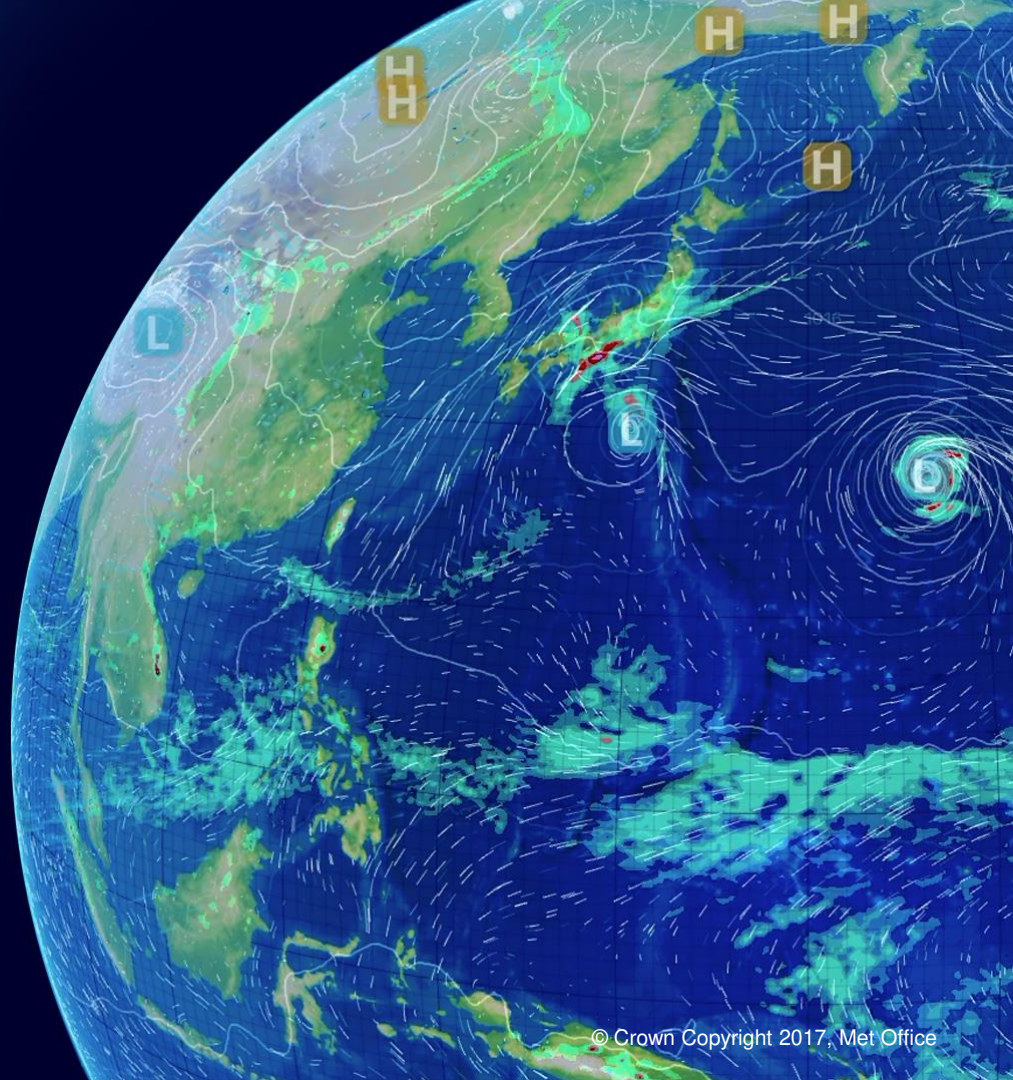


# SI<sup>3</sup> : Sea Ice modelling Integrated Initiative: Overview, updates and plans

IS-ENES3 1st General Assembly  
25-27th March 2020

Ed Blockley, Met Office  
Martin Vancoppenolle, CNRS-IPSL

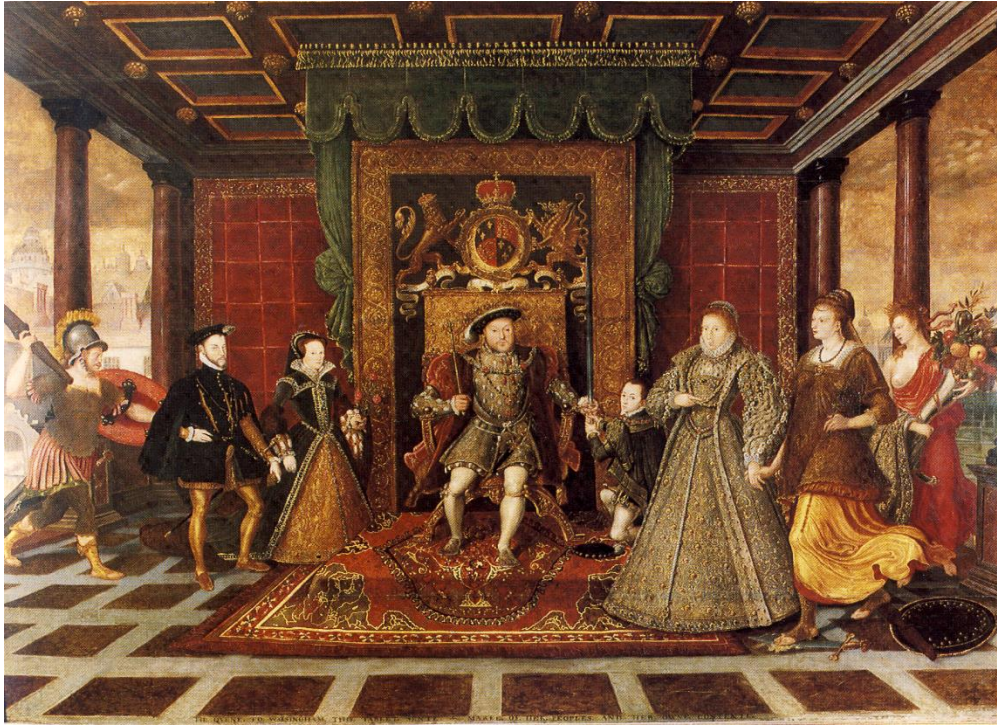


# Contents

- Sea ice within NEMO : a history lesson!
- Sea Ice modelling Integrated Initiative (SI<sup>3</sup>)
- Plans/funding for SI<sup>3</sup>
- IS-ENES3 progress/update
- Iceland workshop – towards a long-term strategy for sea ice modelling



# The past...



## NEMO & sea ice

- In the beginning.....
  - Sea ice less mature than ocean
  - No dedicated long-term resource
  - Not included fully within consortium (planning etc.)
- Many ice models used with NEMO
  - LIM (~ 3/4 consortium members)
  - CICE (~ 3 consortium members)
  - GELATO
- Duplication of resource
  - NEMO – ice model coupling (SBC)
  - Scientific developments
  - Result: less time for science!!



# The present...



## NEMO Sea Ice Working Group (SIWG)

- NEMO Sea Ice Working Group (SIWG) established in 2016
  - To investigate ways to reduce duplication within NEMO community
  - Co-chairs: Ed Blockley (Met Office) & Martin Vancoppenolle (CNRS)
  - BAS; CPOM; NOC; CMCC; CNRM; Mercator Ocean; UCLouvain (+ ECMWF)
- Recommendations:
  - Pool resources and develop a fully unified sea ice model within NEMO framework
  - Bring sea ice fully within the NEMO consortium:
    - Formalising existing development relationships and bringing in new developers (CICE; GELATO)
    - Part of NEMO long-term planning and strategy
- => Sea Ice modelling Integrated Initiative (SI<sup>3</sup>) was born

## **NEMO Sea Ice Working Group (SIWG)**

- SIWG will liaise with other key NEMO WGs:
  - HPC optimisation
  - Atmosphere-ocean-wave interaction
- => HPC optimisation not included explicitly within SIWG/SI<sup>3</sup> activities
  - Although involvement in the form of scientific or procedural guidance is expected

# The future...





## Sea Ice modelling Integrated Initiative (SI<sup>3</sup>)

- Development led by NEMO SIWG
- Starting from LIM3 as a base (C-grid; NEMO coding/standards)
- Incorporating key functionality from CICE & GELATO
  - Melt-ponds; form-drag; EAP rheology; ...
- Met Office/JULES coupling interface
  - Including standard test configuration
- Using existing NEMO partner resources
  - Funding obtained (10 PY) to support transition
  - **EU-IS-ENES3**; EU-IMMERSE; CMEMS



# Existing consortia #1 : IS-ENES3

- EC call for development of key Earth System modelling infrastructure and community building/networking
- Involving: CMCC, CNRM, IPSL, Met Office, UoR (CPOM)
- Planned activities (WP4 & WP8):
  - Technical:
    - Modularity of code
    - Upgrading coupling interfaces (CMCC, CNRM, Met Office)
    - Upgrading local infrastructure to use NEMO-SI<sup>3</sup> (CMCC, CNRM, CPOM/UoR)
  - Community:
    - Development of NEMO training and test configurations
    - Support for: international strategy workshop & NEMO sea ice community development (SIWG)
    - Documentation of NEMO sea ice model



# Existing consortia #2 : IMMENSE

- H2020 call for development of CMEMS modelling systems (i.e., NEMO) for high-resolution (1km-scale) forecasting
- NEMO consortium: CMCC, IPSL, Met Office, NOC
- Planned activities:
  - Implementation of EAP and VP rheologies into NEMO sea ice model
  - Model simulations with EVP, VP & EAP rheologies (ORCA025; 1/16°; 1/36°)
  - Rheology comparison & observational assessment
  - Recommendation for future NEMO rheology and for high-resolution forecasting

# Existing consortia #3: CMEMS sea ice

- CMEMS call for NEMO sea ice model – Lot2: sea ice, towards a unified sea ice model.
- Involving: CNRS, UCLouvain, UoR
- Planned activities:
  - Develop a sea ice evaluation package
  - Test the proper functioning of new features (Melt ponds, form-drag)
  - Document behaviour in hindcast mode (wrt. predecessors, at different resolutions)

## THE CONSORTIUM

Coordinated by CNRS-IPSL, the IS-ENES3 project  
gathers 22 partners in 11 countries



*This project has received funding from the European Union's  
Horizon 2020 research and innovation programme under grant  
agreement N°824084*



Our website

<https://is.enes.org/>



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Join the community  
on ZENODO !

# IS-ENES3 – progress with SI<sup>3</sup>

- Initial model version released with NEMO v4.0
  - Replacing LIM3; LIM2 removed
  - CICE (& GELATO) coupling removed
- Met Office/JULES coupling:
  - Prototype JULES coupling committed to NEMO trunk
  - Fully include SI<sup>3</sup> in HadGEM3 (in place of CICE) ongoing
- Other centres (CMCC, CPOM/UoR, CNRM) transitioning systems to use SI<sup>3</sup>



# Defining a cutting edge future for sea ice models

- IS-ENES3 funded Sea ice modelling workshop [M4.1]
- Held in Laugarvatn, Iceland, Sept 2019
- Co-hosted with Elizabeth Hunke (US DOE/LANL and CICE lead)
- 32 sea ice modelling scientists, 10 invited experts from North America and 22 from Europe
  - 13 NEMO developers/SIWG members, 10 IS-ENES3 partners
- Agenda built around a series of motivating questions
  - 1-2 keynote speaker for each key question but mostly discussion



# Defining a cutting edge future for sea ice models

- IS-ENES3 funded Sea ice modelling workshop: Iceland, Sept 2019





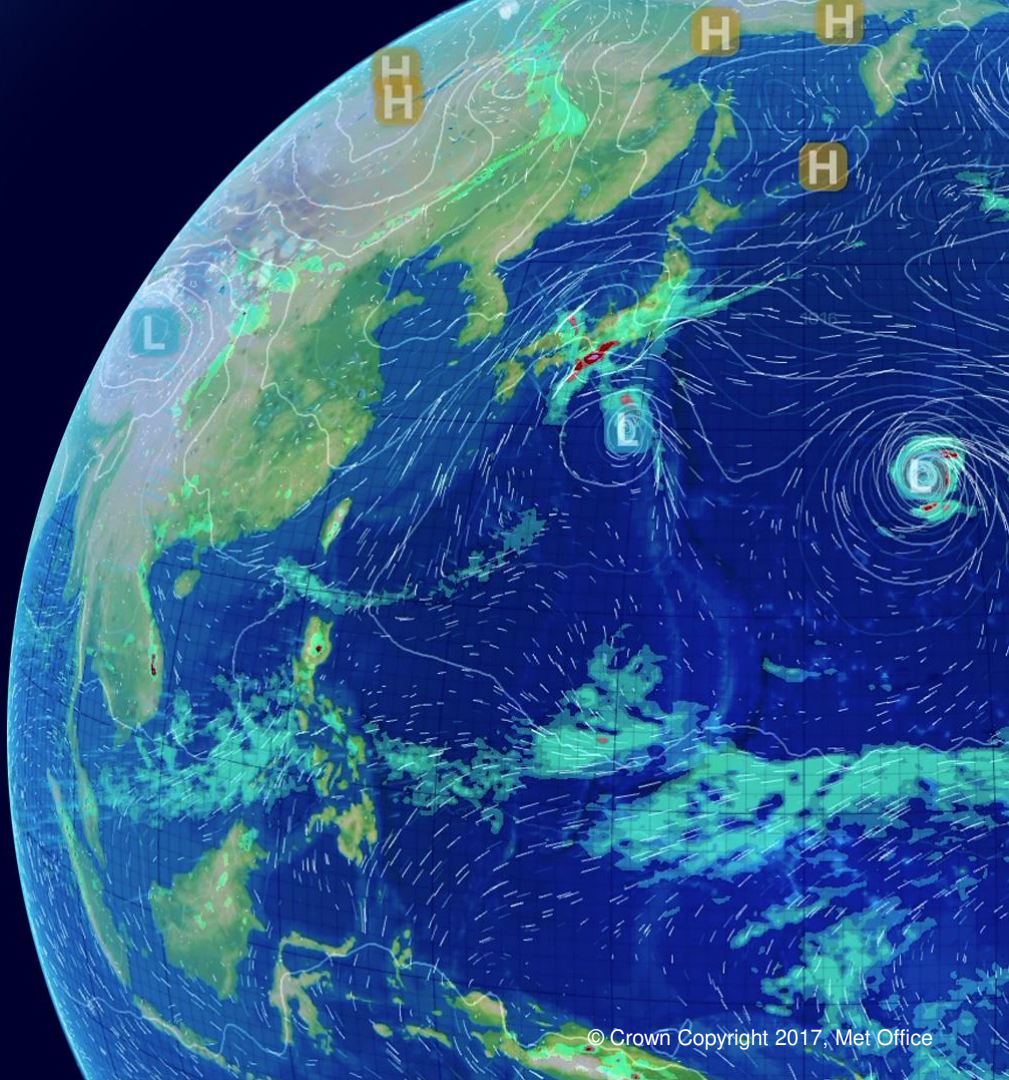
# IS-ENES3 – next steps with SI<sup>3</sup>

- All IS-ENES3 partners to be using SI<sup>3</sup> (CMCC, CPOM/UoR, CNRM)
- Documentation of SI<sup>3</sup>
- Wash-up from IS-ENES Iceland workshop:
  - Publication of Iceland workshop report (BAMS)
  - Future of sea ice modelling paper (Springer)
  - Updating NEMO Development Strategy (NDS) for sea ice [D4.2]

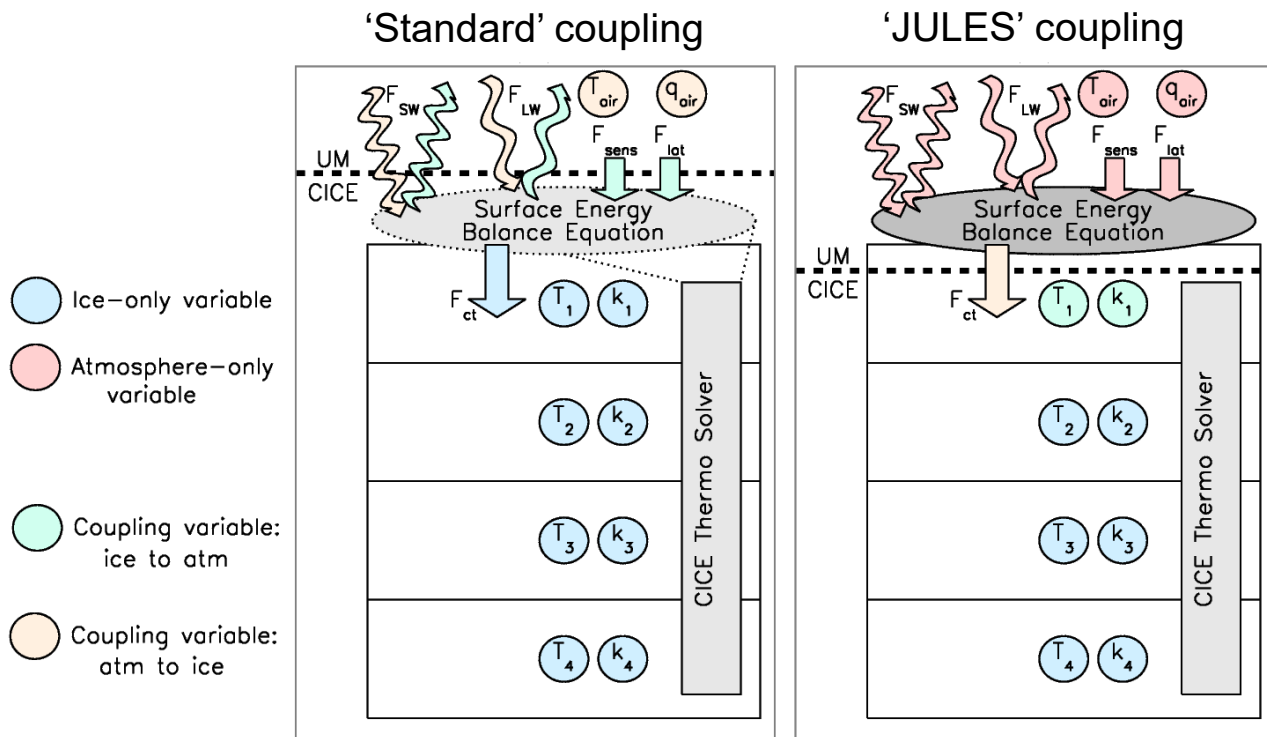


# The end

Thank you for your attention



# JULES/Met Office coupling



# Coupling: Impact on surface heat flux

West et al., (2016): 1-D idealised study

