



ProbaCast: **Exploring the potential for probabilistic forecasting in *myOcean***

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MY OCEAN

Marine
Core
Service

Ensemble simulations

- 1. Probabilistic forecasting & ensemble methods:**
 - a. Initial condition errors & non-linear processes**
 - b. Model imperfections:**
 - parameterizations, numerical schemes**
 - c. Forcing imperfections:**
 - atmospheric input, bottom topography**



Marine Core Service

About *ProbaCast*

Primary objective:

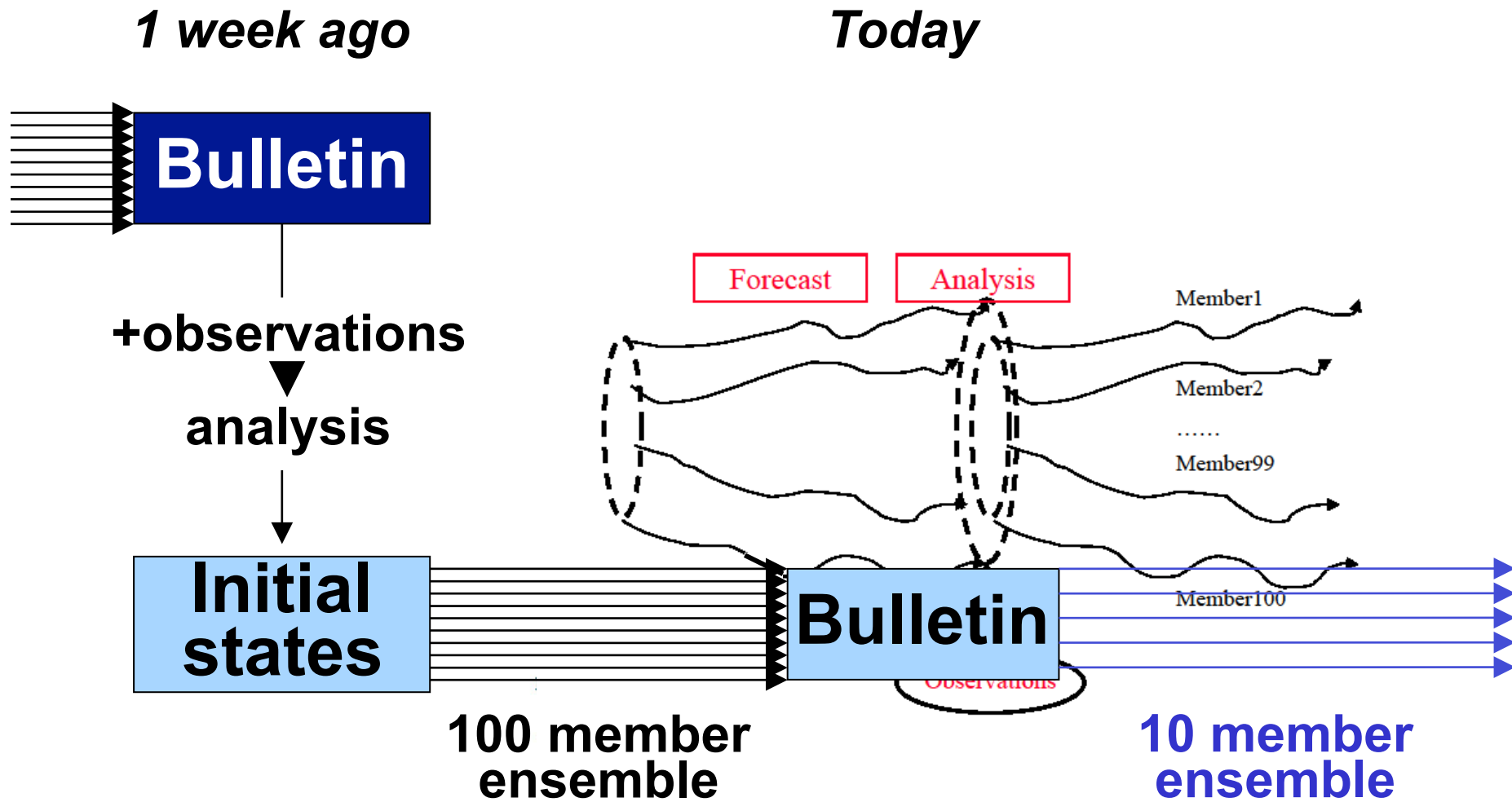
- To lay a foundation for probabilistic forecasting in the MyOcean project and beyond

Secondary objectives:

1. To validate probabilistic forecasting for one or two selected products, based on results from ensemble simulations in myOcean's Arctic Monitoring and Forecasting Centre
2. To implement a prototype for probabilistic forecasting in the closing months of myOcean

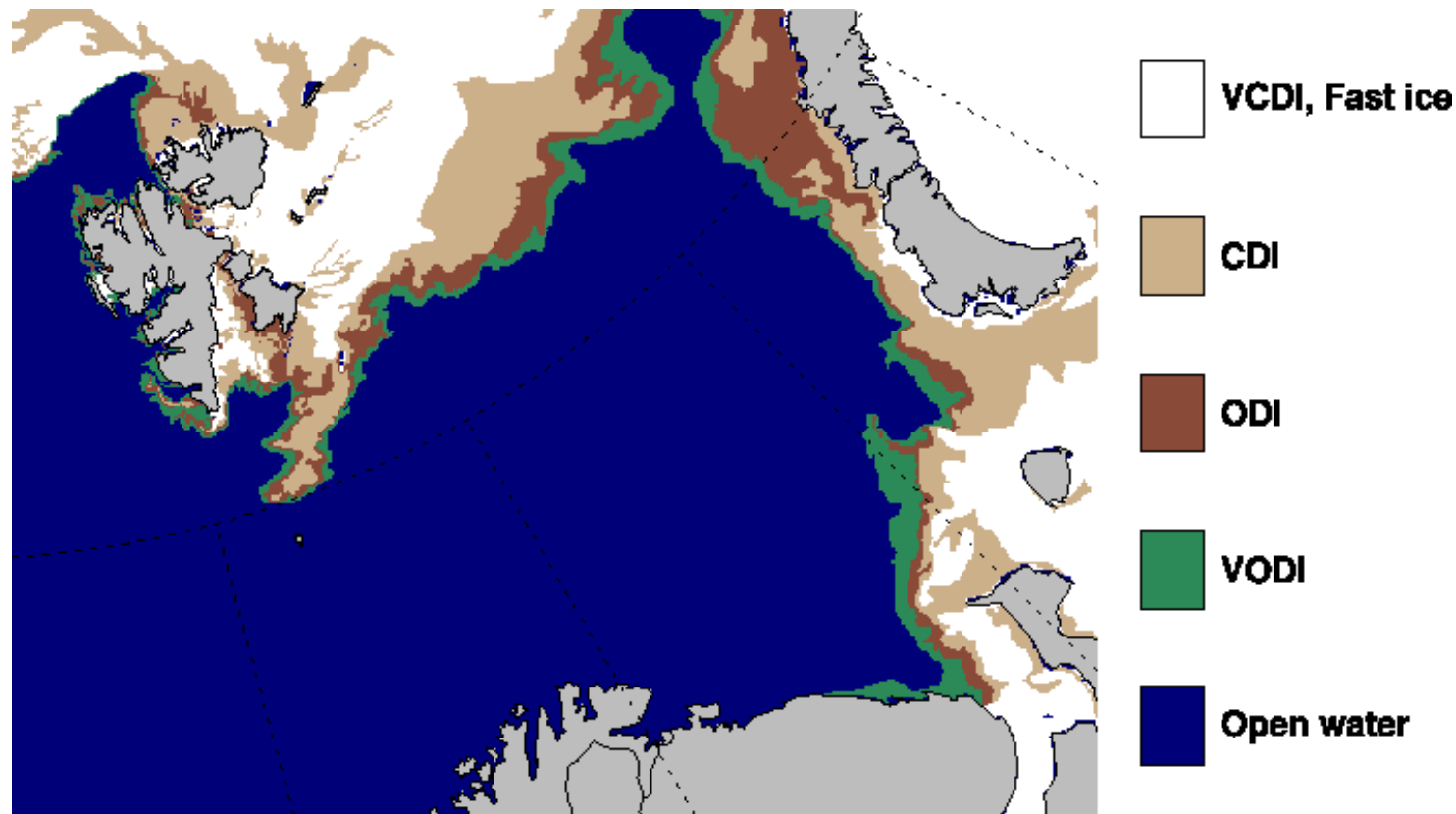
- A data assimilation system using
 - the HYbrid Coordinate Ocean Model (HYCOM)
 - a dynamic-thermodynamic sea ice model
 - an Ensemble Kalman Filter (EnKF) for assimilation
- Horizontal resolution: 9.9-16.6 km (variable, Arakawa C)
- Vertical discretization: 22 hybrid layers (moving)
- Physics, parameterizations:
 - Bi-harmonic viscosity, Laplacian & bi-harmonic diffusion
 - K-Profile Parameterization (KPP) for vertical mixing
 - Linear bottom friction
 - Jerlov water type 1
 - Elastic-Viscous-Plastic (EVP) ice rheology

A TOPAZ cycle @ ARC-MFC

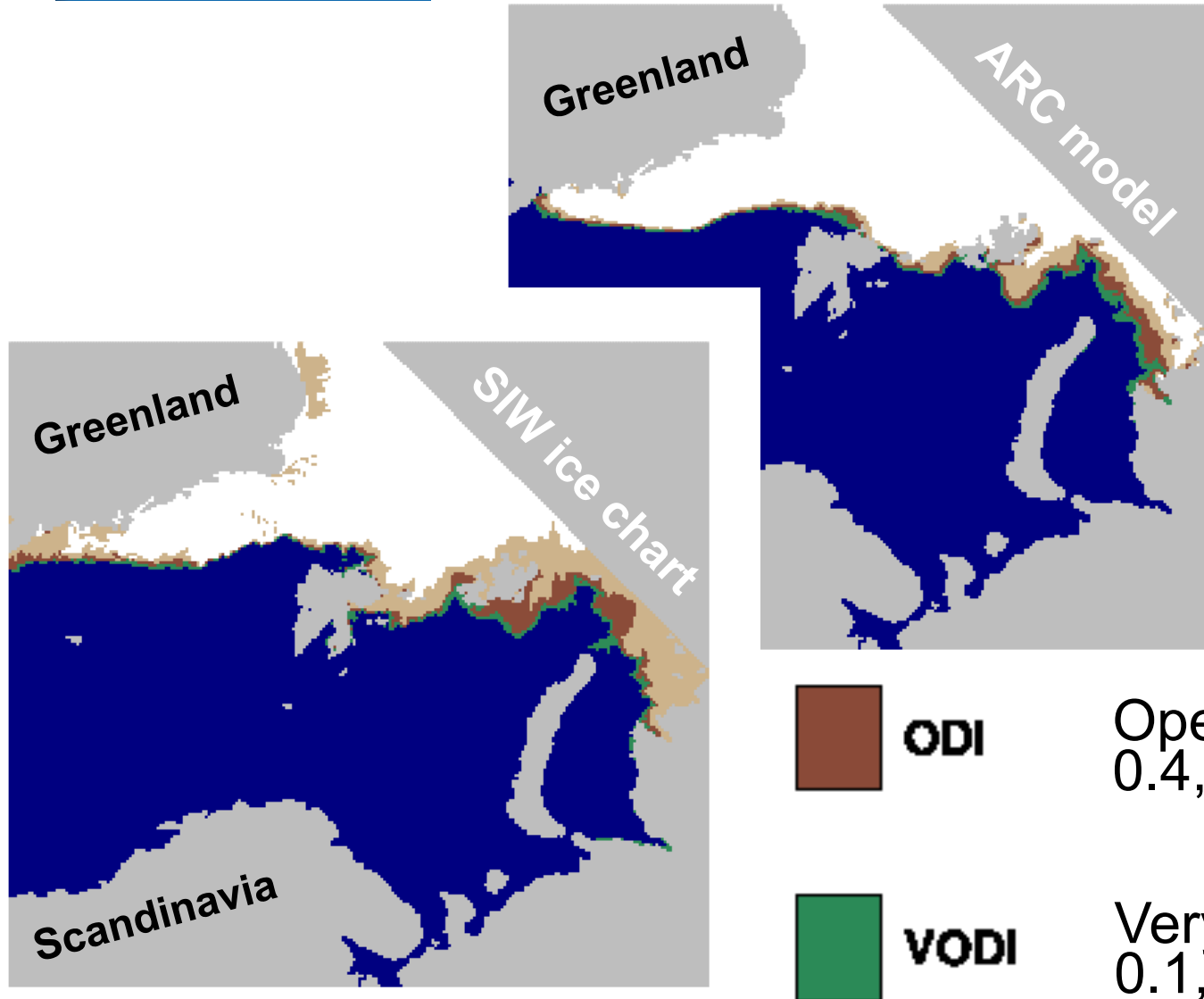


Validation – sea ice chart sample

Sample of daily 1km product. From myOcean's SIW-TAC; data mostly based on SAR scenes.



Sample results – model vs. data



ODI

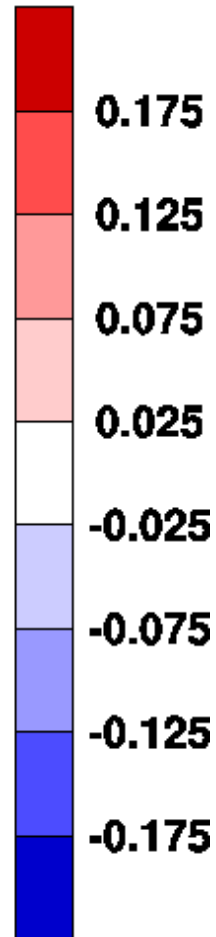
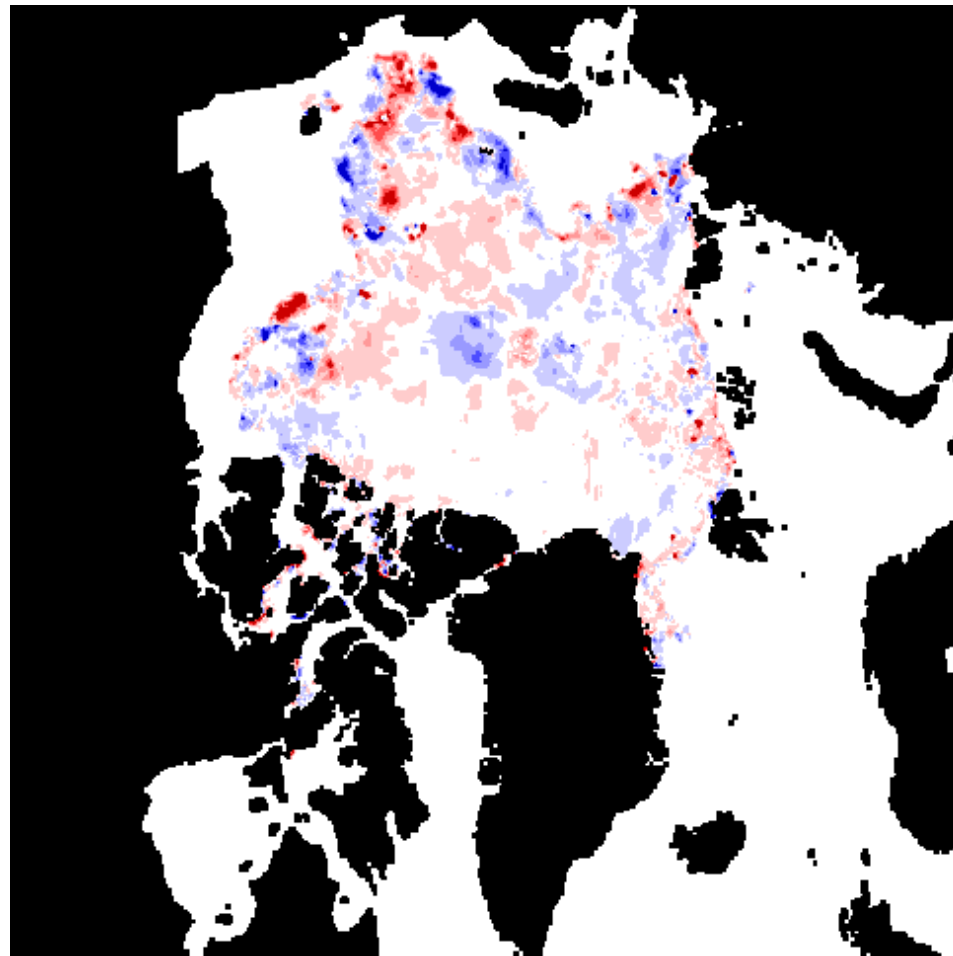
Open Drift Ice:
0.4, 0.5, 0.6



VODI

Very Open Drift Ice:
0.1, 0.2, 0.3

Evolving differences



**Differences
in sea ice
concentration
between two
ensemble
members.**

**Snapshots are
for every two
days during a
16 day period,**

A *ProbaCast* test-bed

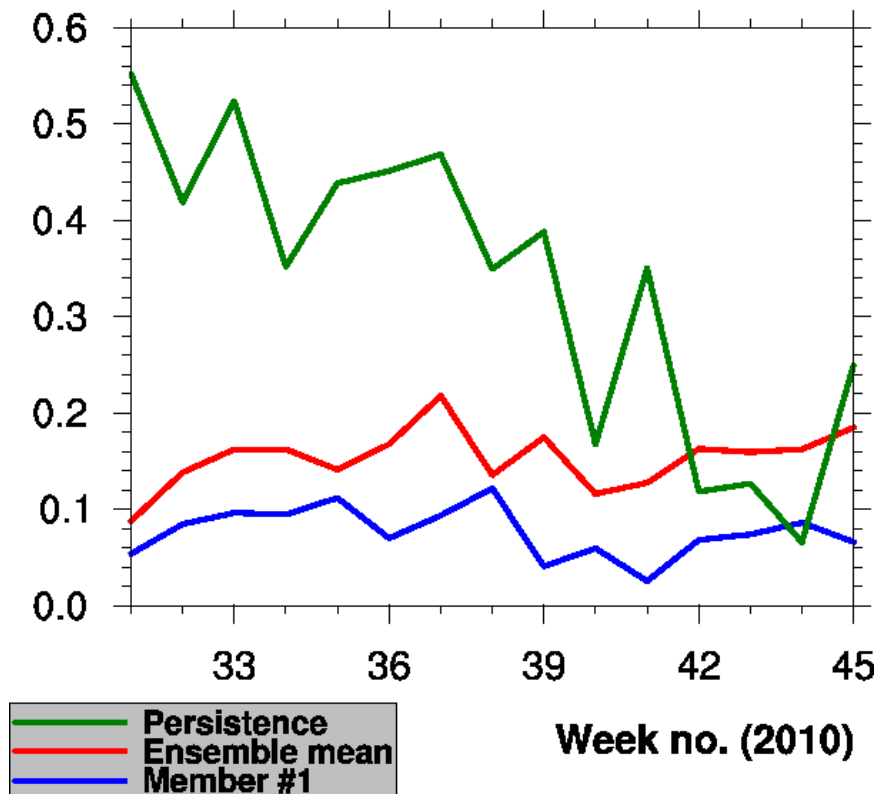
- **Product:**
Probability forecasts for WMO sea ice classes
- **Relevant user activity:**
Off-shore operations that are sensitive to presence of sea ice
- **Forecast variables:**
 - **Very Open Drift Ice** (ice concentrations 0.1, 0.2, 0.3)
 - **Open Drift Ice** (ice concentrations 0.4, 0.5, 0.6)

15 weeks' results w/ V0

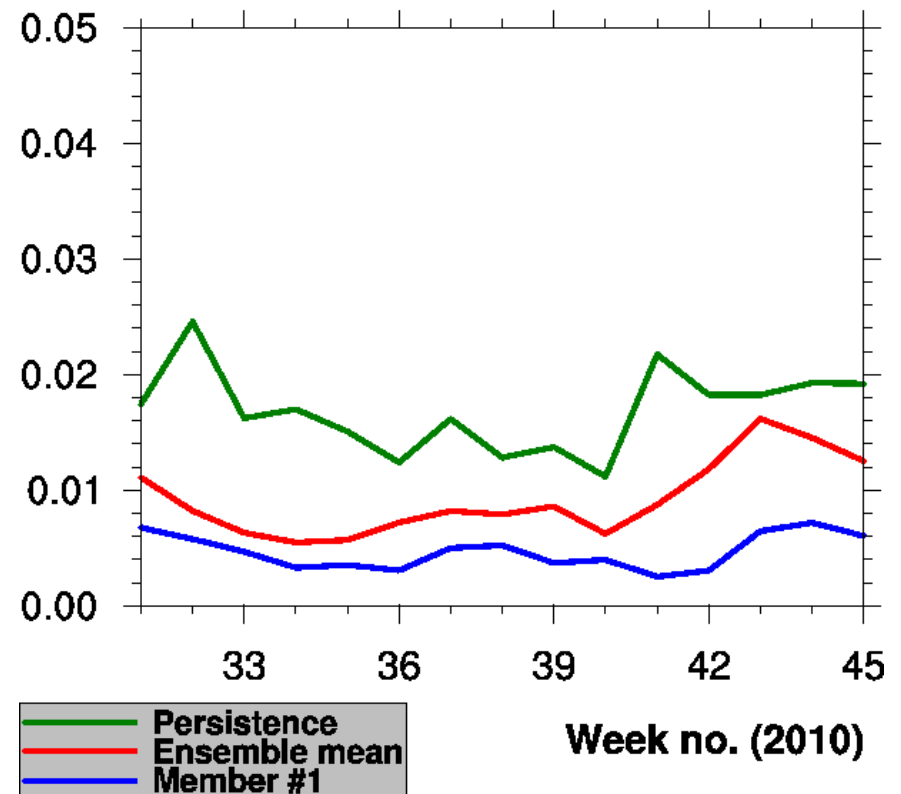
Traditional products for Very Open Drift Ice:

Forecast/observations for analysis + 6 days

VODI Hit rate



VODI False alarm rate

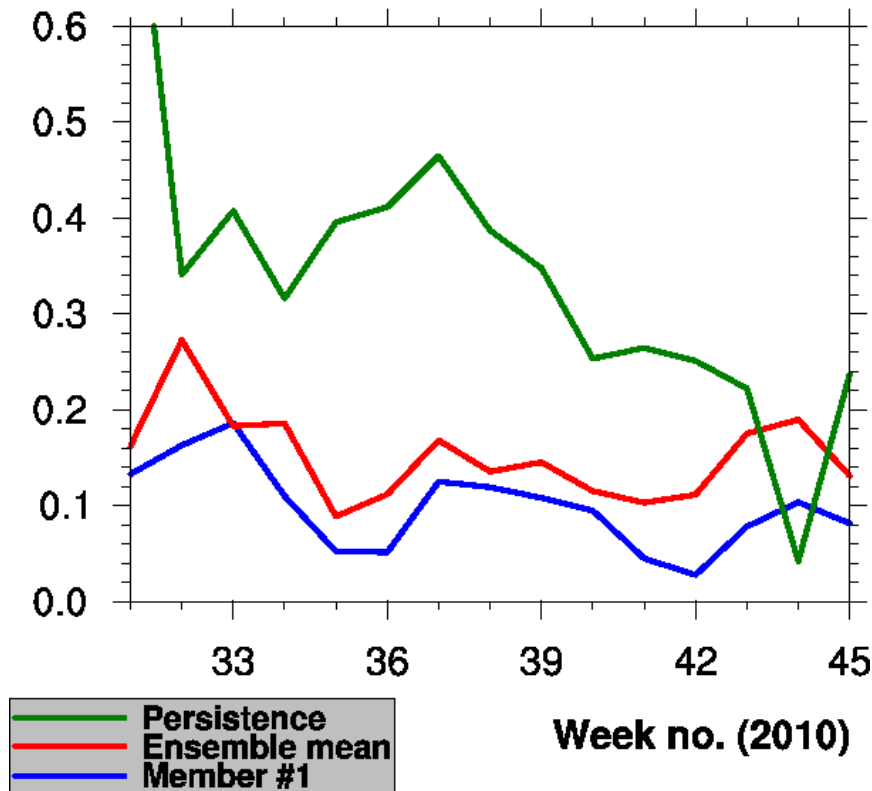


15 weeks' results w/ V0

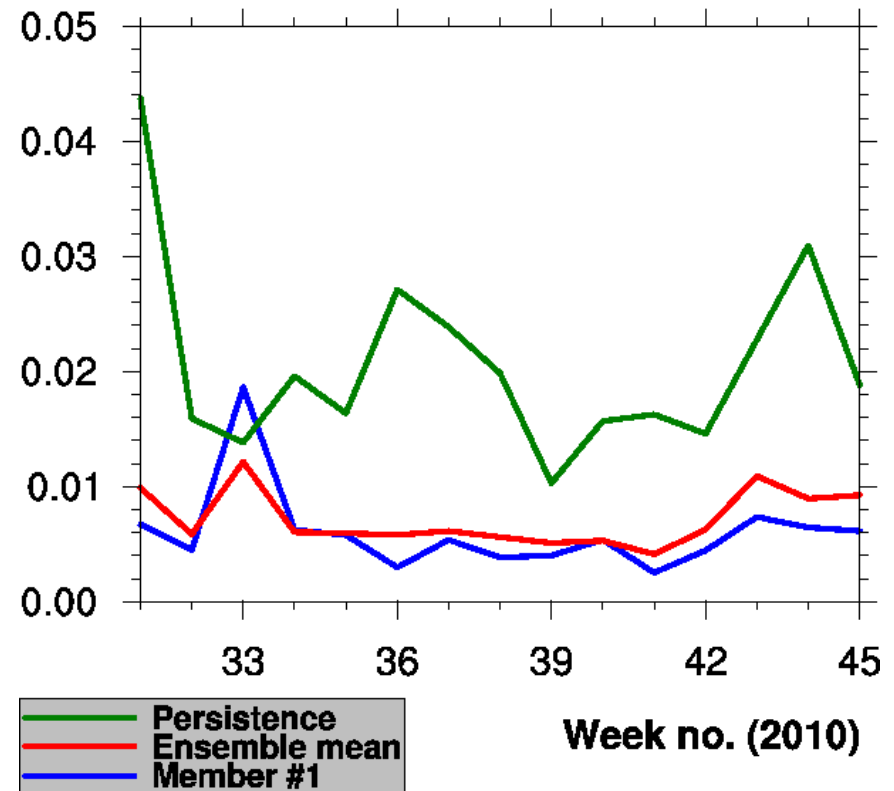
Traditional products for Open Drift Ice:

Forecast/observations for analysis + 6 days

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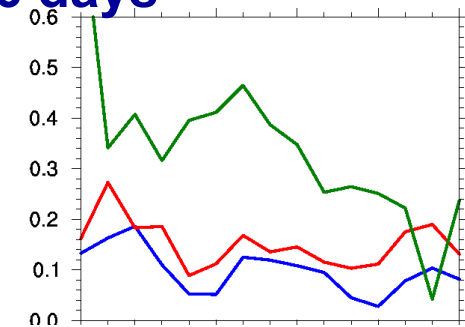
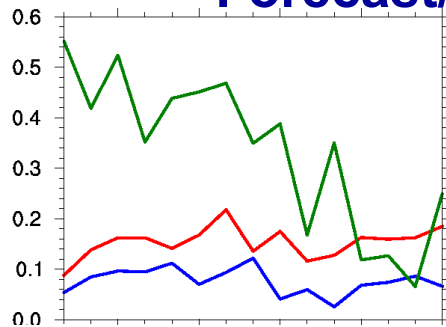
ODI False alarm rate



15 weeks' results w/ V0

Confusion matrix (aggregated)

Forecast/observations for analysis + 6 days



VODI

True	positive	718 1421 3091	1746 3448 6296	False	positive
	negative	8634 7931 6261	371342 369640 366792		
				True	negative

ODI

1092 1678 3971	2234 2655 7660
10048 9462 7169	369066 368645 363640

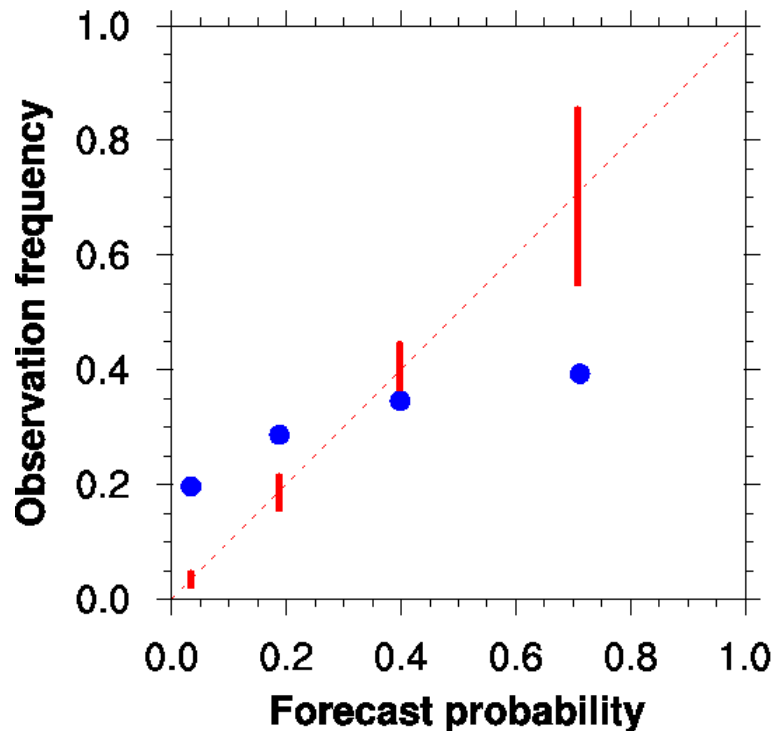
15 weeks' results w/ V0

Reliability diagram

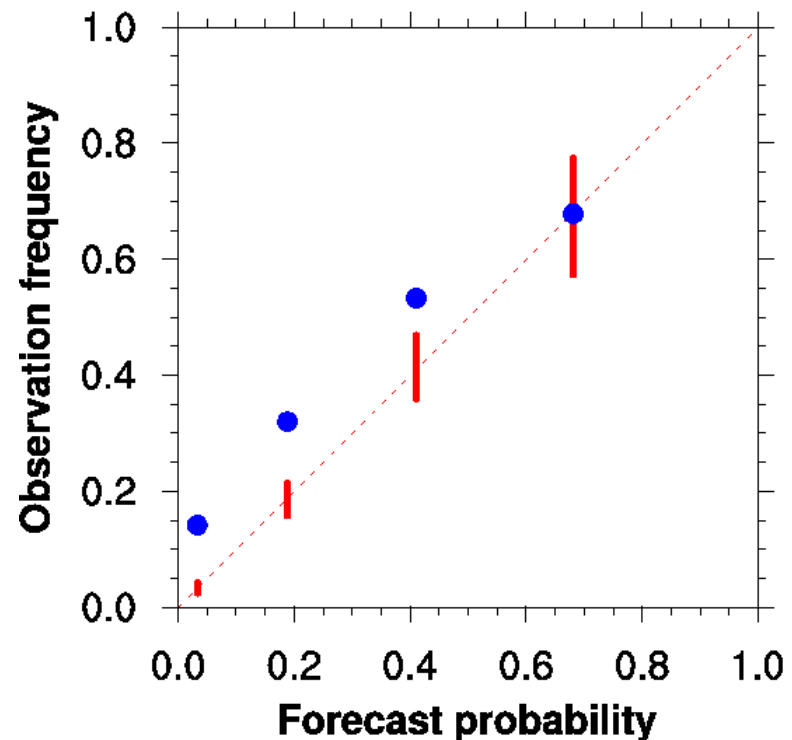
Forecast/observations for analysis + 6 days

Reliability bins: $<0, 0.1]$, $<0.1, 0.3]$, $<0.3, 0.6]$, $<0.6, 1]$

VODI reliability diagram, week 32



ODI reliability diagram, week 32

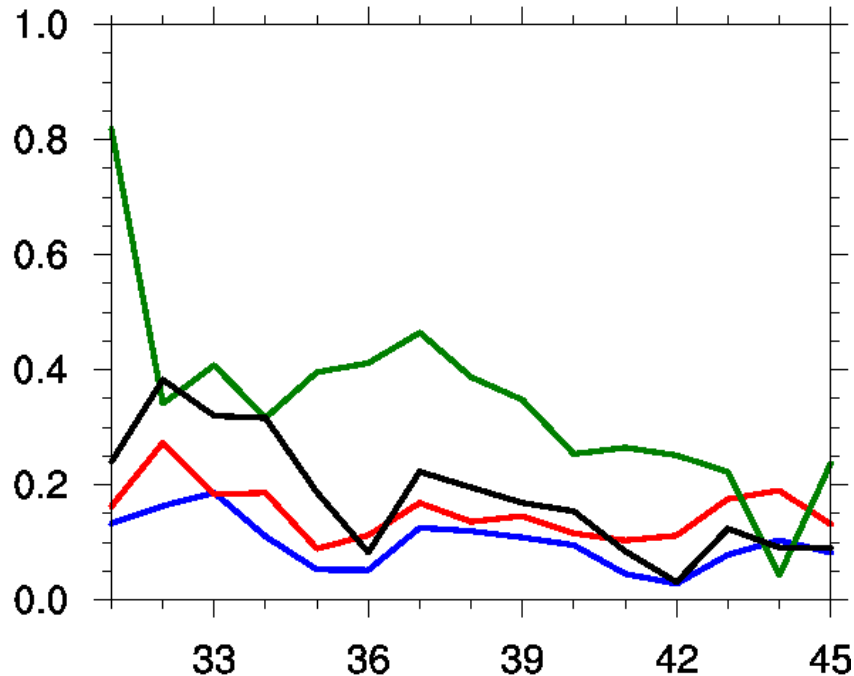


15 weeks' results w/ V0

Ensemble ODI product – alarm issued when $p > 0.2$

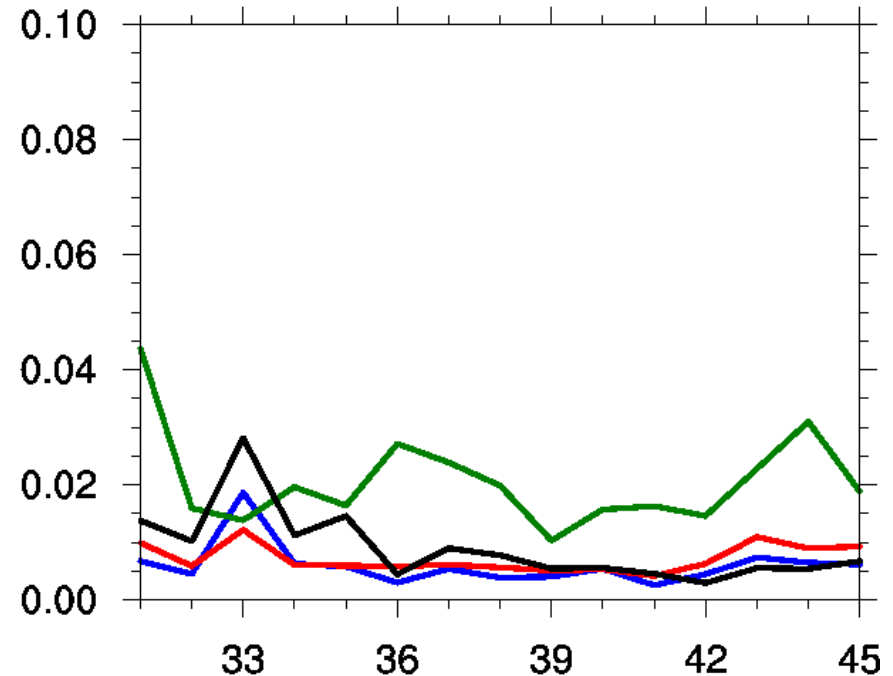
Forecast/observations for analysis + 6 days

ODI Hit rate



Week no. (2010)

ODI False alarm rate



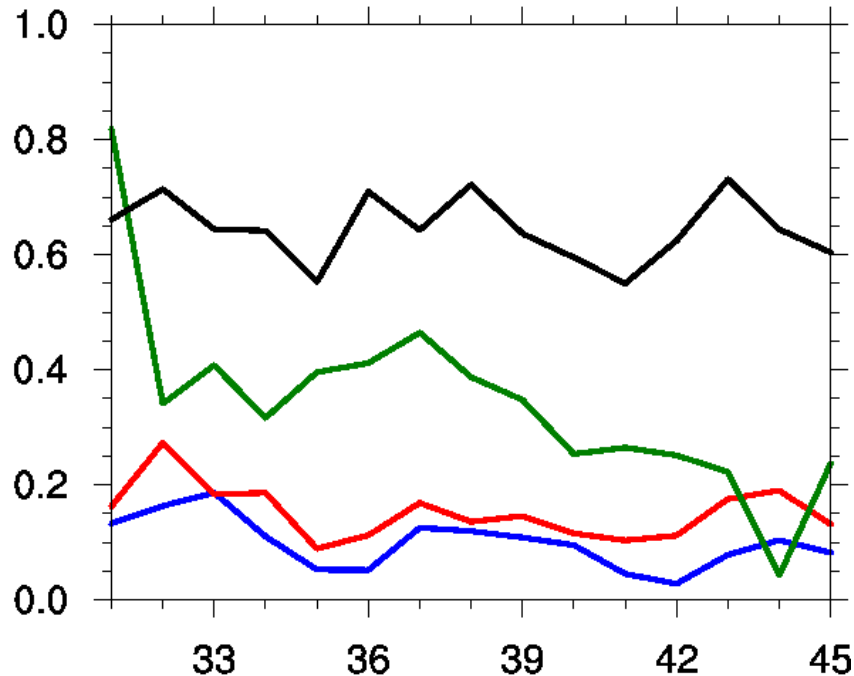
Week no. (2010)

15 weeks' results w/ V0

Ensemble ODI product – alarm issued when $p > 0$

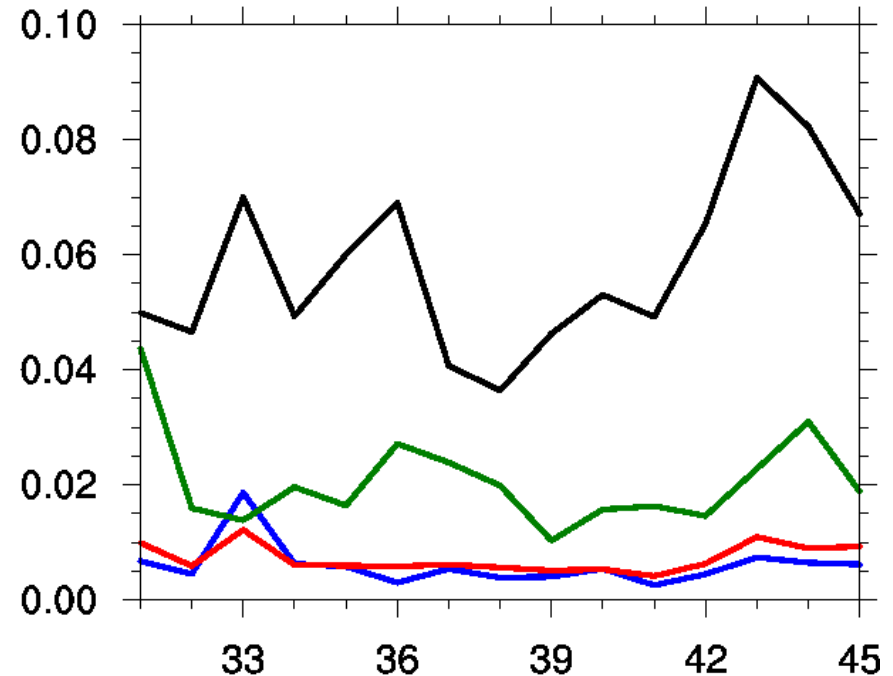
Forecast/observations for analysis + 6 days

ODI Hit rate



Week no. (2010)

ODI False alarm rate



Week no. (2010)

Concluding remarks

- **Status, myO R&D project *ProbaCast***
 - **Ensemble results stored since 2010-08**
 - **Software for post-processing, analysis available**
 - **V1 presently being adapted for *ProbaCast***
- **ARC-MFC V0 ensemble product for sea ice concentration only improves hit rate on expense of increasing #false alarms**
- **Seasonal variability in MIZ extent, motion not yet captured by ensemble time series**



...that's all!

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