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Baltic Operational
Oceanographic System

BOOS: present and future

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On behalf of BOOS Steering Group

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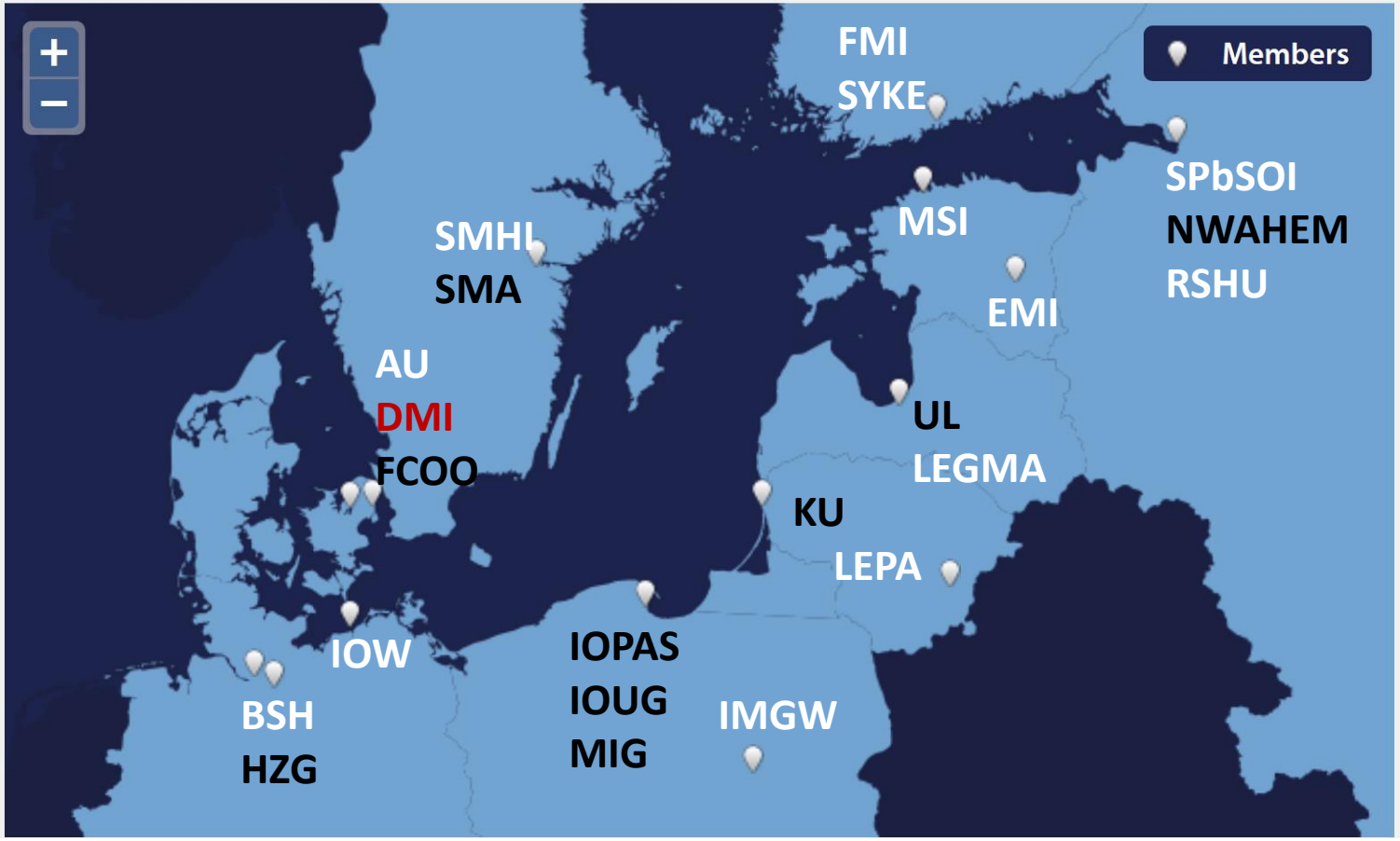
Members Map (20 members, 3 assiciate members)



BOOS members are responsible for both operational and HELCOM environmental monitoring BSH, HZG, IOW, AU, DMI, FMI, SMHI, IOPAS, IMGW, KU, LEGMA, MSI, NWAHEM, RSHU also work on climate change study and service

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BOOS collabrative activities 18/19

- **BMP Working Groups**
  - Cal/Val
  - Data Assimilation
  - Multi-model Ensemble
- **BALMFC**: DMI, BSH, FMI, MSI, SMHI
- **TACs**: INS, OC, SST, SIC
- **CMEMS-BOOS:** MME, PQ NRT validation
- Involvements in **EuroGOOS TTs, WGs**

- **Observation Working Groups**
  - Data exchange
  - NRT ship data delivery
- **BOOS integration**
  - National multi-sector integration
  - WebWG, Communication, outreach
  - Optimization of BOOS observing system
- **New External projects:**
  - BMIP, ESA Baltic+ SEAL, Baltic+SAL, EuroSea, JERICO

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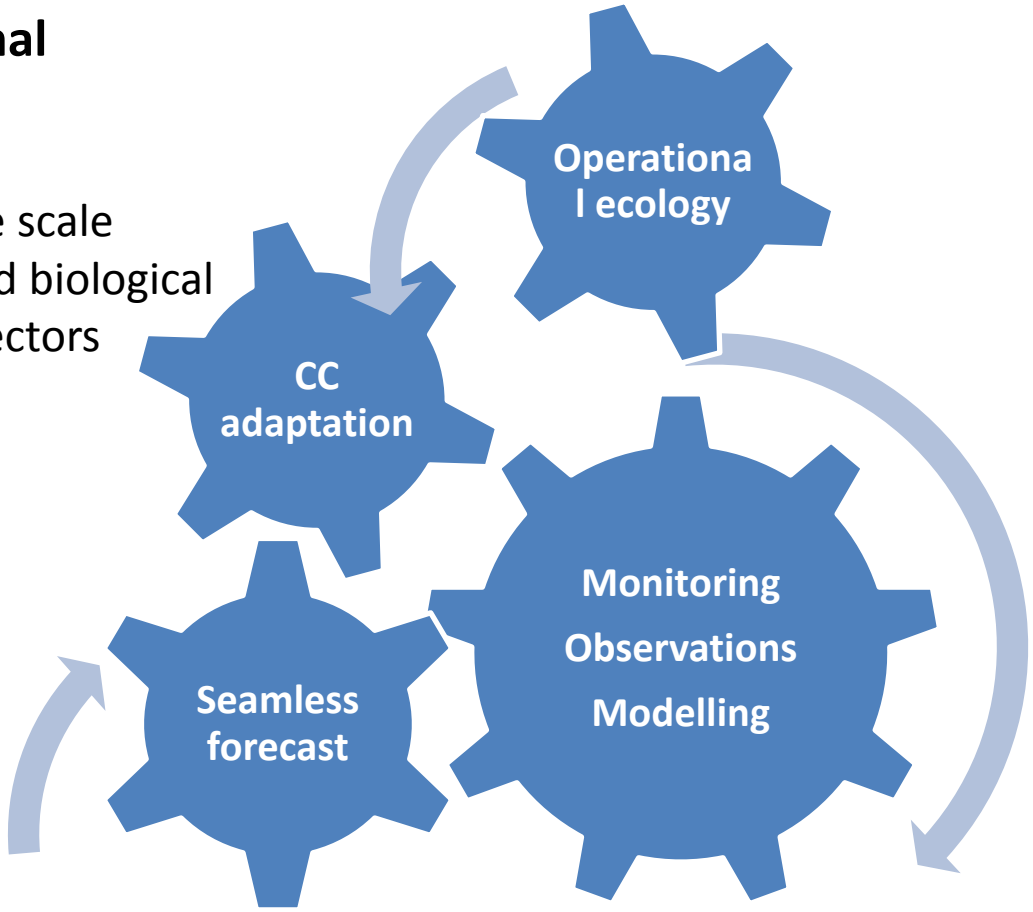
BOOS cooperation statement

- In the past, BOOS cooperation mainly lie on operational modelling, data sharing and data assimilation.
- In the future, BOOS partners should also cooperate on
  - marine climate change adaptation,
  - operational ecology
  - remote sensing and
  - integrated in-situ observing

Develop seamless, operational marine system information service for the Baltic Sea

Seamless operational service:

- Basin to local scale
- Synoptic to climate scale
- Physical to BGC and biological
- Public to private sectors



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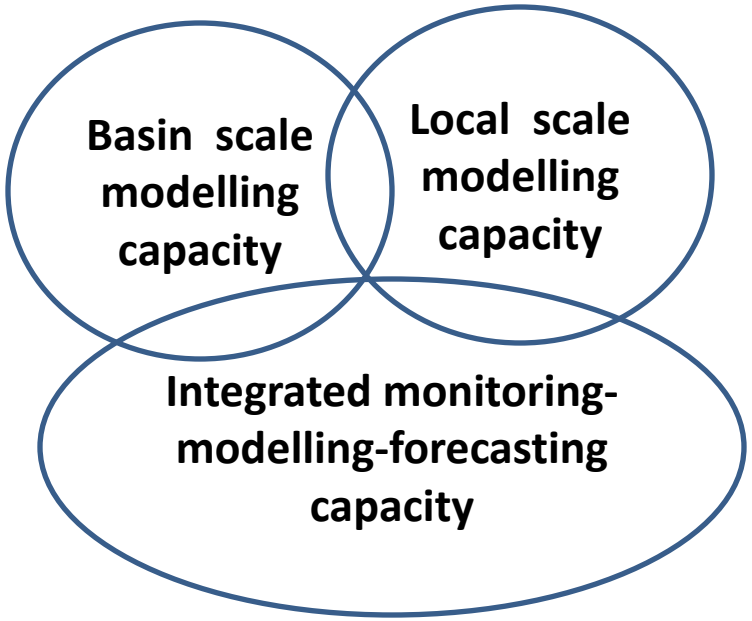
Seamless forecasting

- **The basin scale BOOS model** should be supported by a core development team, not only model users.
  - Is this already the case?
- **Local scale**:
  - downscaling
  - Hydrological/flooding forecast
  - Coastal-estuary continuum
  - How to cooperate?
- **Data assimilation** is a key for integrating monitoring and modelling
  - The goal is to use more observations and give guides to monitoring



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CMEMS future evolution

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BAL MFC

- Fully coupled ocean-ice-wave-BGC model in Baltic scale
- PDAF data assimilation (SST, sea ice, Sea level, T/S/O/N/P/Chl) for
  - NRT assimilation
  - Interim assimilation
  - Historical assimilation
- Annual Ocean State Report and Interim Ocean Monitoring Index
- MME and extensive validation
- More user friendly interfaces esp for postprocessing

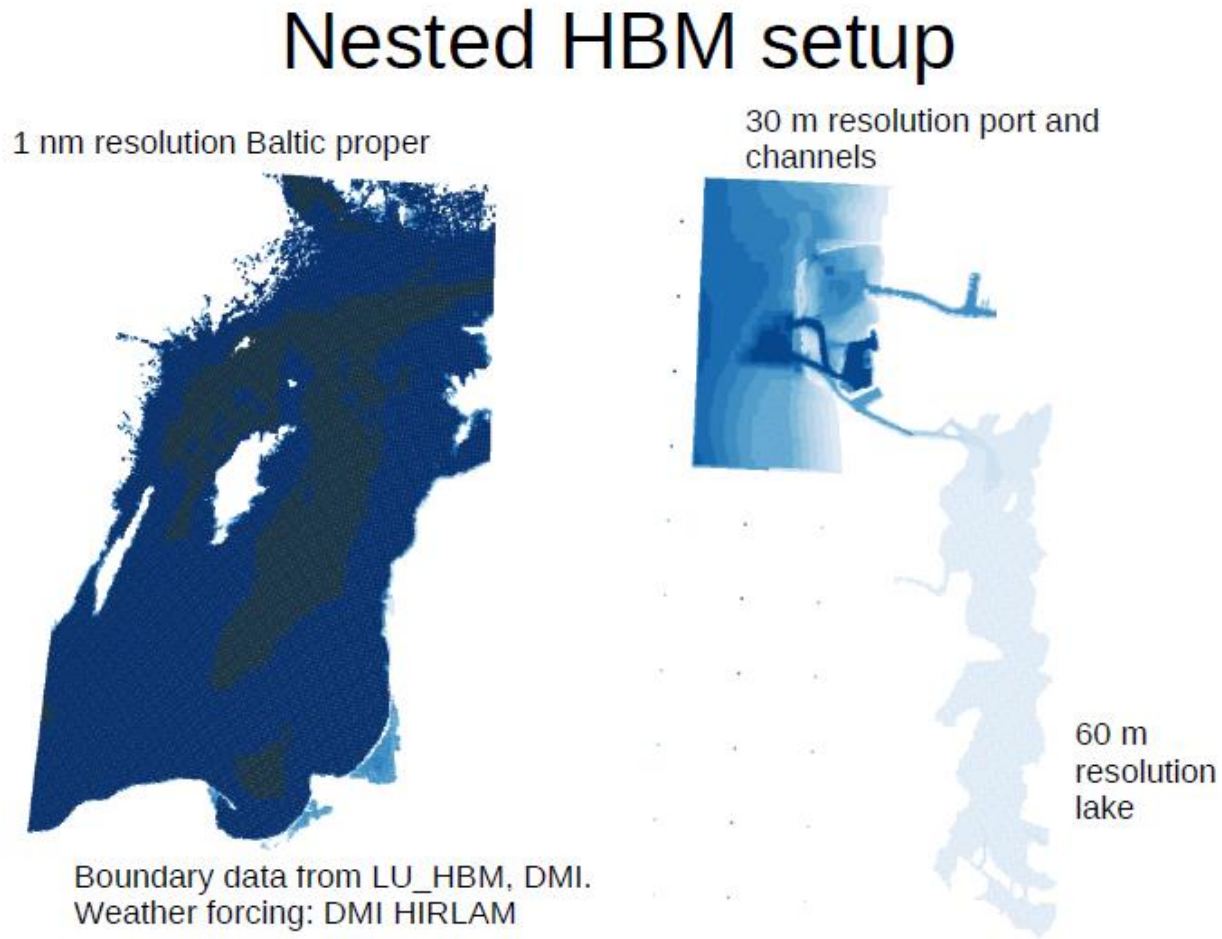
TACs

- INSTAC (more data, better QC)
- SST TAC (diurnal products)
- Sea Ice TAC (improved quality)
- OC TAC (improved quality, more variables)

Relevance to BOOS partners

- Shared modelling & DA technology with BAL MFC
- More downscaling & downstream user applications
- New forecasting capacity at national level: BGC, MME etc.

New forecasting capacity development (flooding, lakes, WQ, SPM, carbon, plastic litter)



- **UL lake forecast (Frishfelds et al. 2018)**

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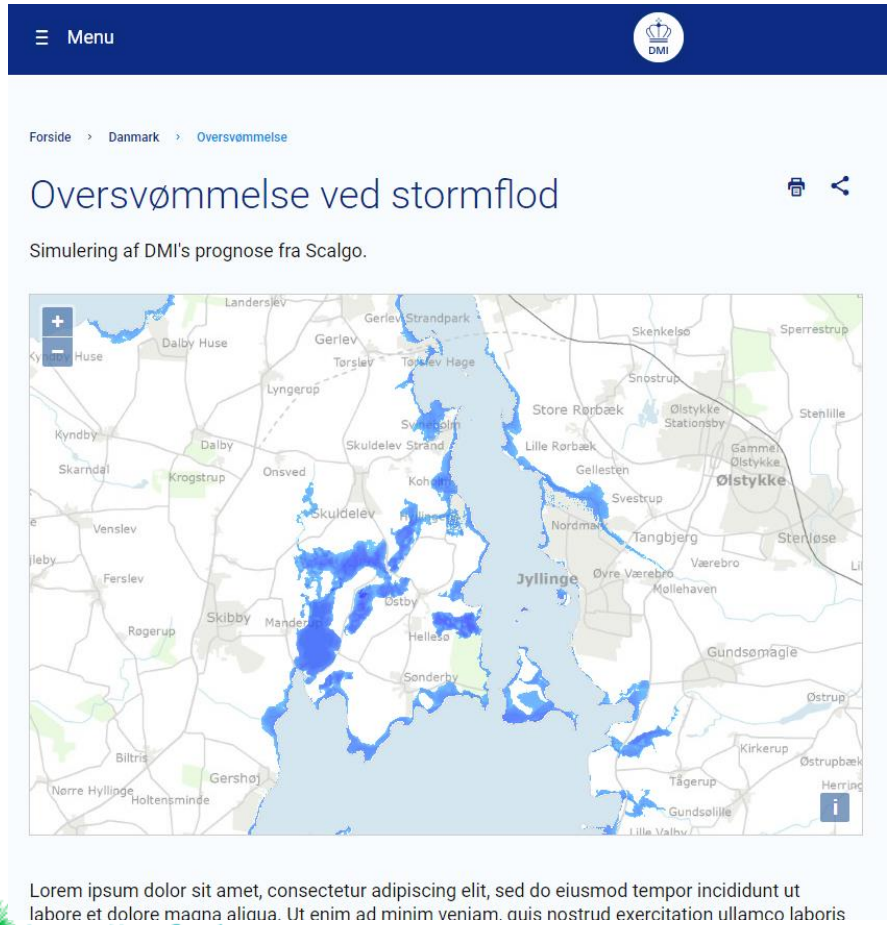
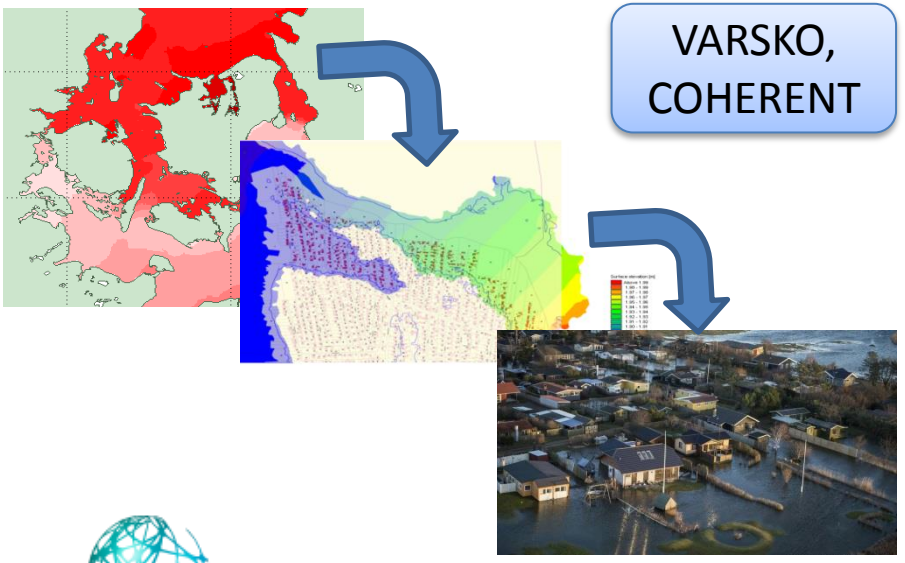
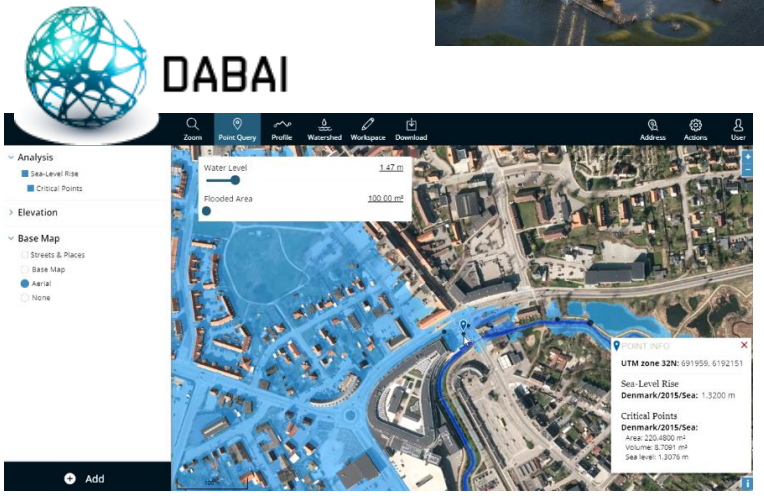
Flooding

Risk based forecast: move towards forecast / projections of both sea level and flooding





VARSKO, COHERENT



Innovationsfonden

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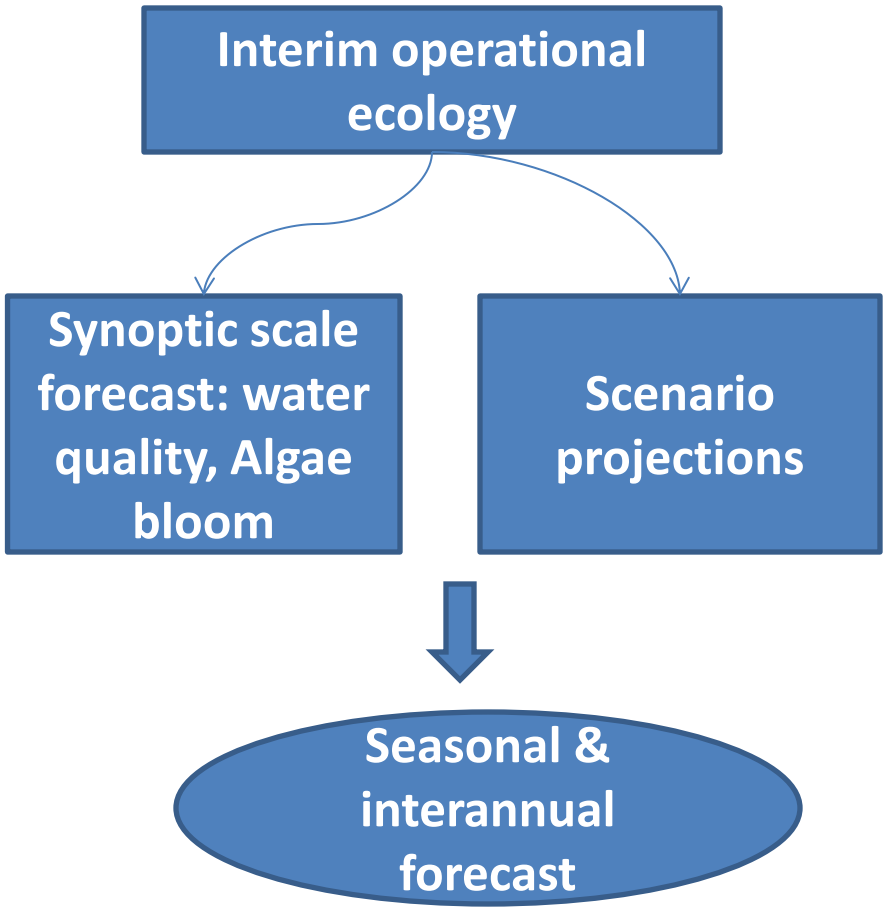
Operational ecology



- **Interim operational ecology**
  - BGC/BIO monitoring network
  - Interim data access
  - Basin/local ecosystem modelling
  - Interim reanalysis (assimilating satellite and in-situ data in interim scale)
  - Interim assessment
- **More to be presented in the OE talk**

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Operational Marine Climatology (OMC)

- **Questions for discussing**
  - For OMC, is one BOOS model sufficient? Or Multi-models are necessary?
  - Is coupling essential for OMC? How to develop easy coupling framework?
  - How can operational modelling best practice raise confidence level of OMC models? (eg Core Developers, HPC, quality standard, capacity for modelling extremes etc)
  - How to balance basin scale and local scale OMC?
  - Synergy and cooperation between national OMC projects
  - Climate variability of synoptic or anomalous events
  - Does BOOS monitoring network fit for the purpose of CC Adaptation?
  - Future of OMC: a BOOS view for a better OMC service
  - Do we need an OMC-WG? Common proposals, joint R&D efforts.

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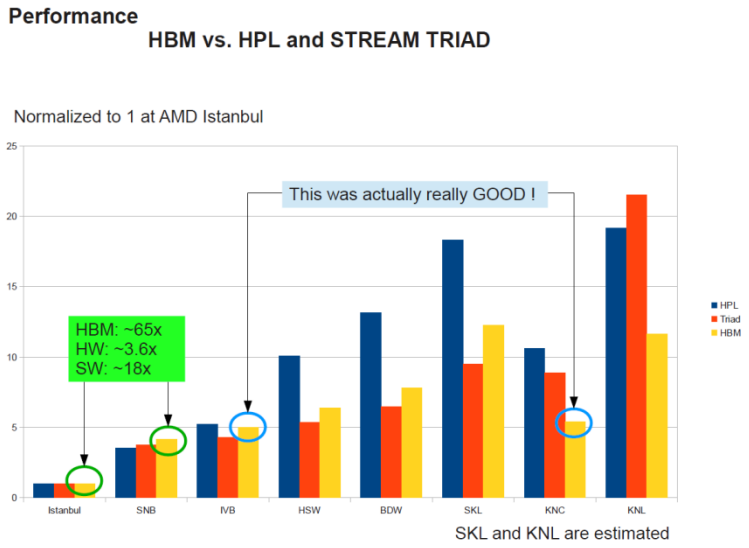
Code optimization for seamless modelling

- Efficient use of many-core architecture depends on the code quality
- Challenges:
  - Binary-reproducibility
  - Critical high Amdahl parallel ratio
  - Optimzation of ISAs: SIMD, FMA etc
  - Blance between BW/Flops bounds
  - Thread load balance
  - Hybrid parallelization
- Solutions: code optimization



Courtesy of Berg and Poulsen (2016)

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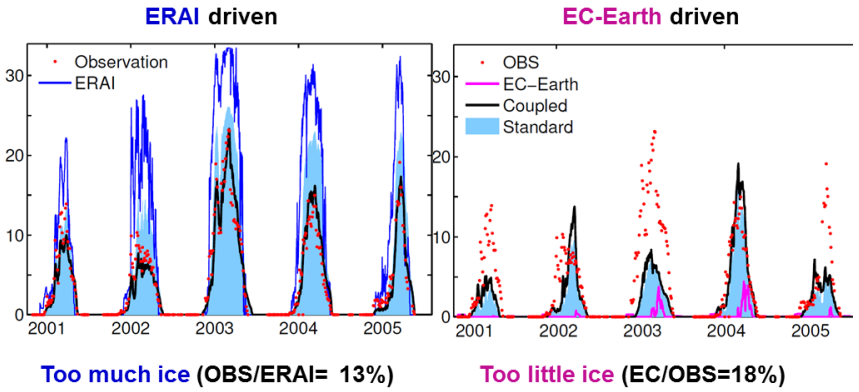
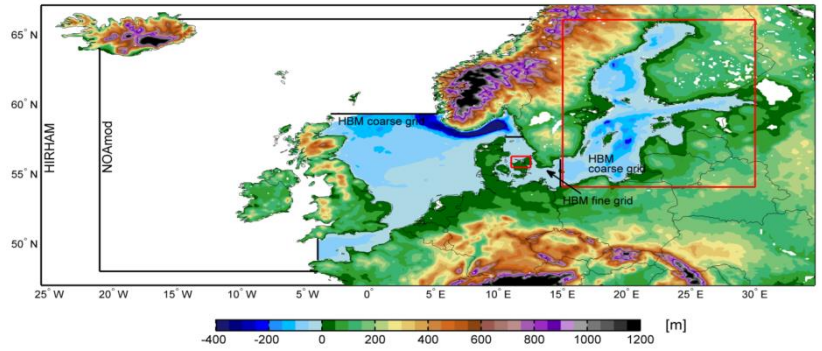
Seamless modelling: from operational to climate scale (Is a coupled system better than uncoupled one?)

Hindcast exps: coupled vs uncoupled
N. Baltic Sea ice extent (10^4 km^2)

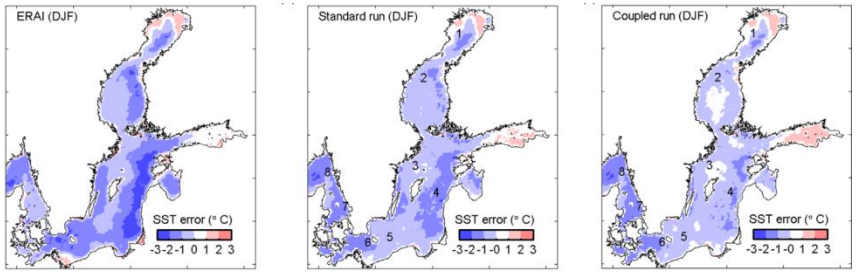


Too much ice (OBS/ERAI= 13%) **Too little ice** (EC/OBS=18%)

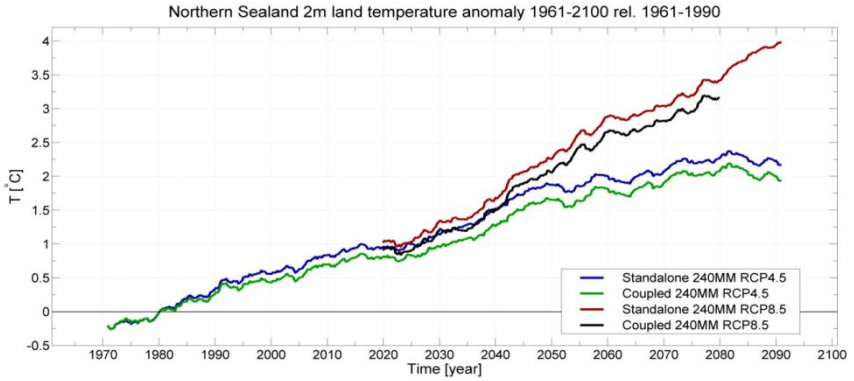
HIRHAM-HBM Model domain (Tian, et al. 2013)



Hindcast exps: coupled vs uncoupled
Winter SST error



RCP projections: coupled vs uncoupled



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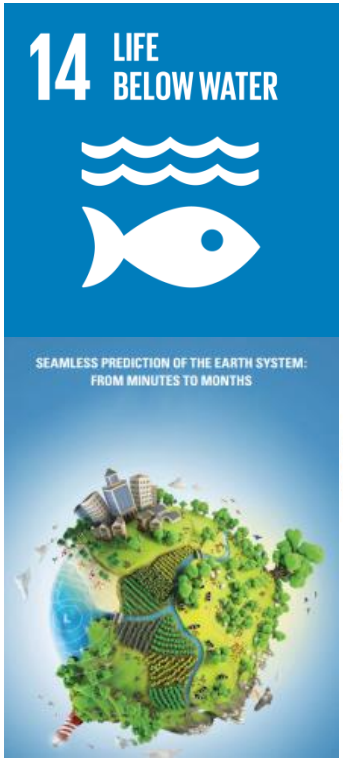
Vision & planning post2020



EMODnet

- BOOS post2020 vision (for discussion):
  - To develop and provide seamless, operational marine system information service for supporting public safety, efficient and sustainable marine economy, climate change adapation and ocean health preserving in the Baltic Sea.
- Initiate BOOS post2020 strategy and organization development

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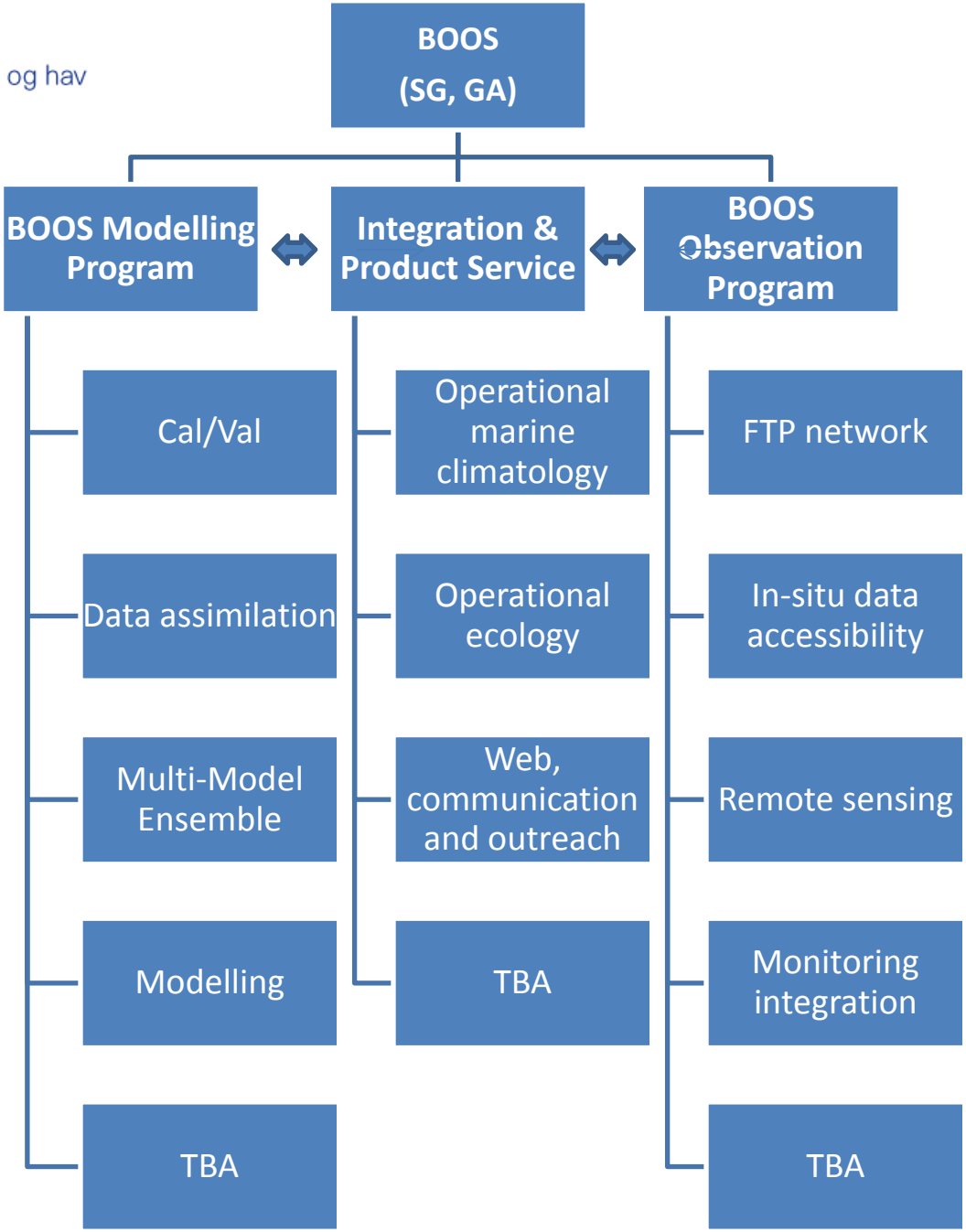

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Thank you for your time!