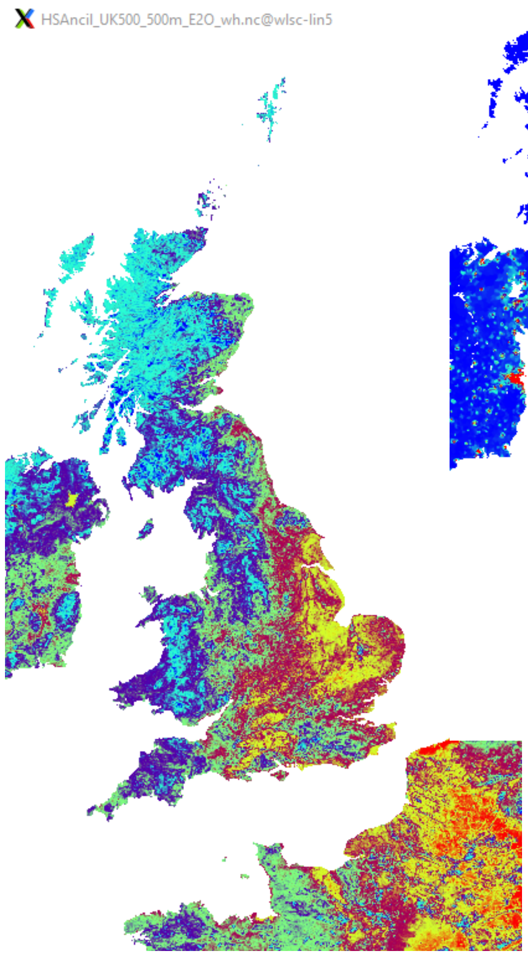
Data for the land model (right)

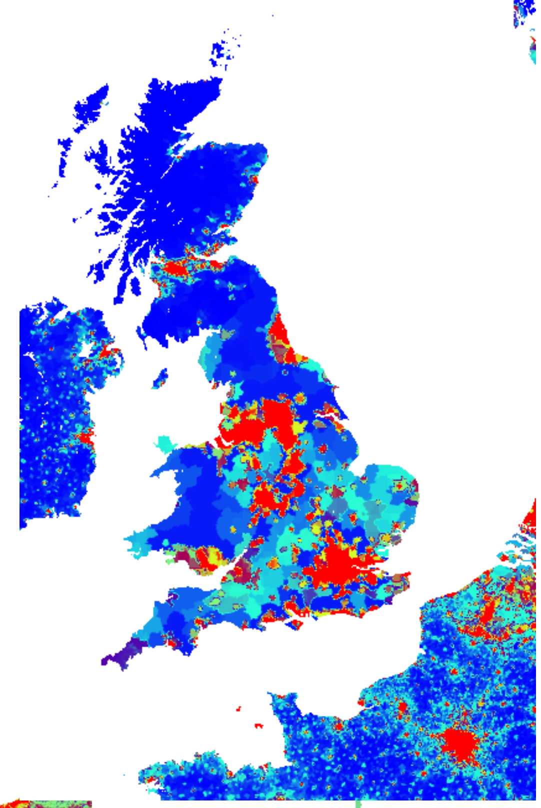
Data for the ocean (with thanks Julia Rulent, NOC)

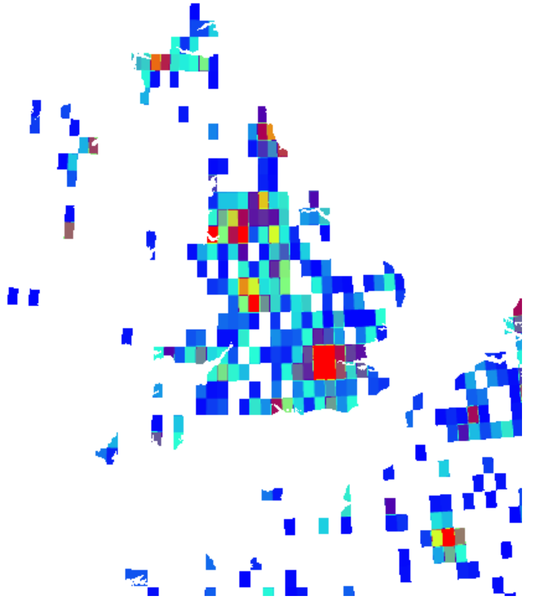












Quick recap

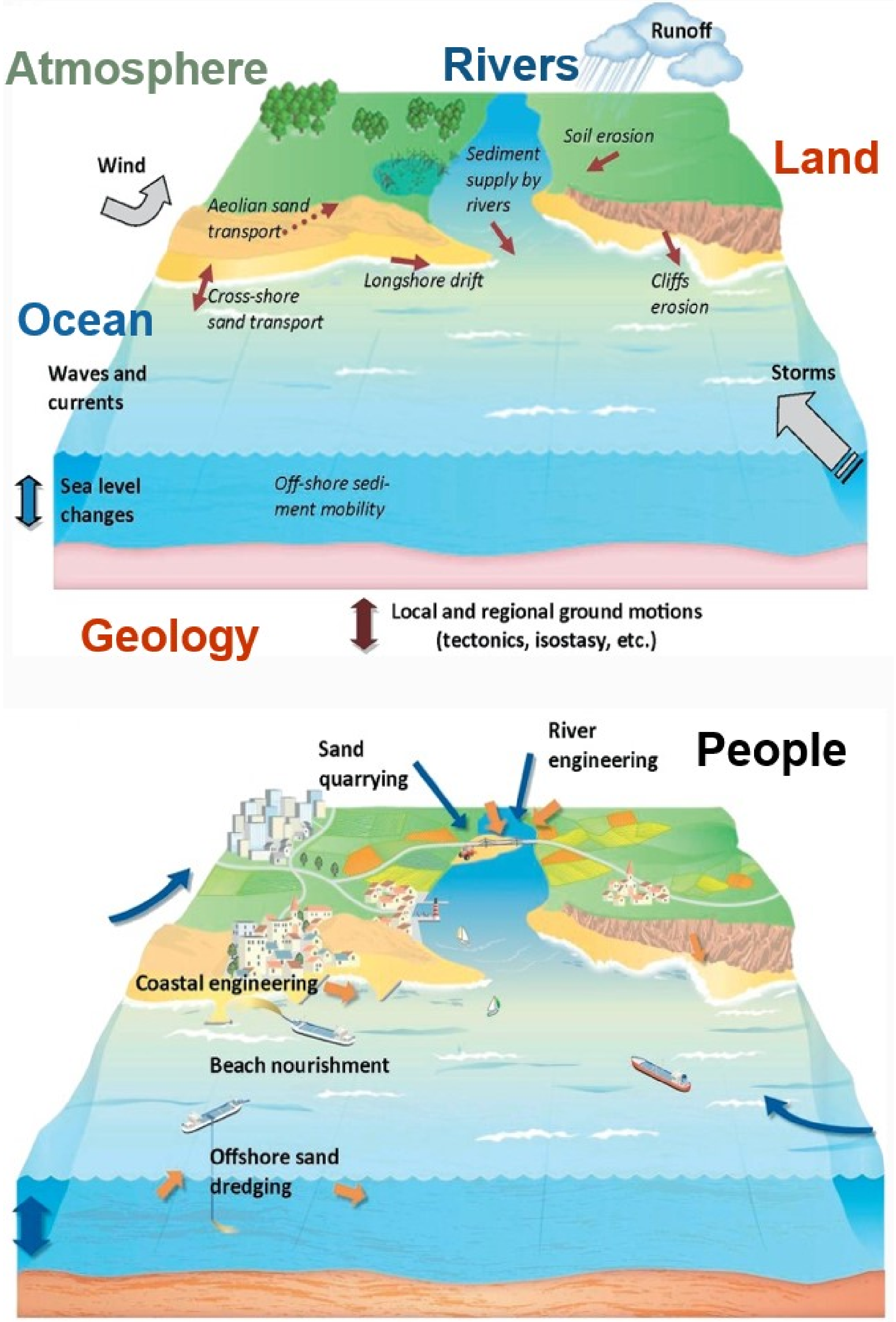
- Inundation is divided into several different types.

- To model all of this is ambitious: we need the river dynamics, all forms of inundation and, of course, the ocean dynamics and coastal exchange too if we want coastal inundation as well. CaMa-Flood is (I believe) the best for the river dynamics, but the other elements are needed too. There are many processes to be considered (see right, from Cazenave & le Cozannet 2014, *Earth's Future*).

- A coupled model framework would probably be the best solution, but it's expensive in terms of both data requirements and runtime.

- A good aspect of this research area is that there is (in 2025) good funding available for projects that can produce impact in this space.

- *CHAMFER* is our (current) attempt in the UK to produce a useful, predictive tool for coastal impacts.



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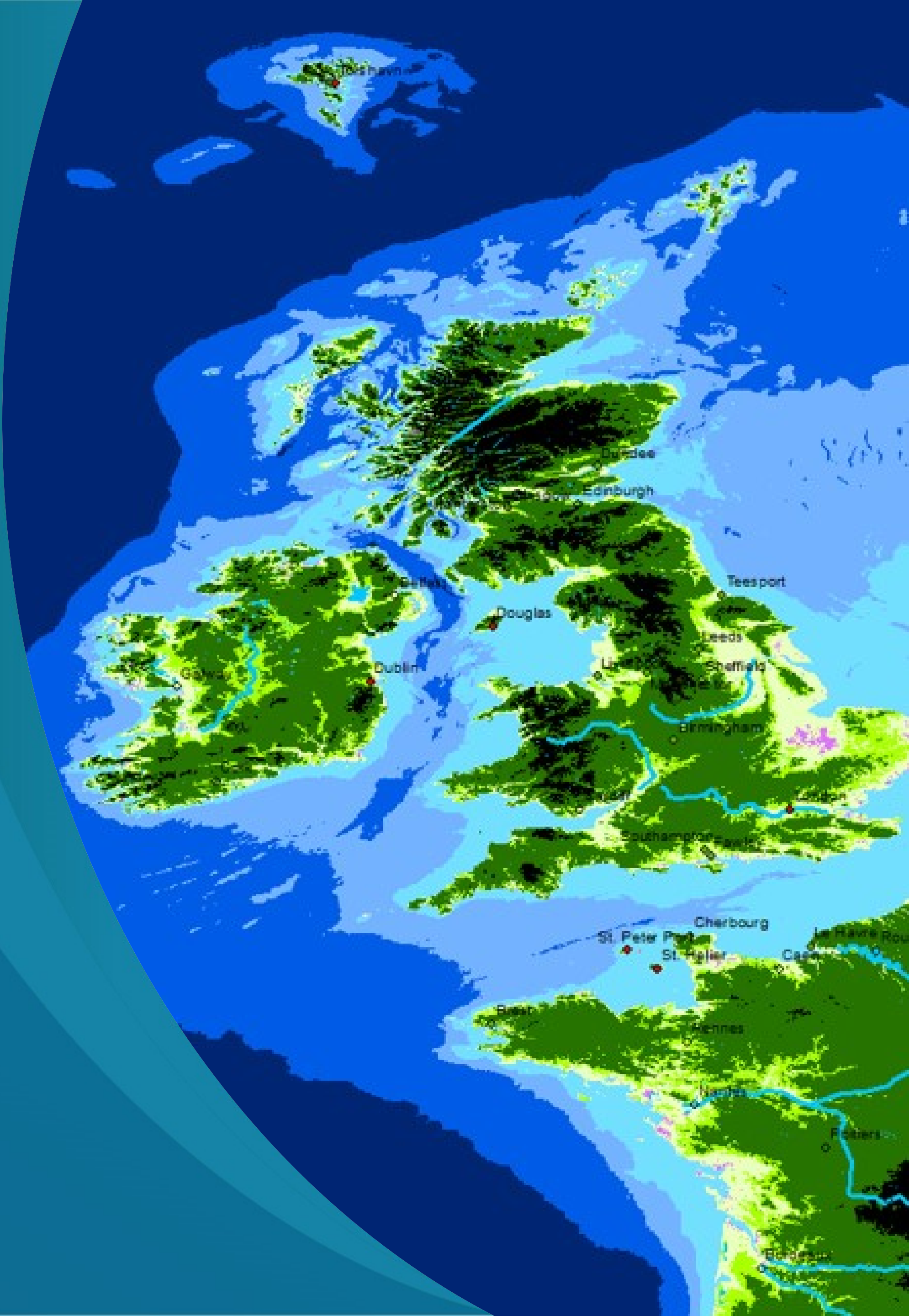

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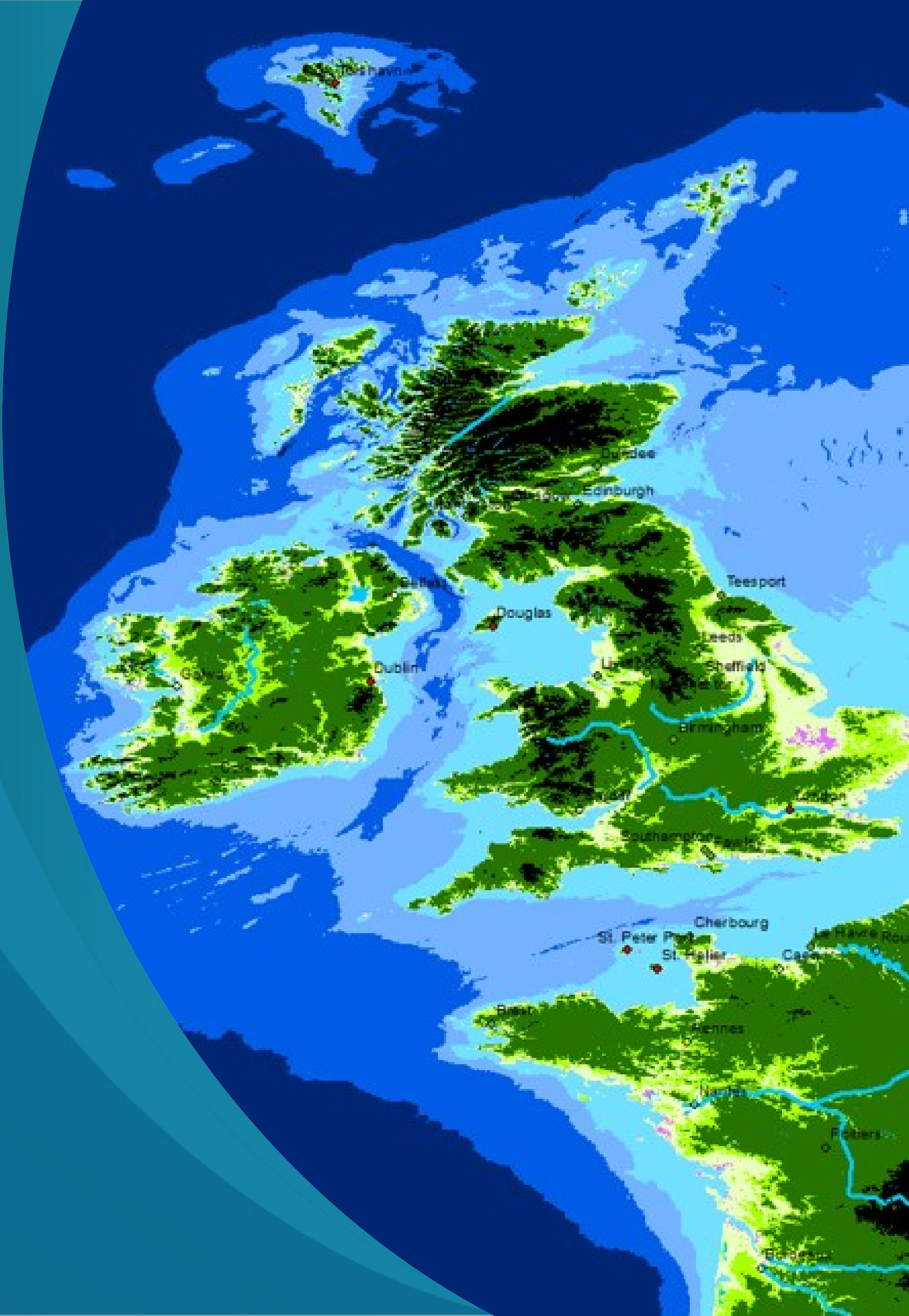

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UKCEH Modelling approaches

At UKCEH we have a (small) CaMa-Flood modelling group working on three different modelling approaches:

1. JULES -> CaMa-Flood (in sequence) with no coastal coupling
2. JULES-Camaflood (combined) with coastal 'by hand' coupling
3. JULES-Camaflood (combined) in a fully land-ocean coupled model framework (Momentum)

1

JULES Joint UK Land Environment Simulator

Run **JULES** for time period with no river flow. Output runoffs.

CaMa-Flood

Run **CaMa-Flood** using runoff outputs.

Already working (Marthews *et al.* 2022) (now being extended by Sonja Folwell).

2

JULES Joint UK Land Environment Simulator

CaMa-Flood

Run Combined **JULES-Camaflood** for time period with river flow.

NEMO

Exchange river outflow (from JULES-CMF) and sea surface heights (from NEMO) at coasts.

3

Momentum

The Unified Earth Environment Prediction Framework

The Momentum framework includes JULES and NEMO, with some development required to include also Camaflood

JULES Joint UK Land Environment Simulator

NEMO

CaMa-Flood

Momentum has good atmosphere-ocean and atmosphere-land coupling, but land-ocean not yet completed (in progress, REP).

Dependent on UK Met Office development

(see e.g. https://www.metoffice.gov.uk/research/approach/collaboration/gc-seamless-model-workshop)

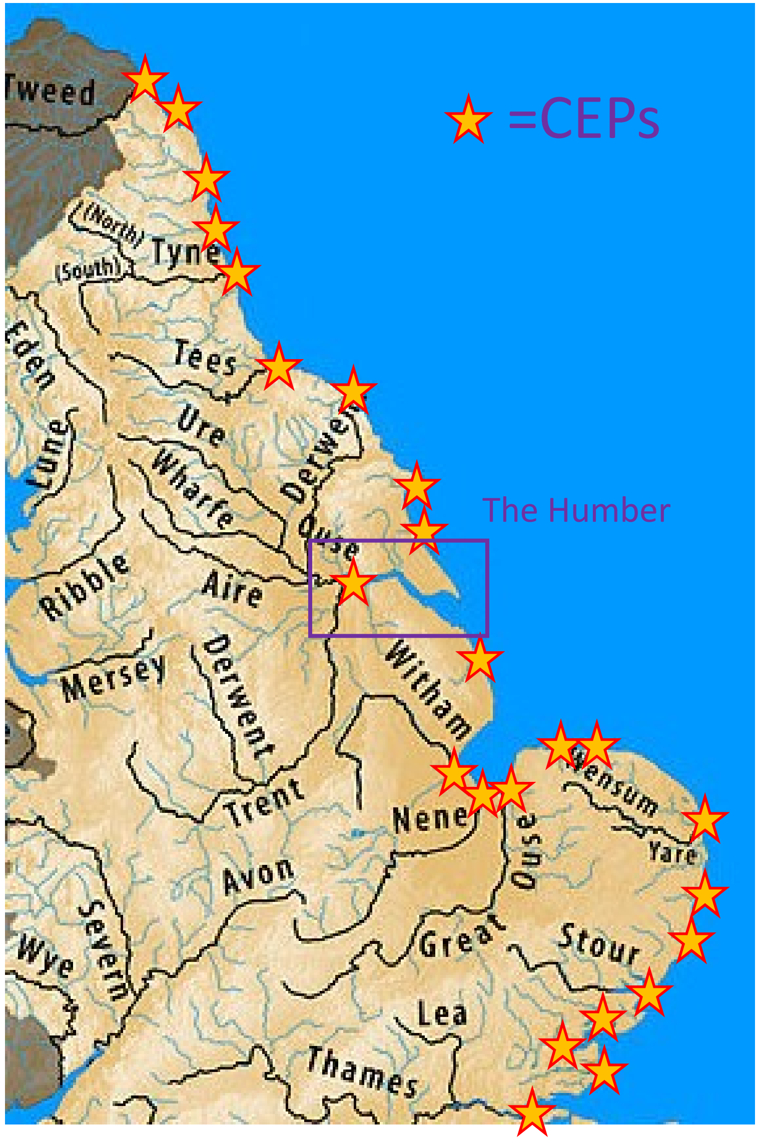
Coastal Exchange Points

I need to talk quickly about coastal exchange points.

I have added a routine to the CaMa-Flood code (meaning, the JULES-Camaflood code) that parses the input river directions ancillary and identifies the river estuary points (see output below).

Over the globe I get 18,481 estuary points with the CaMa-Flood ancillary file for 0.25deg resolution (though that number changes if I use different source files).

[INFO] init_rivers_props: RIVMAP_INIT: calculate river sequence
[INFO] init_rivers_props: Longest river on grid is 259 gridcells long (source to mouth).
[INFO] init_rivers_props: Over the river domain: 4646 inland_drainage points found
[INFO] init_rivers_props: Over the river domain: no. labelled river_mouth points is 18481
[INFO] init_rivers_props: Over valid river domain: no. river routing points = 252383
Over valid river domain: 73564 gridcells are either inland_drainage points or river source points (headwaters)
[INFO] init_rivers_props: Over the river domain, we have 247737 points that are real flowpath points headwater to mouth (exc. inland_drainage and river_mouth points)



Coastal exchange points

The Humber Estuary (right) is very dynamic with a tidal range of up to six metres near the mouth at Spurn Head. Severe storms can raise water levels by up to 1.5 metres above normal and result in waves up to four metres high near the mouth (Boukalova et al. 2011).

Modelling this with a CEP approach, we only allow exchange of water between the land and ocean at the CEP:

- Inundation upstream from the CEP is handled by JULES (overbank inundation code)
- Inundation adjacent to the rest of the Humber is not modelled.
- Inundation will have contributions from (i) groundwater, (ii) upstream flow causing overbank inundation and (ii) sea/tidal surge. The current code can handle (i) and (ii) left of the line, but we need the sea wall height numbers from NEMO in order to add the effects of (iii).

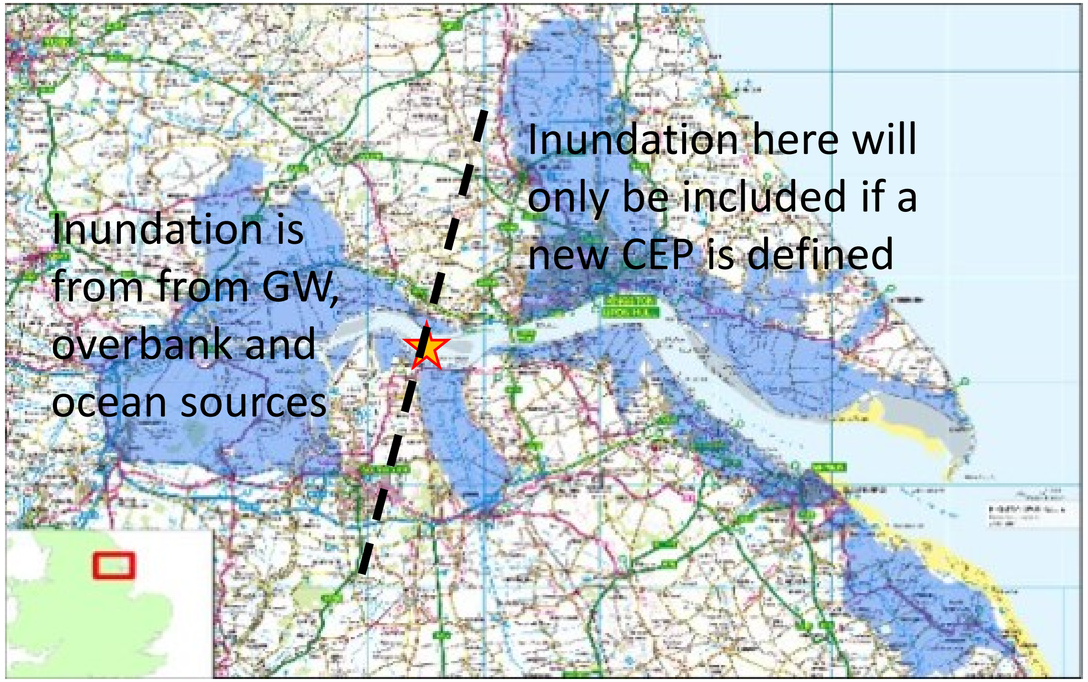
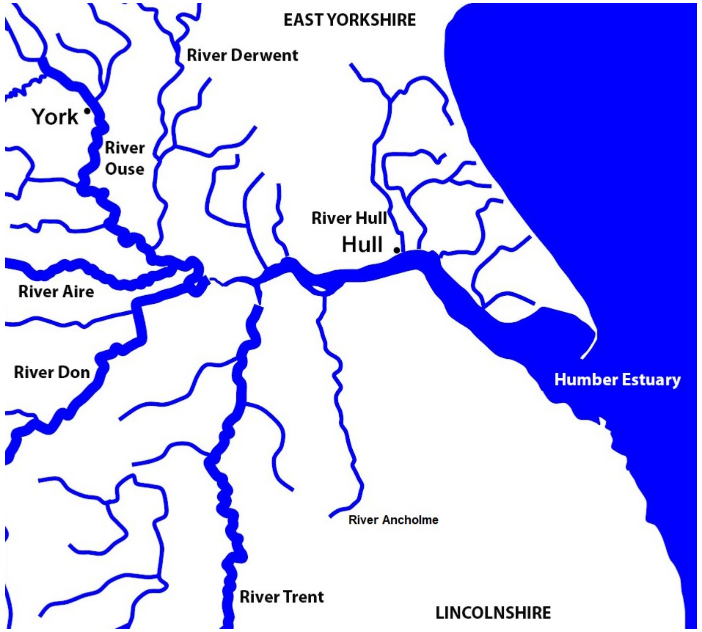


Fig. from Boukalova et al. (2011). Blue = saline sediments, indicating flood-risk areas.



Coastal exchange points

Across the UK500 domain, we have 8651 coastal exchange points (Fig. 1). I have written a script that can extract these river outflows and produce a 1D output file containing these data (with a 'land axis' running 1:8651 points).

This NetCDF file will then be passed to the NEMO ocean model, which calculates sea surface height and passes that back to me.

I will then run a new version of JULES integrated with CaMa-Flood, imposing the sea surface heights as a boundary condition at all CEPs. CaMa-Flood can then simulate coastal inundation (along with its simulation of non-coastal inundation).

Parts of this have been achieved with example data.

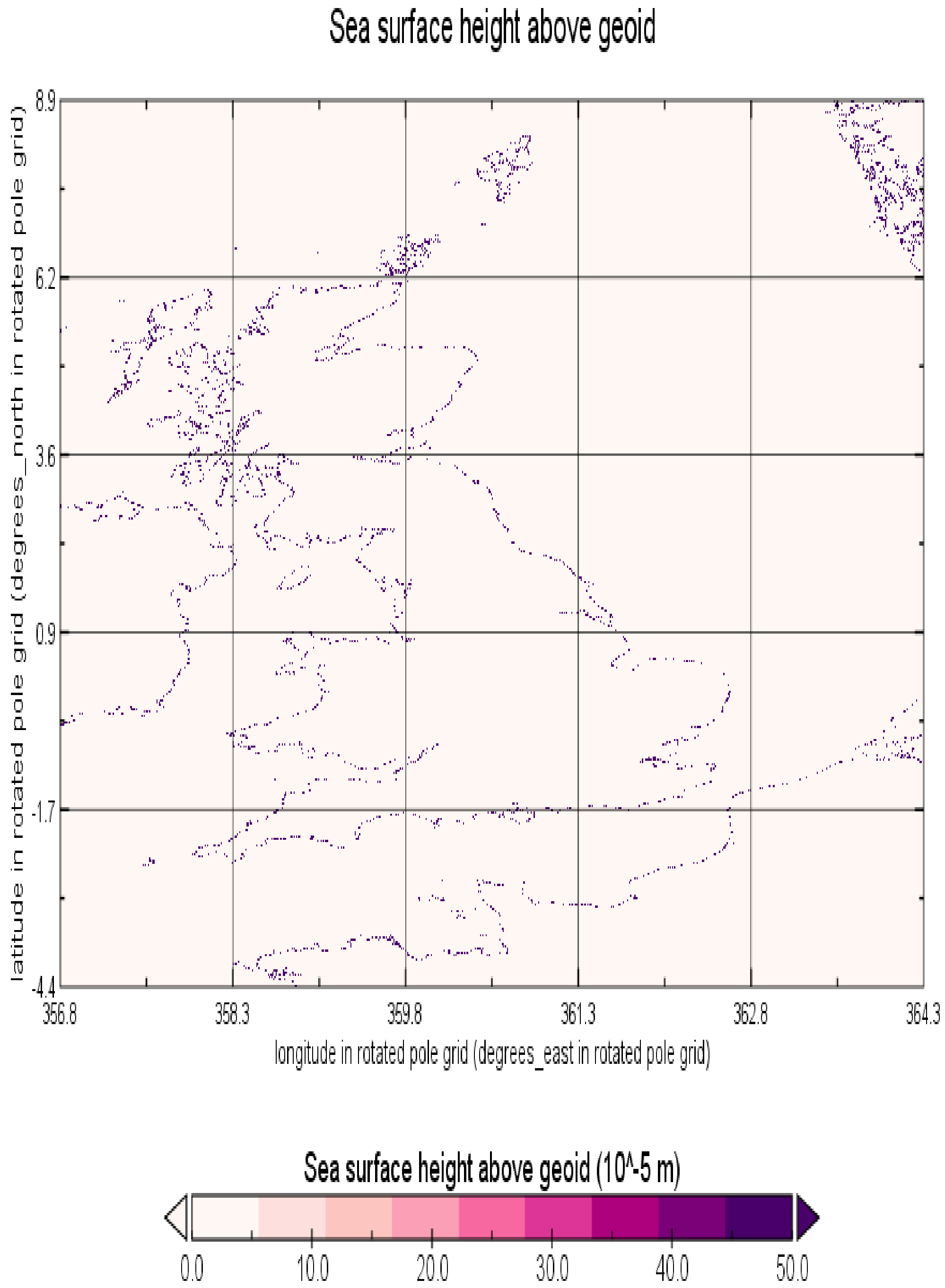


Fig. 1: 8651 Coastal Exchange Points (CEPs) for the UK and surrounding territories on the UK500 grid.

Coastal exchange points

The global importance of this river-ocean exchange should not be underestimated, but it varies greatly by global region.

River plume at the mouth of the Congo from [EOS](EOS).

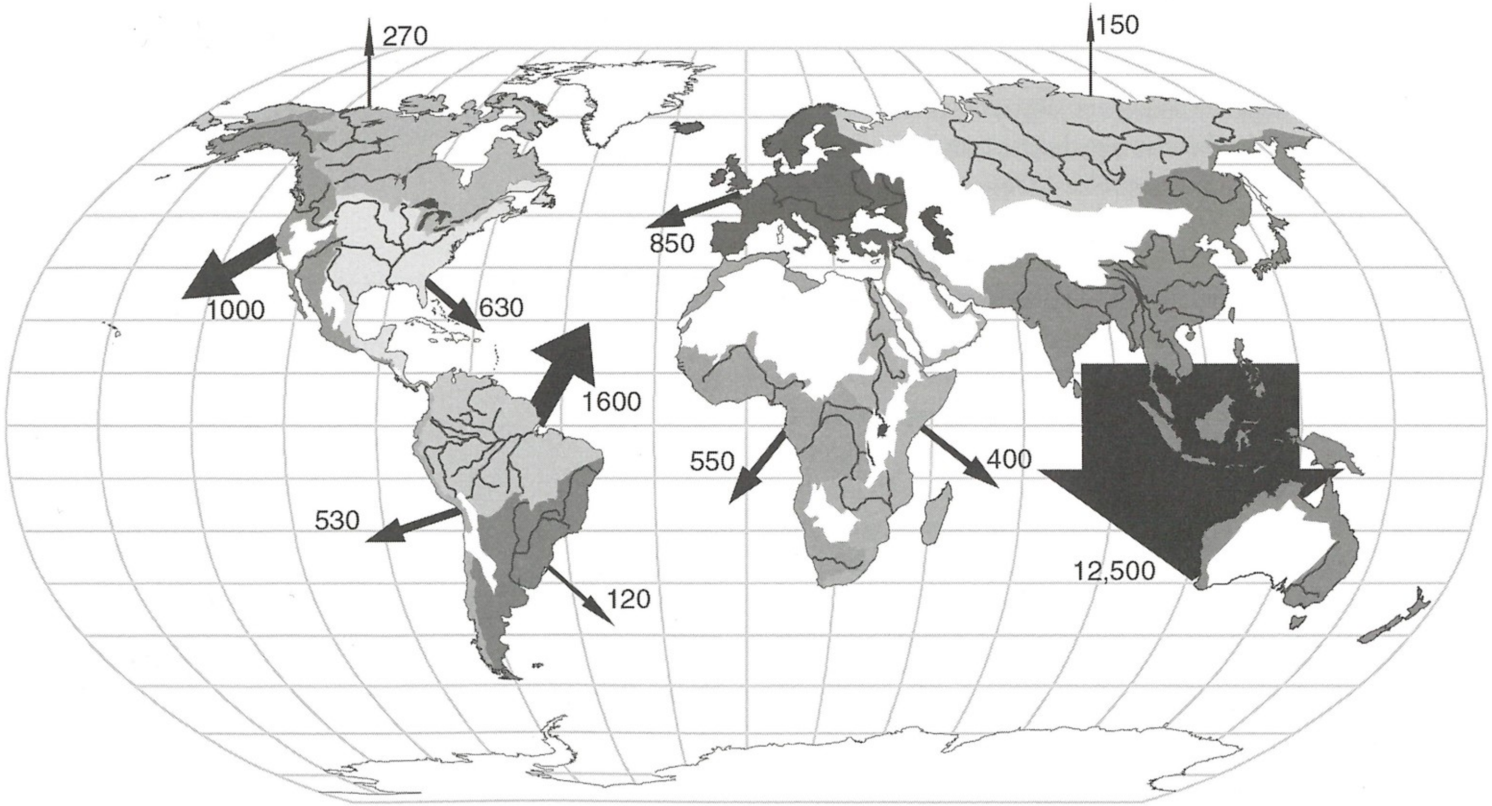


Figure 3.2. River fluxes of suspended sediment to the oceans from different geographic regions. Values are in Mt yr^{-1} (from Milliman and Farnsworth, 2011).

UKCEH Modelling approaches

At UKCEH we have a (small) CaMa-Flood modelling group working on three different modelling approaches:

1. JULES -> CaMa-Flood (in sequence) with no coastal coupling
2. JULES-Camaflood (combined) with coastal 'by hand' coupling
3. JULES-Camaflood (combined) in a fully land-ocean coupled model framework (Momentum)

1

JULES
Joint UK Land Environment Simulator

Run **JULES** for time period with no river flow. Output runoffs.

CaMa-Flood

Run **CaMa-Flood** using runoff outputs.

Already working (Marthews *et al.* 2022) (now being extended by Sonja Folwell).

2

JULES
Joint UK Land Environment Simulator

CaMa-Flood

Run Combined **JULES-Camaflood** for time period with river flow.

NEMO

Exchange river outflow (from JULES-CMF) and sea surface heights (from NEMO) at coasts.

3

Momentum
The Unified Earth Environment Prediction Framework

The Momentum framework includes JULES and NEMO, with some development required to include also Camaflood

JULES
Joint UK Land Environment Simulator

NEMO

CaMa-Flood

Momentum has good atmosphere-ocean and atmosphere-land coupling, but land-ocean not yet fully developed.

Dependent on UK Met Office development

(see e.g. https://www.metoffice.gov.uk/research/approach/collaboration/gc-seamless-model-workshop)

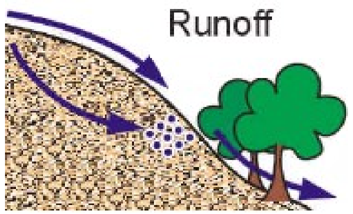
UKCEH Modelling approaches

I am developing option #2 in the CHAMFER project, which involves the three models JULES, CaMa-Flood and NEMO.

2

JULES
Joint UK Land Environment Simulator

Precipitation (regridded from ISIMIP meteorology)



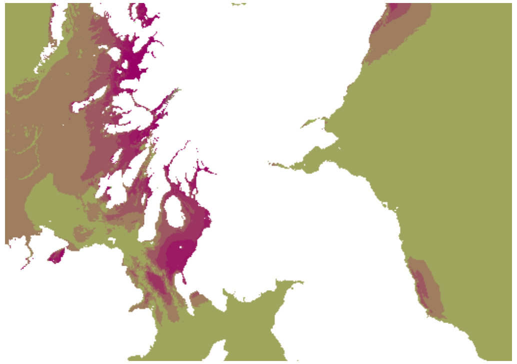
Run **JULES** for time period with standard (not CMF) river flow (no coastal exchange). Produces file of river outflows at all CEPs (runoff calculated by JULES internally)

Runs carried out by UKCEH

Use river outflows to run ocean model **NEMO**

NEMO

NEMO produces sea wall heights at all CEPs as output.



Runs carried out by NOC

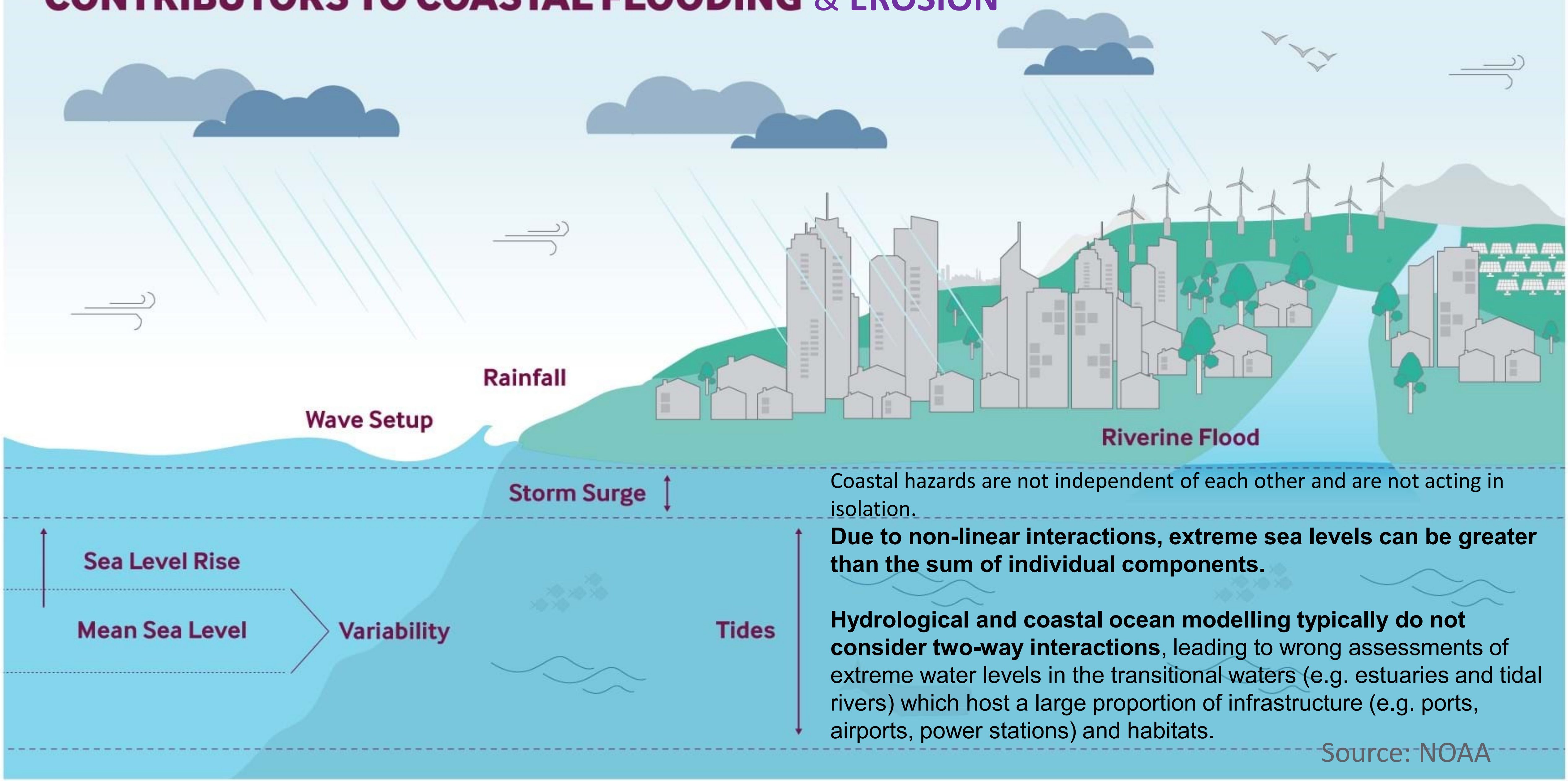
Rerun **JULES** with JULES-Camaflood* routing, with sea wall heights as boundary condition at all estuaries.

CaMa-Flood

Output of inundation predictions and other impact variables

* A recoded Fortran module based on v3.95a CaMa-Flood with no flow bifurcations

CONTRIBUTORS TO COASTAL FLOODING & EROSION

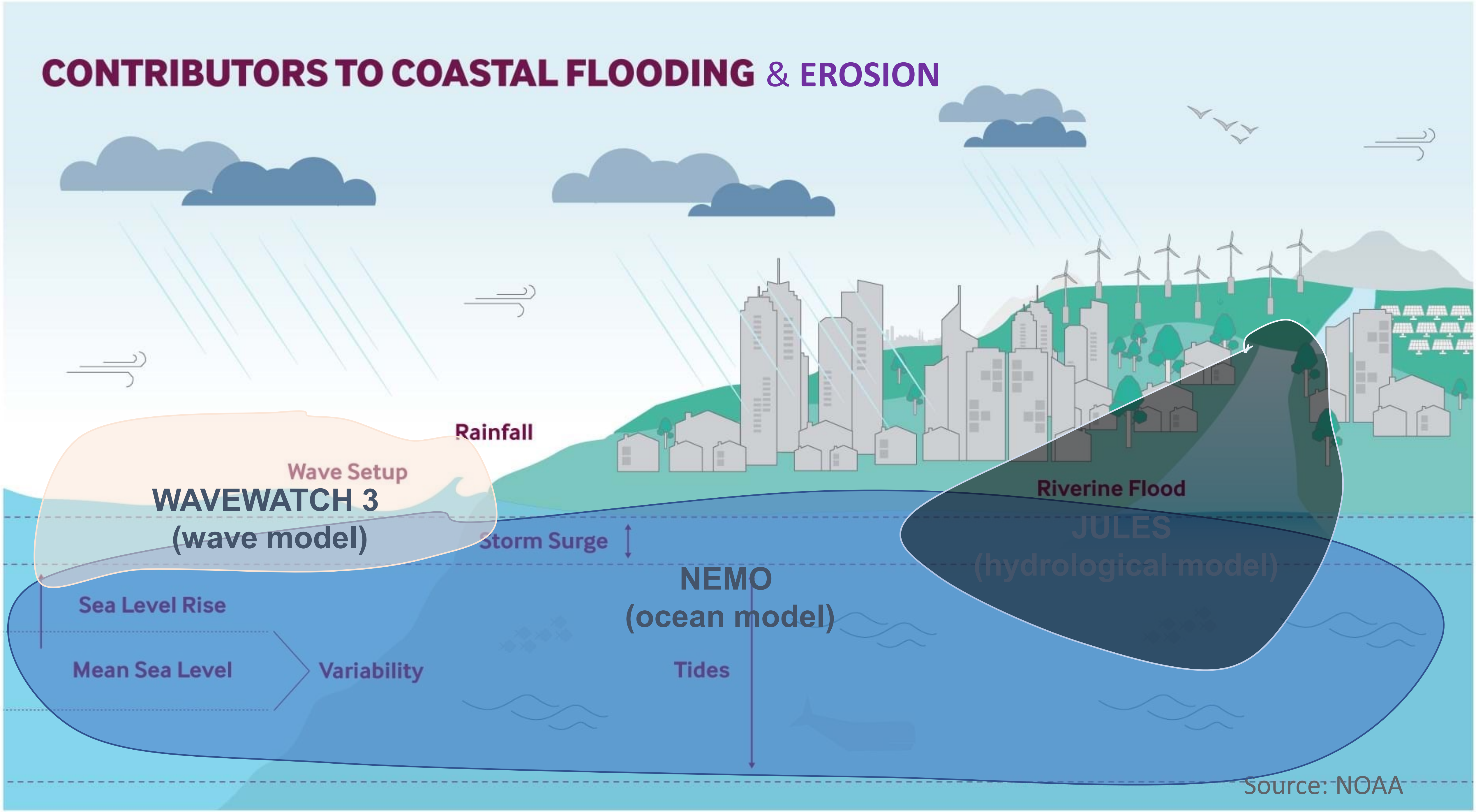


Coastal hazards are not independent of each other and are not acting in isolation.

Due to non-linear interactions, extreme sea levels can be greater than the sum of individual components.

Hydrological and coastal ocean modelling typically do not consider two-way interactions, leading to wrong assessments of extreme water levels in the transitional waters (e.g. estuaries and tidal rivers) which host a large proportion of infrastructure (e.g. ports, airports, power stations) and habitats.

Source: NOAA


CONTRIBUTORS TO COASTAL FLOODING & EROSION
Rainfall
Wave Setup
WAVEWATCH 3
(wave model)
Storm Surge
Riverine Flood
JULES
(hydrological model)
NEMO
(ocean model)
Sea Level Rise
Mean Sea Level
Variability
Tides
Source: NOAA

A new UK scale ocean-wave-river modelling system for predicting extreme sea levels at the coast

Michela De Dominicis[1] , Lucy Bricheno[1] , Ryan Patmore[1] , Toby Marthews[2] , Segolene Berthou[3] , and Laurent Amoudry[1]

[1]National Oceanography Centre, Liverpool, United Kingdom (micdom@noc.ac.uk)
[2]Centre for Ecology and Hydrology, Wallingford, United Kingdom
[3]Met Office, Exeter, United Kingdom

Quick recap #2

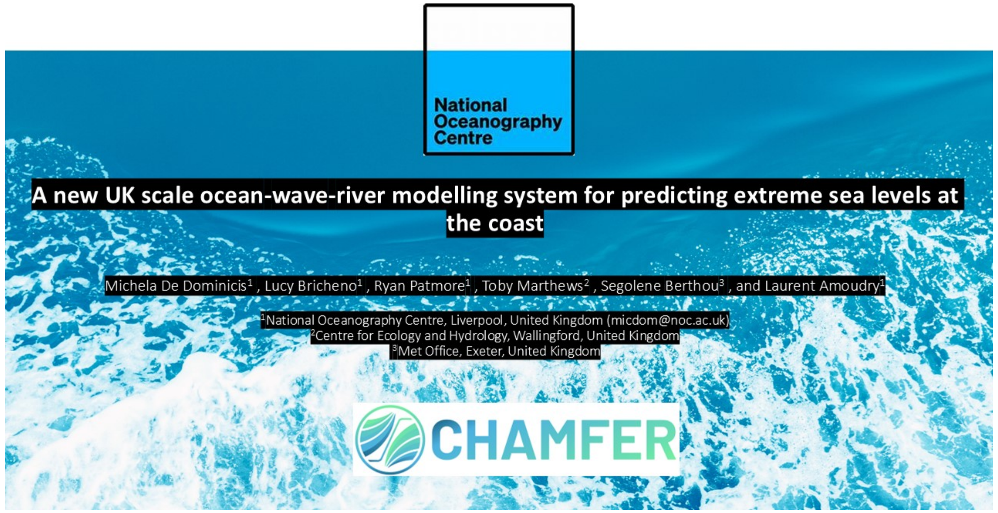
- At UKCEH, we are pursuing more than one direction at once:
  - We are still developing running JULES and CaMa-Flood in sequence
  - We are keeping up to date with fully coupled modelling options within the Momentum framework (under development at the UK MetO)
  - I am taking the middle path: working on integrating CaMa-Flood into JULES and also developing an approximate way to handle coastal inundation in collaboration with NOC.

- Coastal Exchange Points are crucial.

- This modelling system will be a major product of the CHAMFER project.

- Although CHAMFER is UK-focused, the tools we are developing are general and we hope will have new applications world-wide.

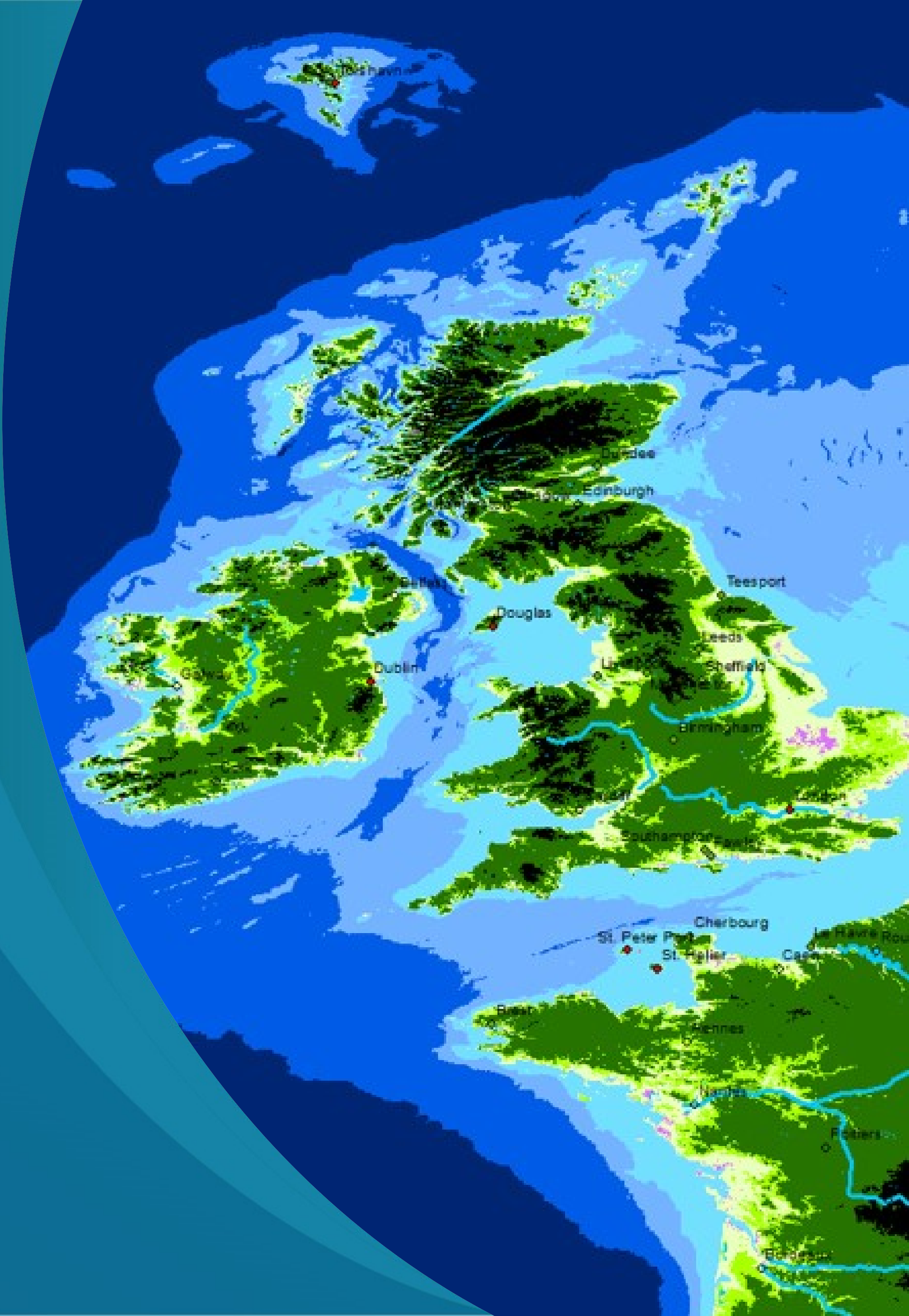
River plume at the mouth of the Congo from EOS.



1. River, inundation, coastal and ocean modelling: Hydro-JULES and CHAMFER

2. UKCEH Modelling approaches

3. Sea surges require more thought



UK Centre for
Ecology & Hydrology

1. River, inundation, coastal and ocean modelling: Hydro-JULES and CHAMFER

2. UKCEH Modelling approaches

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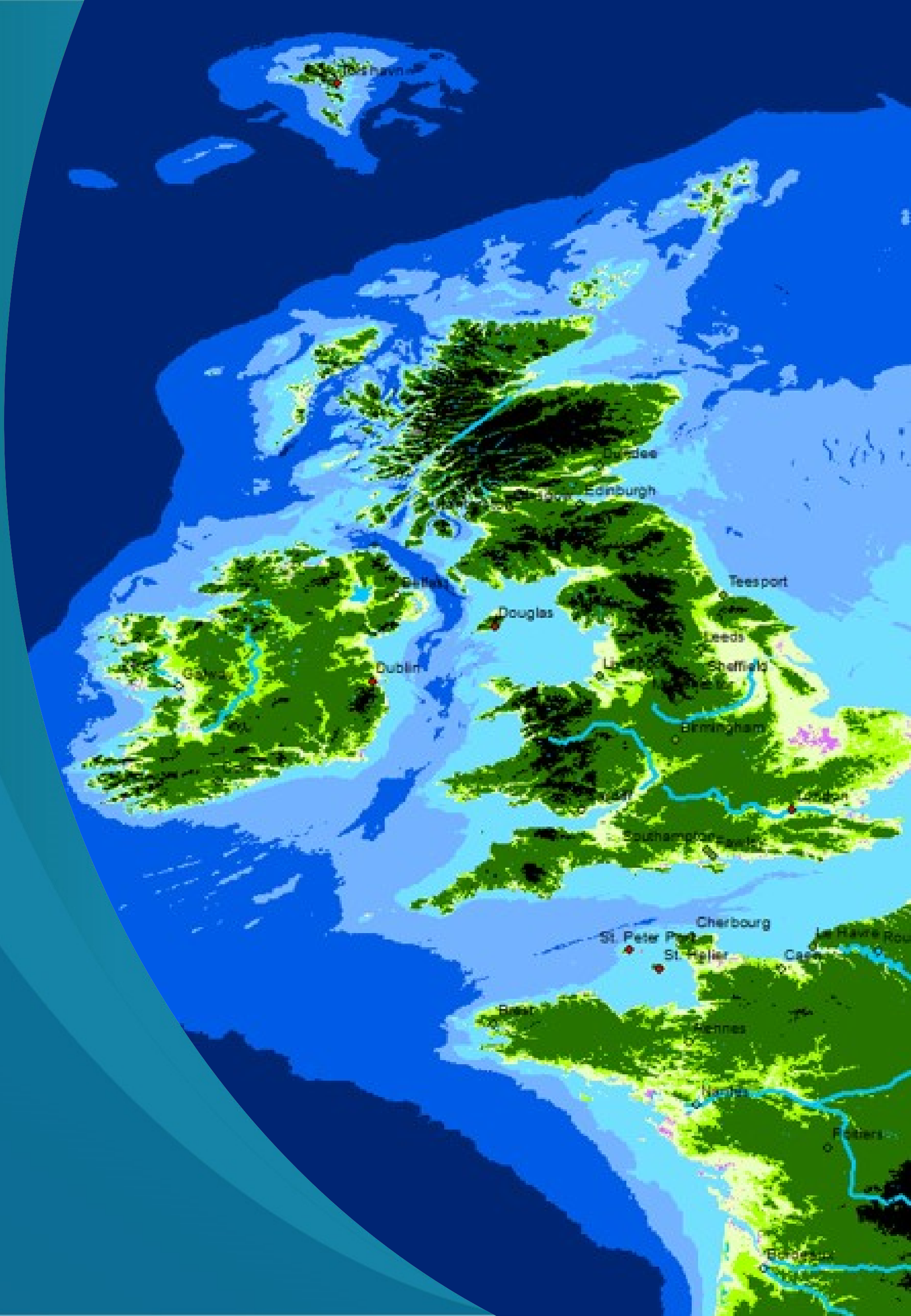
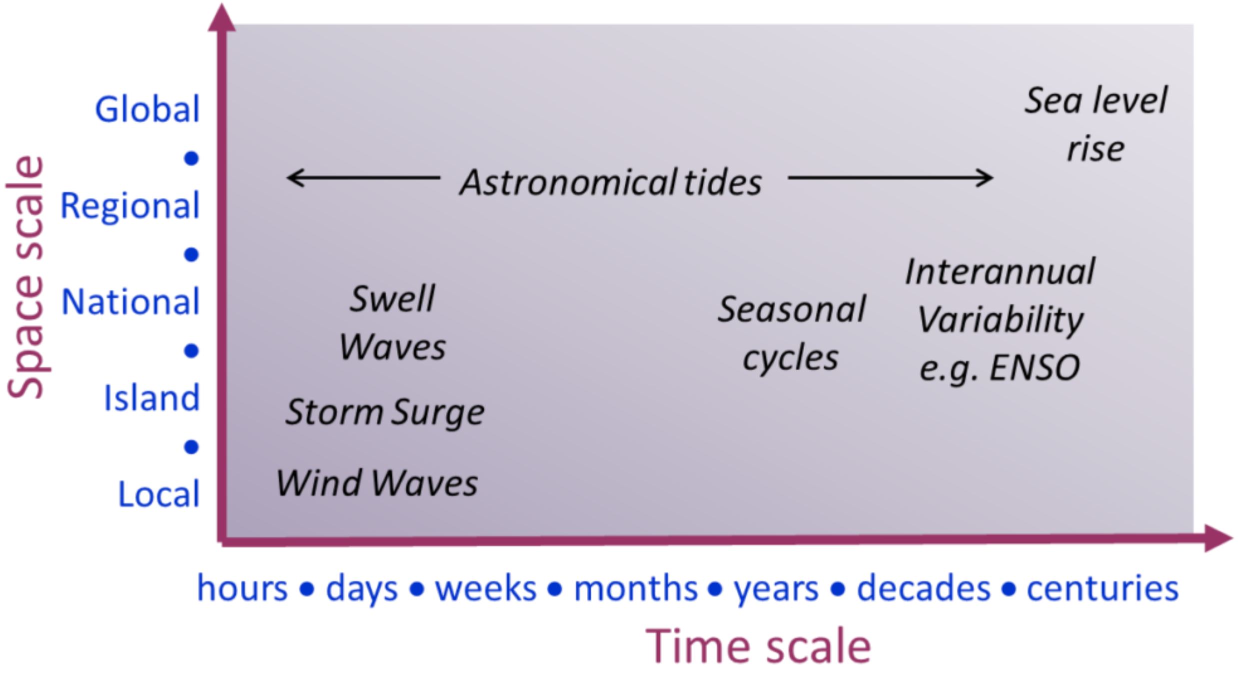
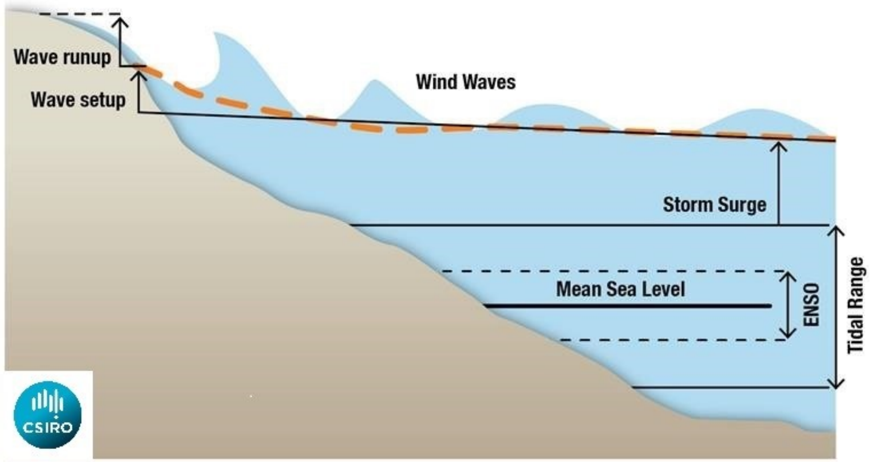


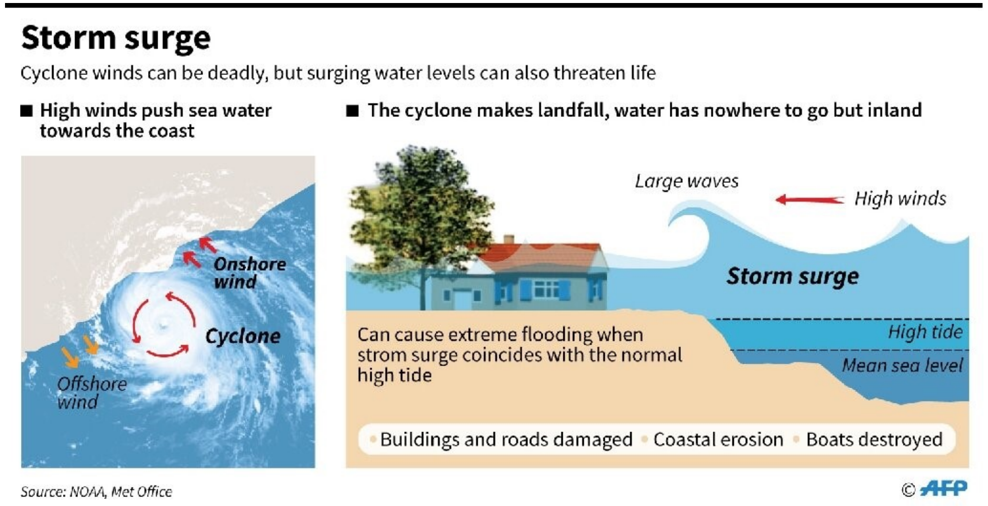
UK Centre for Ecology & Hydrology

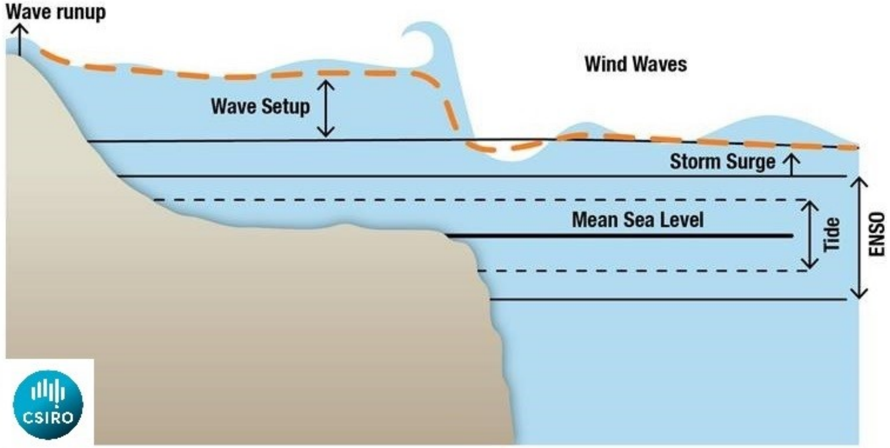
Sea surges

Sea surges are caused by various factors (including storms). The inundation and damage they cause depends on many factors, including timing (e.g., whether they occur at high tide and are reinforced by the tides) and coastal geometry (e.g., see below).









Graphics with thanks to https://research.csiro.au/slrwavescoast/extremes/causes-extreme-sea-levels/ and https://phys.org/news/2019-05-storm-surge-dangerous.html

Sea surges

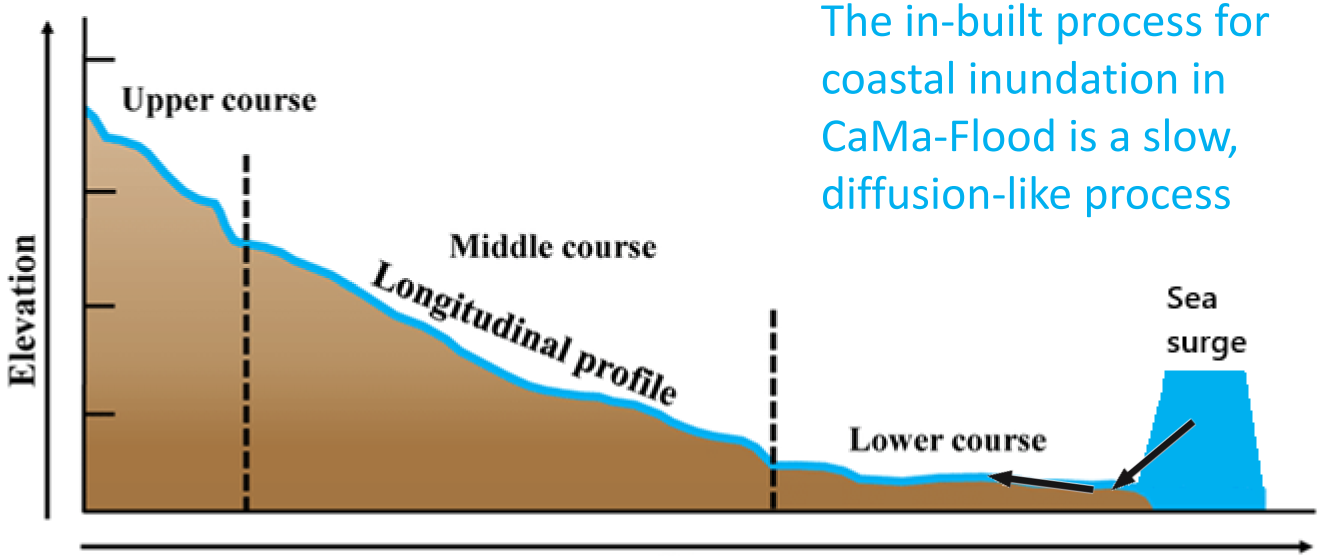
CaMa-Flood has a facility to allow sea surge inundation onto the land surface already (at v3.9.5) (here called **Slow coastal inundation**). This was investigated in the CASPER project a few years ago at UKCEH (Clark *et al.* 2021).

However, I found this to be a very slow process and did not capture the faster dynamics of a storm-induced sea surge. Therefore, I have modified CaMa-Flood to implement a faster process of coastal flooding (here called **Fast coastal inundation**).

In terms of ODEs, one can think of the slow inundation as an equilibrium solution and the fast inundation as a transient solution. CaMa-Flood appears to have been coded for equilibrium solutions only (conserving differentiability of the water surface along all flowpaths and limiting water slopes to 0.005 m/m). This is appropriate for long-term sea level rise, but not for storm surges which are, of course, a transient phenomenon.

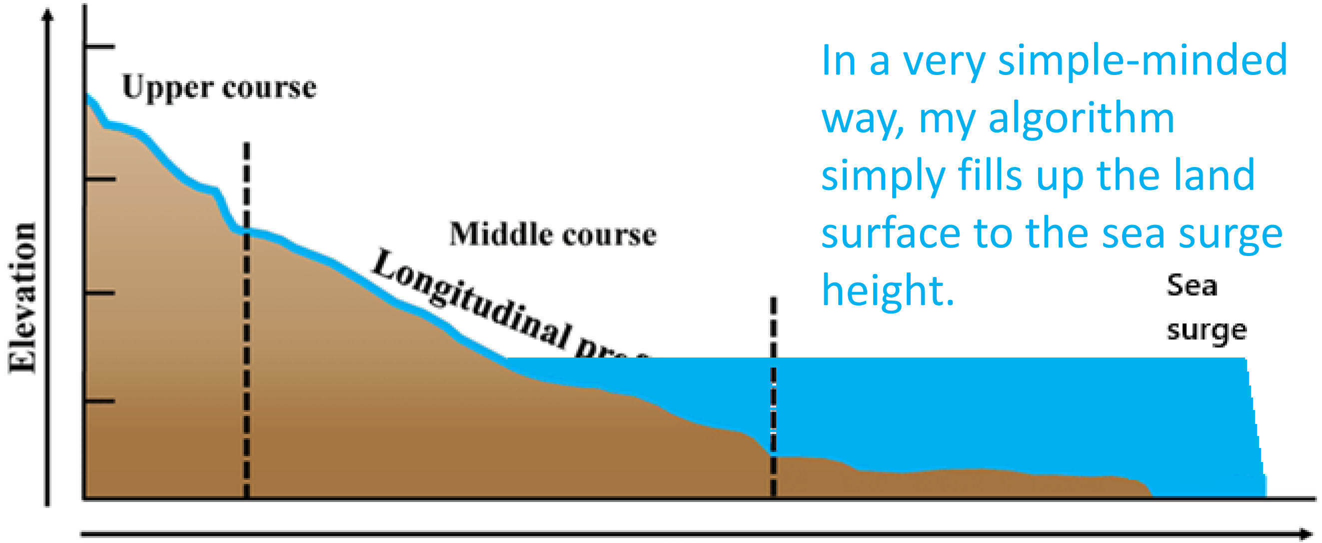
Clark D, Wiggins W & Feng X (2021). Land-ocean coupling. *Report for WCSSP India Project CASPER*.

Slow coastal inundation



The in-built process for coastal inundation in CaMa-Flood is a slow, diffusion-like process

Fast coastal inundation

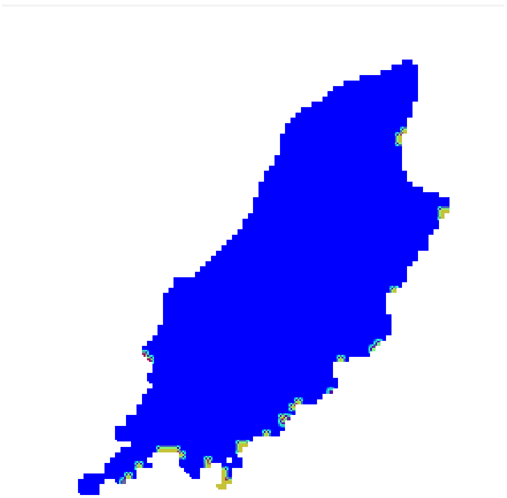
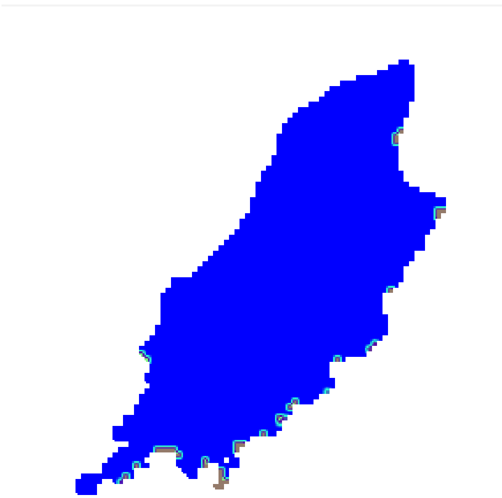
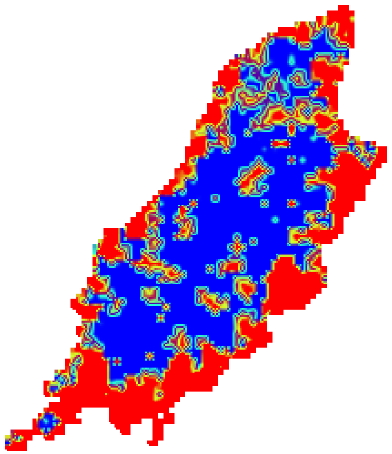
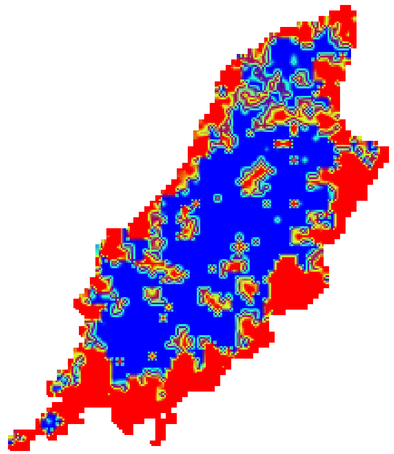


In a very simple-minded way, my algorithm simply fills up the land surface to the sea surge height.

Sea surges

Plots right use hypsometric overbank inundation.

I simulated a 50 m high sea surge around the Isle of Man (i.e. a tsunami) and allowed this **sea surge** to inundate the land surface either using CMF's in-house coastal inundation scheme (slow) and a new code addition by me to simulate storm surge inundation (fast). Plot is a screenshot after 10 days of tsunami.

JULES-CaMa-Flood river routing	Without slow coastal inundation	With 'slow' coastal inundation (CMF's method for coastal inundation)
Without fast coastal inundation		
With fast coastal inundation (i.e., Toby's addition to the CMF code)		

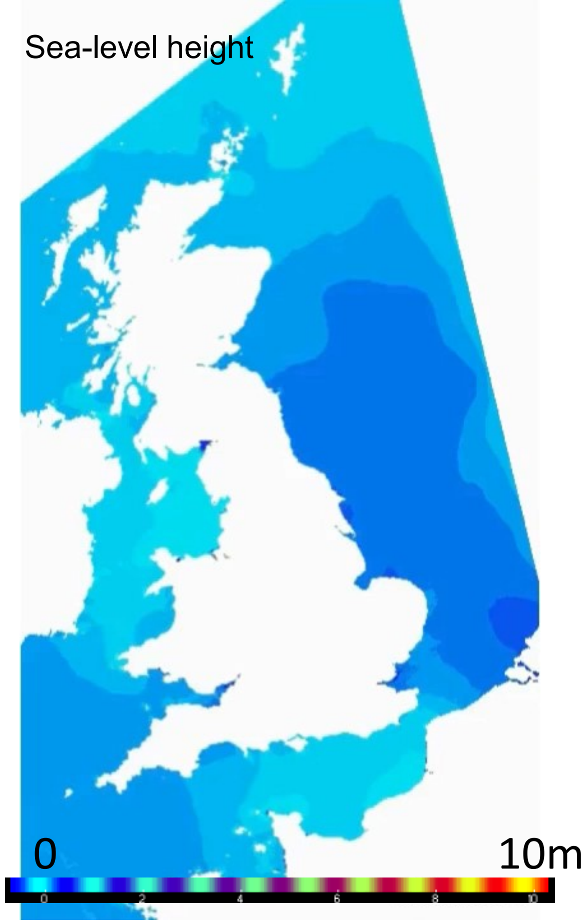
Fraction of gridcell

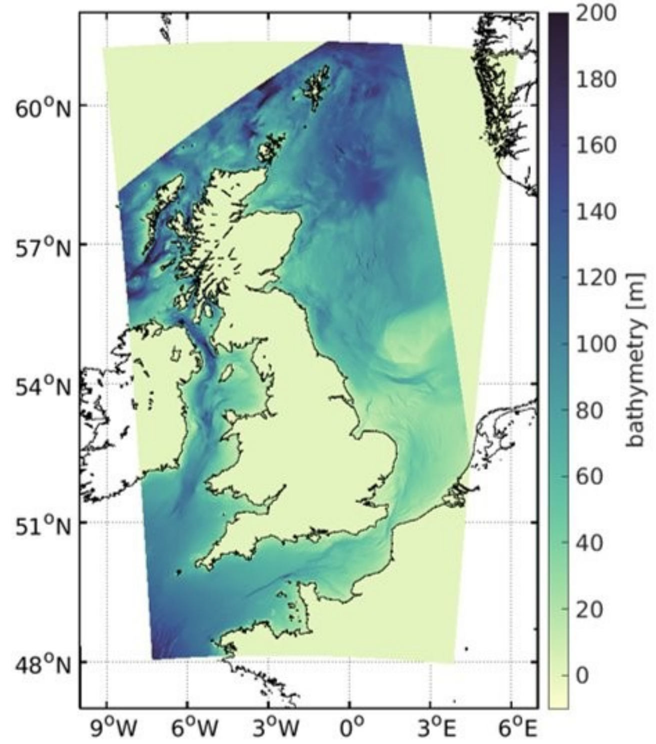
Coupled modelling

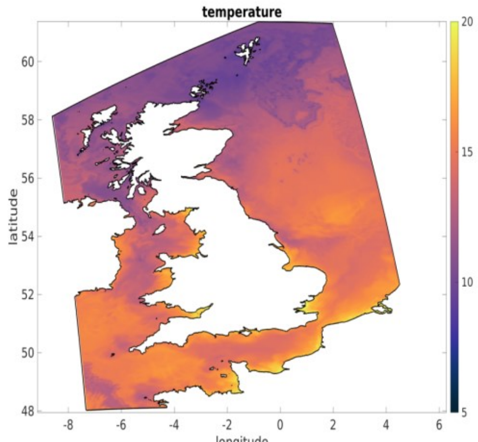
However, coupled models need lots of data!

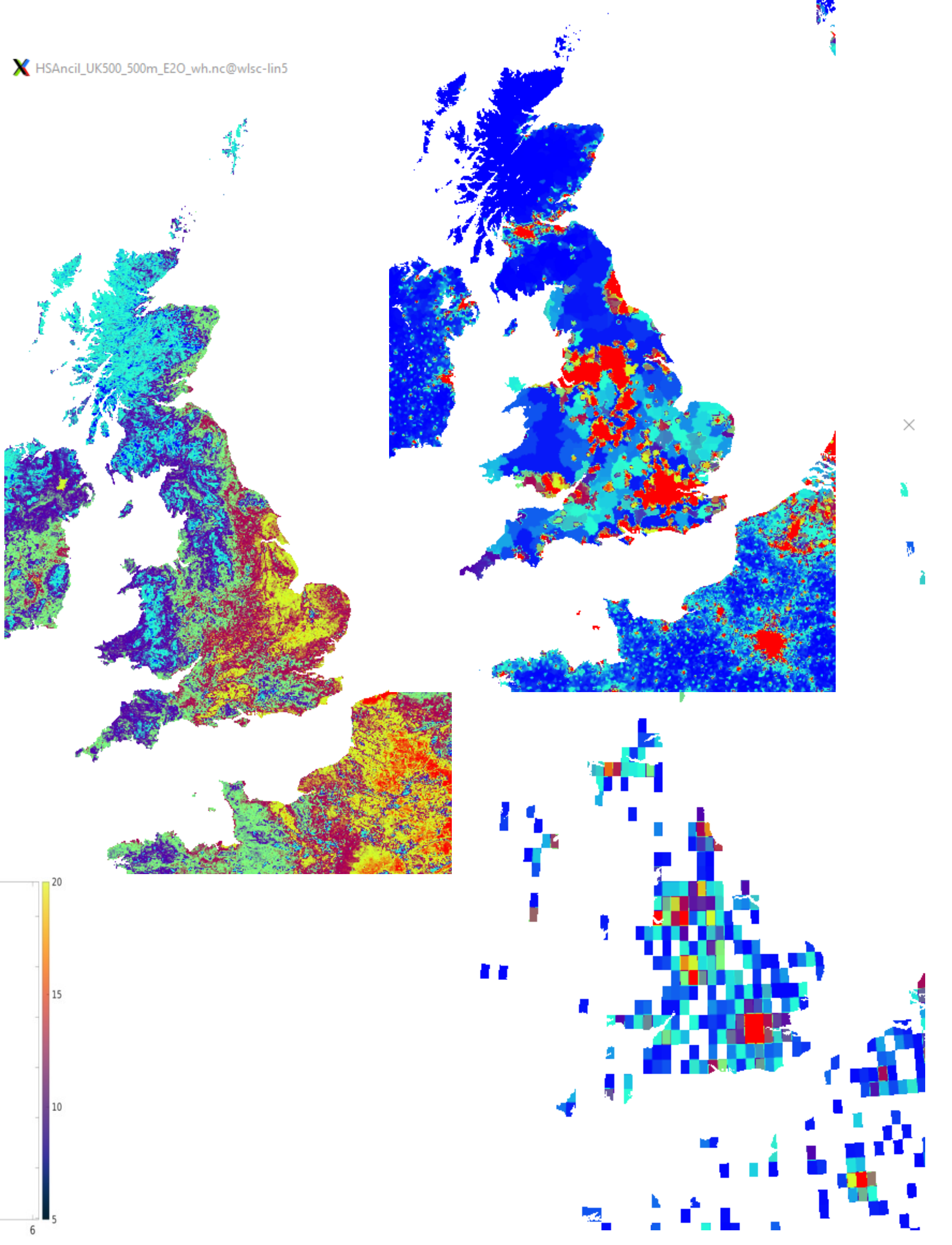
Data for the land model (right)

Data for the ocean (with thanks Julia Rulent, NOC)







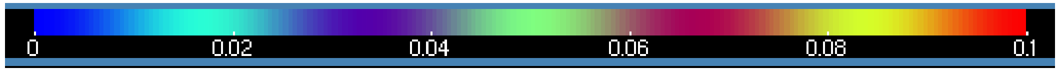


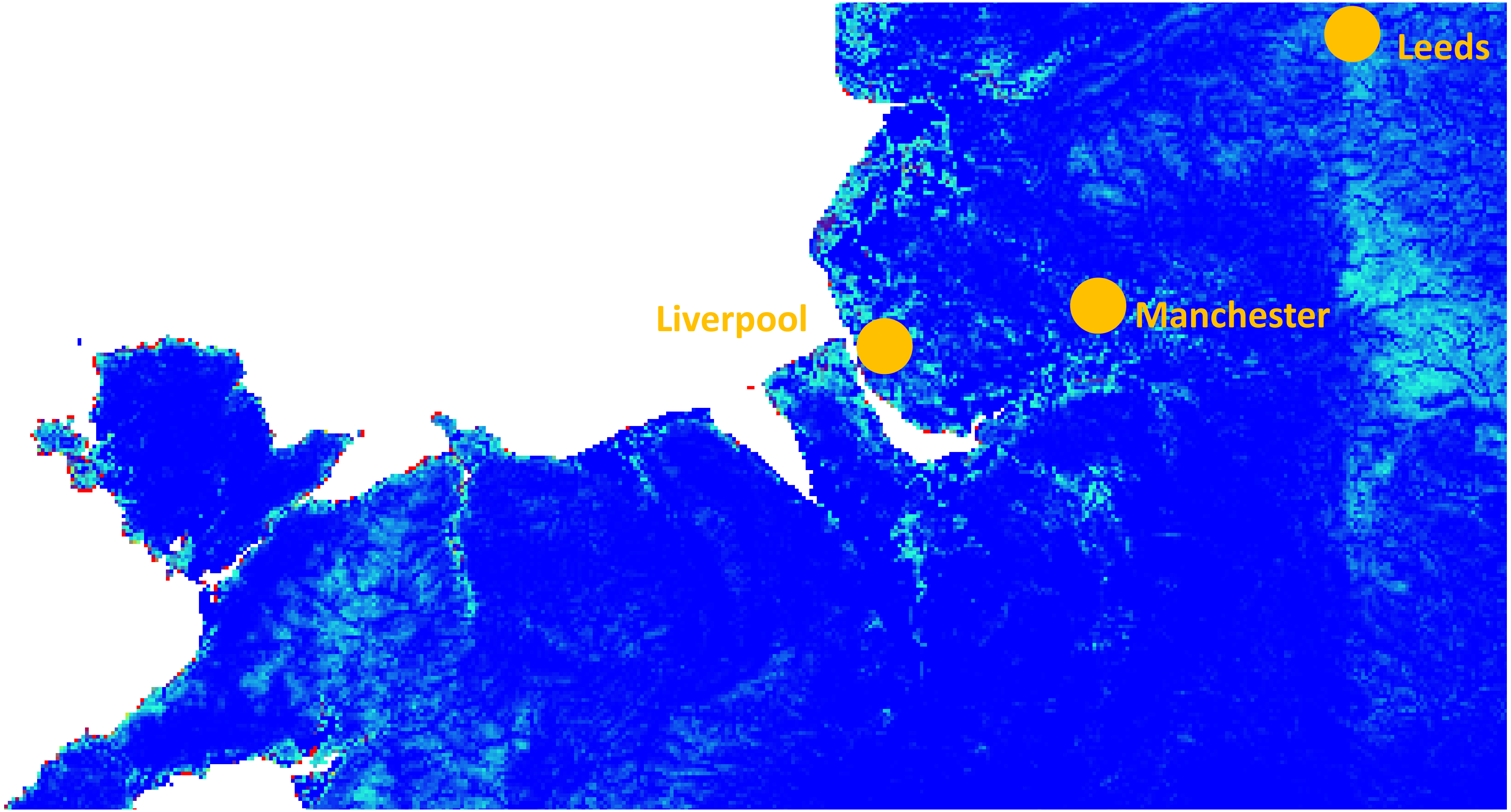
275 km

Sea surges

Simulating a larger area: this time, values are fractional inundation of gridcell (and no tsunami!).

Fractional inundation of gridcell

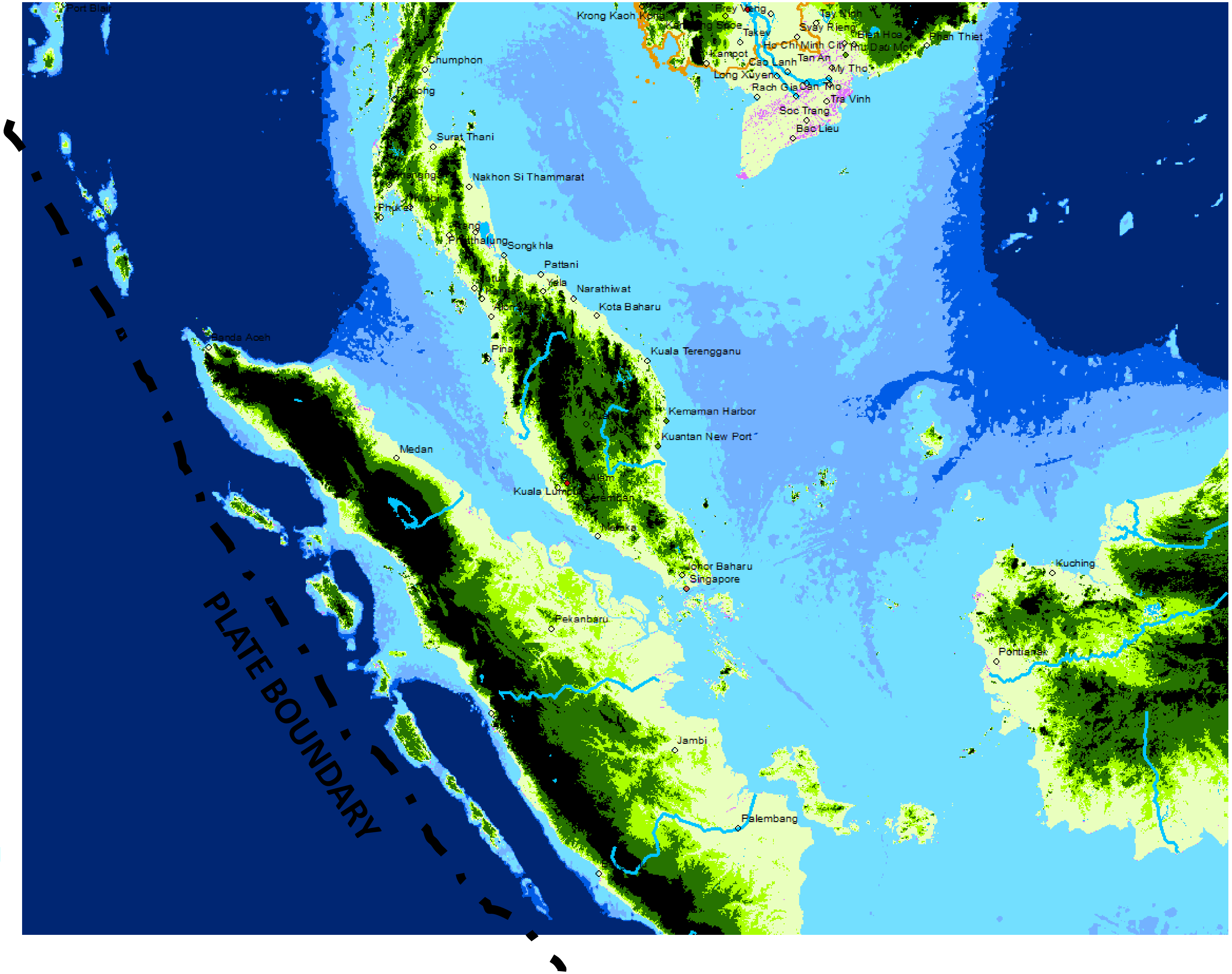


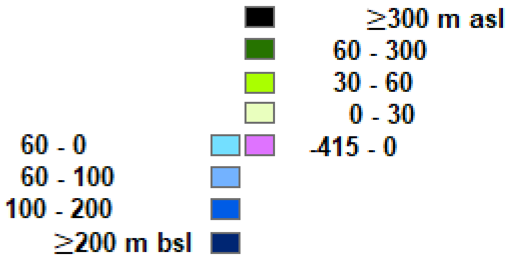


S.E. Asia

Just to mention that other areas of the world introduce more complications. For example, in Southeast Asia, there's a large area of coastal plain and shelf seas. We would certainly need a good ocean model like NEMO to simulate sea surface heights here.

There are also other complications that don't occur elsewhere: rocks here are much younger than the Eastern US (<100 Mya rather than >250 Mya) and there is, of course, a long tectonic boundary to the west of Sumatra.





Final recap and summary

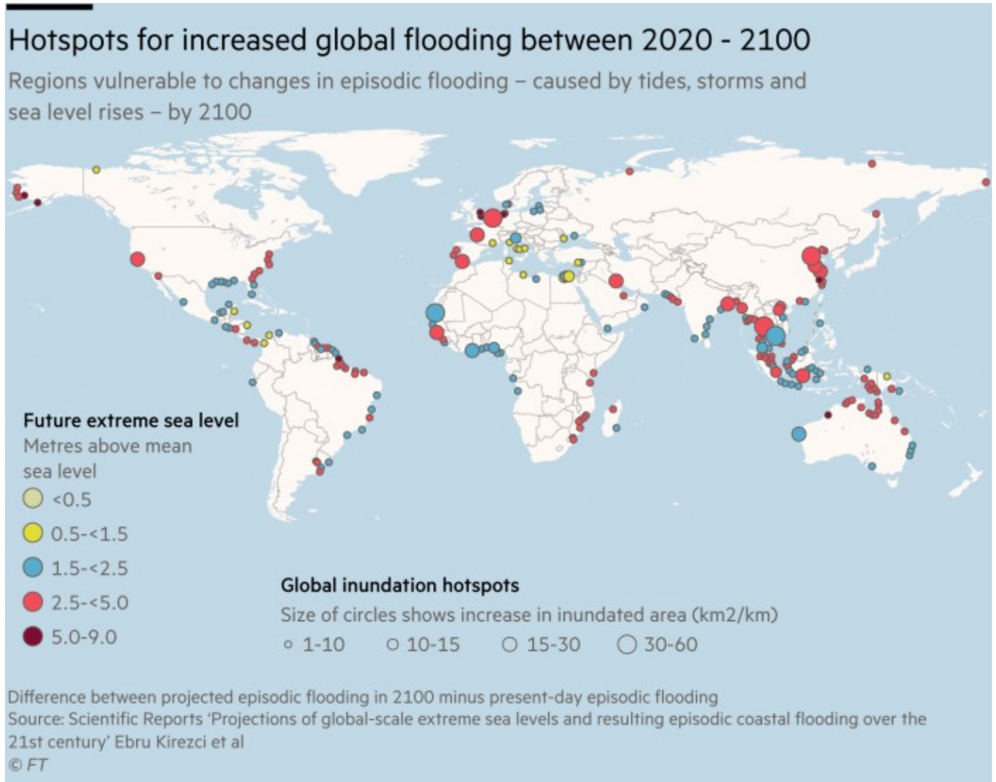
- Coastal inundation is of high national concern in the UK (and globally).

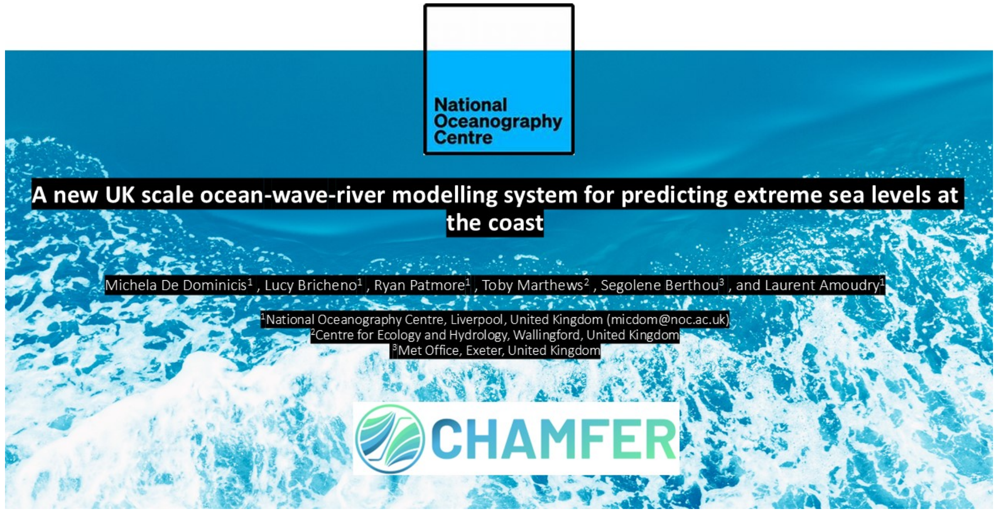
- At UKCEH (and the UK MetO), we are trying to upgrade our modelling systems to be able to simulate this form of inundation (along with our hydrology in general).

- Our approach is to work with Dr Yamazaki at Univ. Tokyo to deliver this by accessing the existing model routines in CaMa-Flood.

- This is part of a new UK scale ocean-wave-river modelling system being developed by NOC and UKCEH through the CHAMFER project.

- We are almost ready with this (we hope, end 2025), but sea surges seem to require further thought.





1. River, inundation, coastal and ocean modelling: Hydro-JULES and CHAMFER

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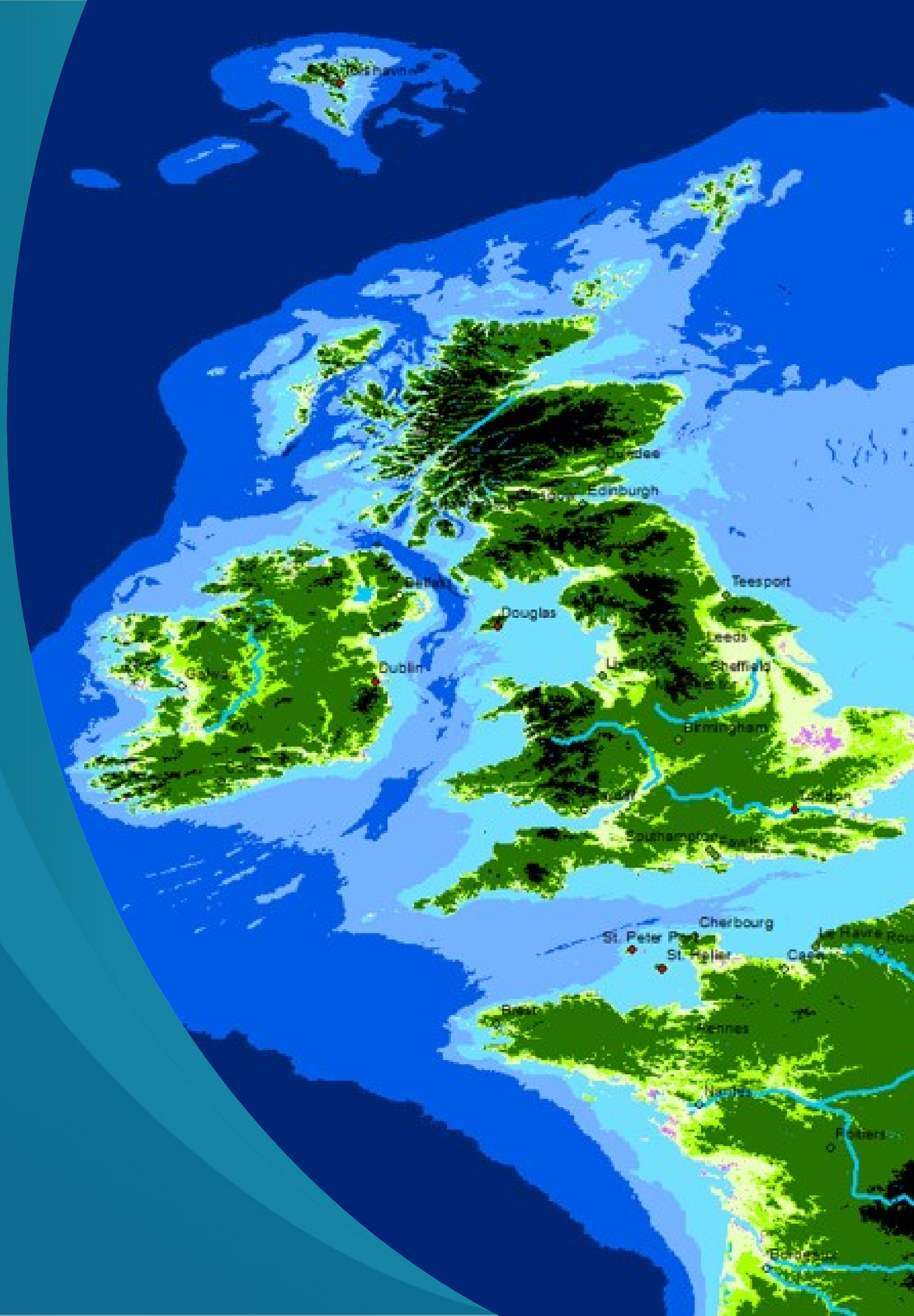


UK Centre for Ecology & Hydrology

Hydro-JULES

Land and Water in a Changing Climate

24th September 2025

Join leading researchers and practitioners for a day of knowledge sharing and conversation at the Royal Society on 24 September 2025. This gathering will bring together the hydrological and land-surface modelling community, industry and practitioners across the UK to share insights on how this area of research can address critical hydrological challenges.

Tickets are now open for booking and close on Tuesday 9 September at 5pm.

As well as science talks from a range of guest speakers, there will be an interactive session designed to help the community share its aspirations for the coming years, and to identify areas of focus for future engagement sessions. Our keynote speakers are:

- Professor Martyn Clark, University of Calgary
- Dr Ségolène Berthou, Met Office
- Dr Glenn Watts, UK Centre for Ecology & Hydrology

Lunch will be provided during the conference, with an optional dinner at The Feathers, 18-20 Broadway, Greater, London SW1H 0BH for those who want to continue networking.

Spaces are limited so book now!

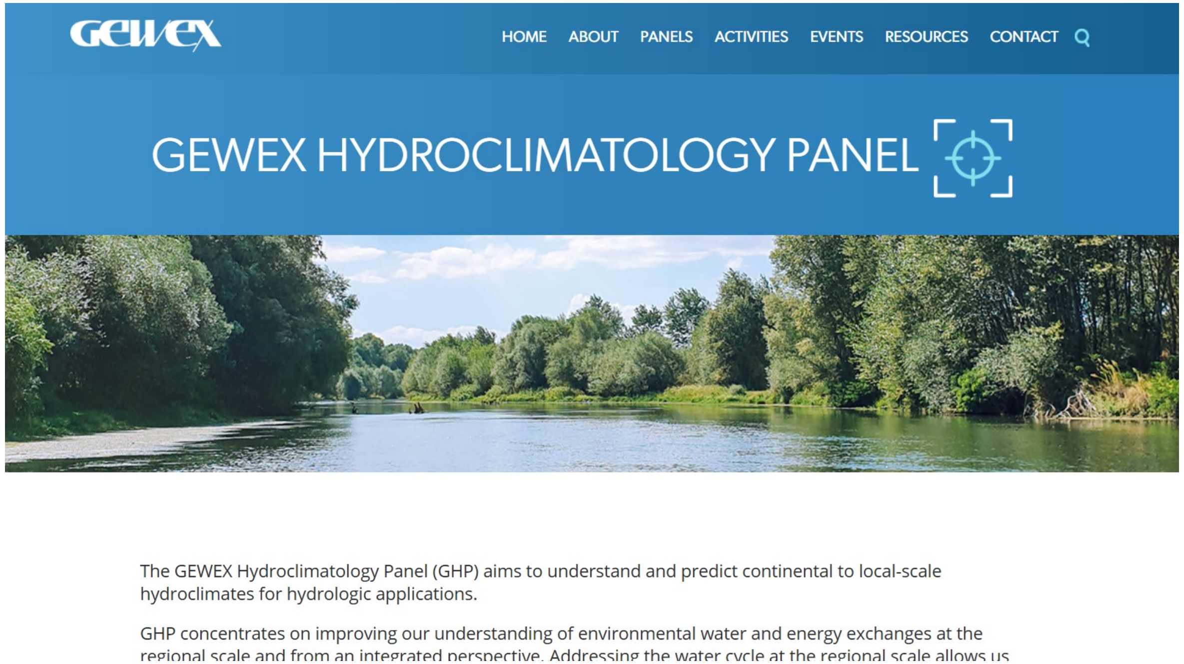
[The Royal Society]

6-9 Carlton House Terrace, London

Date: 24th September 2025

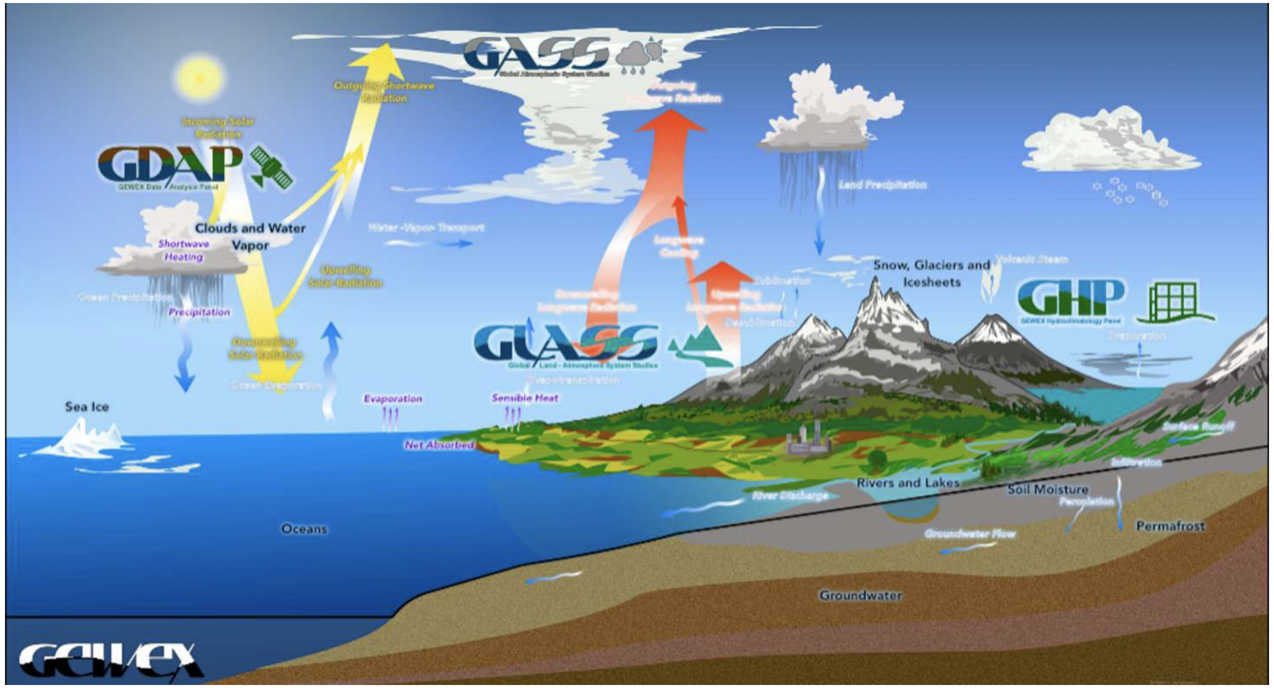
Time: 9:30-17:00

https://enterprise.mitingu.com/ceh-events/land-water-changing-climate#registration



We are also extending our work with GEWEX, linking in with projects in other areas.

For example, soil modelling work with Univ. Reading, UK, under the *SoilWat* initiative (GEWEX/GLASS).

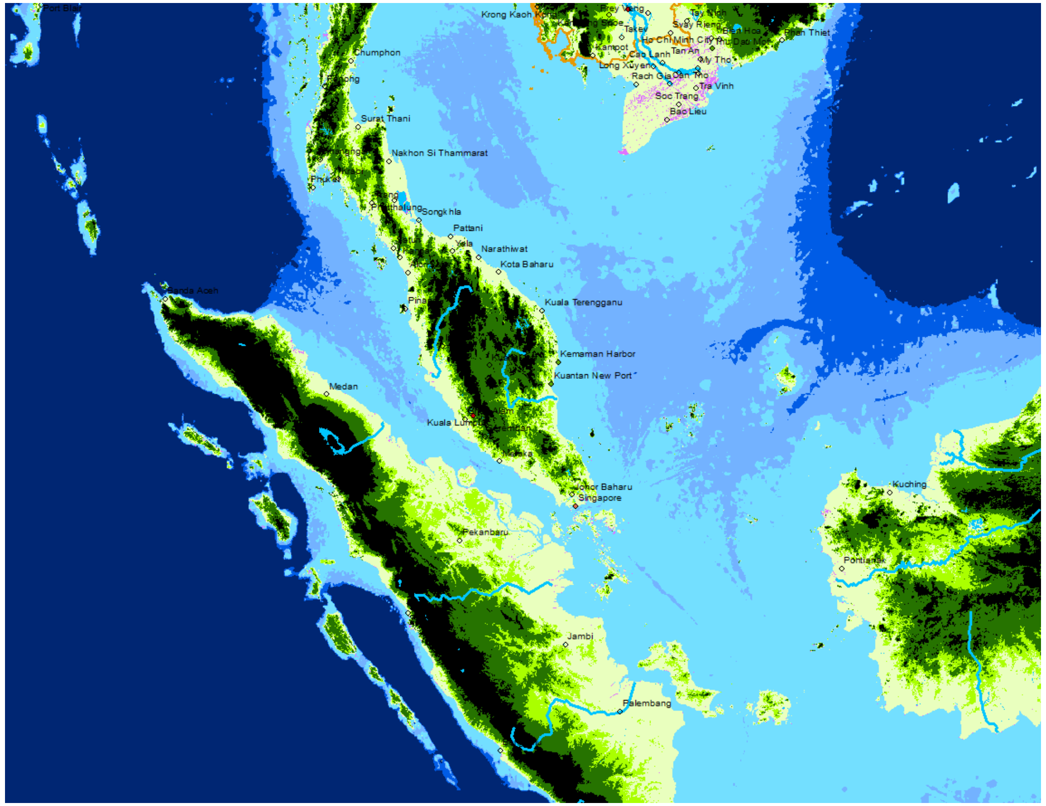


Asia Oceania Geosciences Society

Abstract Details	
Session	HS09 - Advances in Large-scale River Modeling: Developments and Applications
Abstract Title	**Rivers, Wetlands and Inundation: in Cama-flood, in Jules and in Reality**
Keywords	River Modelling;Inundation;Wetlands
Abstract Preview	**Rivers, Wetlands and Inundation: in Cama-flood, in Jules and in Reality** Toby MARTHEWS[1#+], Douglas CLARK[1], Simon DADSON[2], Dai YAMAZAKI[3] *[1]UK Centre for Ecology & Hydrology, United Kingdom, [2]University of Oxford, United Kingdom, [3]Tokyo University, Japan* Rivers, wetlands and other inundated areas play a key role in hydrological and biogeochemical cycles and provide multiple ecosystem

I presented an earlier version of this talk at AOGS 2025 in Singapore at the end of July.

There are several groups in Asia working on rivers and inundation, especially in Japan (Univ. Tokyo developed CaMa-Flood of course) and the Maritime Continent.



Thank you for your time

Toby Marthews, UKCEH Wallingford

with huge thanks to colleagues at
UKCEH (all 4 sites), NOC Liverpool,
UK Met Office, Univ. Liverpool,
BGS and Many others.

https://www.tobymarthews.com/

For more information: @UK_CEH , @UKCEHPapers

UK Centre for
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