Needs for SST and sea-ice at ECMWF

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Outline

1. How we use SST and Sea Ice data
2. Problems found
3. What we need in our system
How we use SST and sea-ice data

- Medium-range weather forecasting needs SST and sea-ice as the lower boundary conditions for the atmospheric model
  - Input to surface model

- For the HRES (high resolution, deterministic) atmospheric system we use:
  - SST and sea-ice concentration from OSTIA at analysis time
  - For the forecast we compute the anomaly from OSTIA SST at initial time and persists the anomaly during the forecast
  - The sea-ice concentration is kept constant throughout the 10 day forecasts

- For the ENS (ensemble prediction + monthly forecasting, probabilistic) system we use:
  - SST and sea-ice concentration from OSTIA at analysis time
  - SST tendencies from an interactive coupled ocean model for the first 5 days changing to fully coupling from day 10 onwards
  - OSTIA sea-ice concentration is used for the first 15 days damping towards the last 5 years climatology
    - Work on an inactive sea-ice model is on-going
**How we use SST and sea-ice data**

**Use of SIC in:**

- **IFS**
  - The analysis system sets a minimum sea ice concentration below which it sets the concentration to 0. This is currently 20%.
  - For sea-ice / wave interaction some tests have been done to reduce this value.
  - Tests at 2% highlighted odd ice points in the analysis (for concentrations between 2-5%)
  - In the next cycle 41R1 this value will be set to 5%.

- **Wave model**
  - Currently SIC used just as a simple binary mask (cover > 30% no waves, otherwise full waves)
  - Work in under way to include wave sea ice interaction, where small amount of sea ice cover will become more important to get right
For ocean reanalysis, we assimilate daily gridded sea ice concentration data from OSTIA with thinning and in a univariate way.

**Gridded SIC from OSTIA (Jan 2004)**
interpolated to ORCA grid
Thinning factor=2
The high sea-ice concentration along some coastal points is suspicious
The SST is quite warm close to these points
The 2m temperature is quite warm as well.
Problems detecting melting sea-ice?
Who is checking (or trusting) who?

- We believe that OSI-SAF is using ECMWF’s 2m temperature as a part of a consistency check for sea-ice concentration (only operational products)

- We use OSI-SAF sea-ice concentration (via OSTIA) with very little additional checking

- A consequence of this could be:
  - If the sea-ice concentration is too large then our 2m temperature will be too cold
  - If our 2m temperature is too cold then the OSI-SAF check will not remove too large sea-ice concentration

- It is not clear how to solve this problem (if it indeed exists).
What we need in our system

- Satellite projection SST and SIC for direct assimilation:
  - after bias correction
  - before gridding and interpolation

- Acquisition time of the data (not to lose the diurnal cycle)

- Data without consistency check between SST and SIC

- Reliable SIC data at low values
What we need in our system – 2

High Quality Thickness Products

- Model overestimates SIT in the Beaufort Gyre with/without SIC assimilation
- Spatial variation of SIT north of the Greenland and Canadian Archipelago is hard to simulate in model
- Including SIT data assimilation may solve these problems?
What we need in our system – 3

**Ice Drifting velocity**

- Validation of reanalysis product
- Assimilation to correct model SIT bias

**ORAP5 Ice velocity (2009 March)**

**GlobICE (2009 March)**

ASAR WS scenes from the Envisat
Remarks & Conclusions

- We use SST and SIC from OSTIA products

- Need of reliable and consistent datasets

- Products we need: are some of them already operationally available?
  - Satellite Projection SST and SIC:
    - *We would like to test the L2 hourly SST products: any suggestions?*
  - Data without consistency check between SST and SIC
  - High Quality Thickness Products
  - Ice Drift

- Is there a minimum size of melt ponds to detect them?