Norwegian
Meteorological Institute
met.no

Evaluation of the components of an operational ocean forecasting system

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Background:

Development of an
ocean forecasting system
for the Arctic & northern Nordic Seas
in the EU project myOcean

Present purpose:

Identify the weakest link/ the limiting
factor for forecast quality

**Implementation and development is
a joint NERSC/met.no effort**

Validation data

SST data from drifting buoys

Period:

  2009-10-01 – 2010-03-31

Domain:

  Atlantic Ocean > 45 °N

  Arctic Ocean

  adjacent shelf seas

Data product:

  daily averaged SSTs

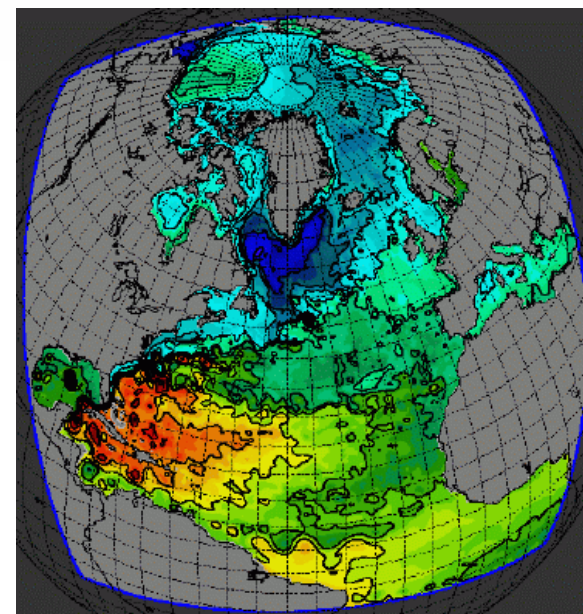0 100 500 1000 1500 2000 2500
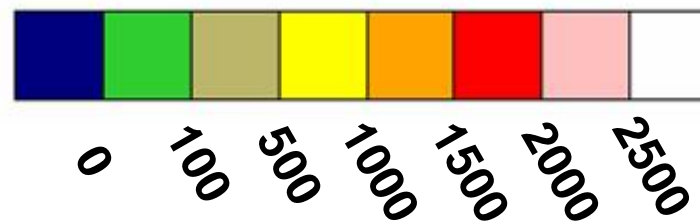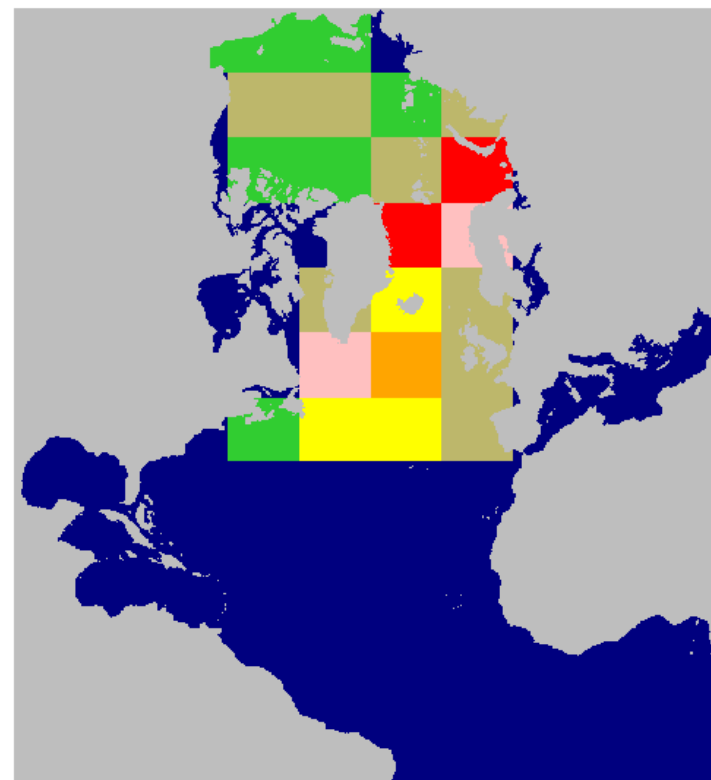
Ocean forecasting system

Production System: TOPAZ

- HYCOM core: v. 2.1

- NERSC sea ice model

- Assimilation: Ensemble Kalman filter

- Model domain: displayed to the right, 9.9-16.6 km; 22 hybrid layers

- Forcing:

  - Atmospheric forcing from ECMWF

- Physics:

  - K-Profile Parameterization (KPP) for vertical mixing

From *msc.nersc.no*

TOPAZ
Production Cycle

a.d.   analysis   a.d.

- 7   day (a.d.)   + 17

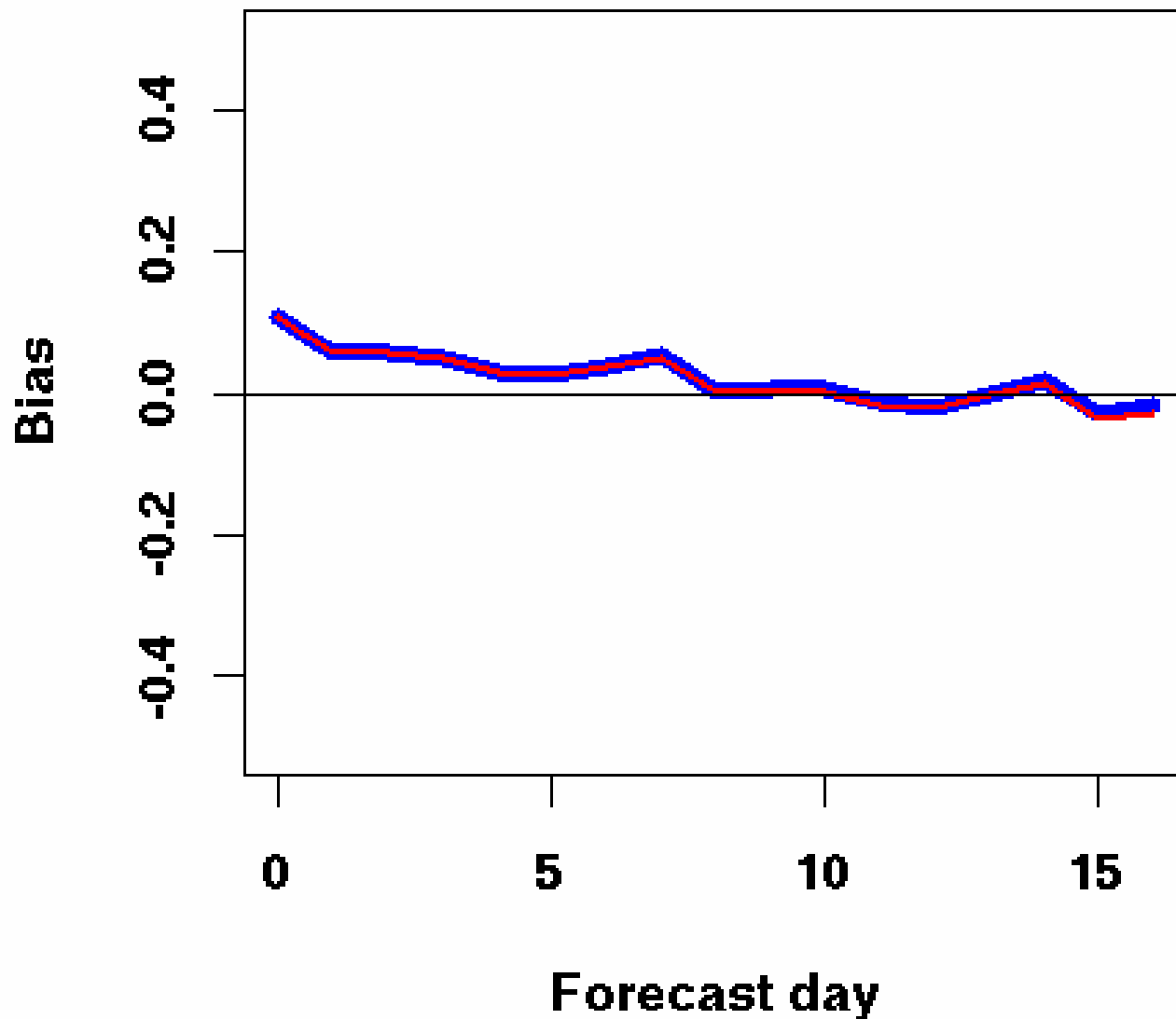**forecast #1 @a.d.+6**
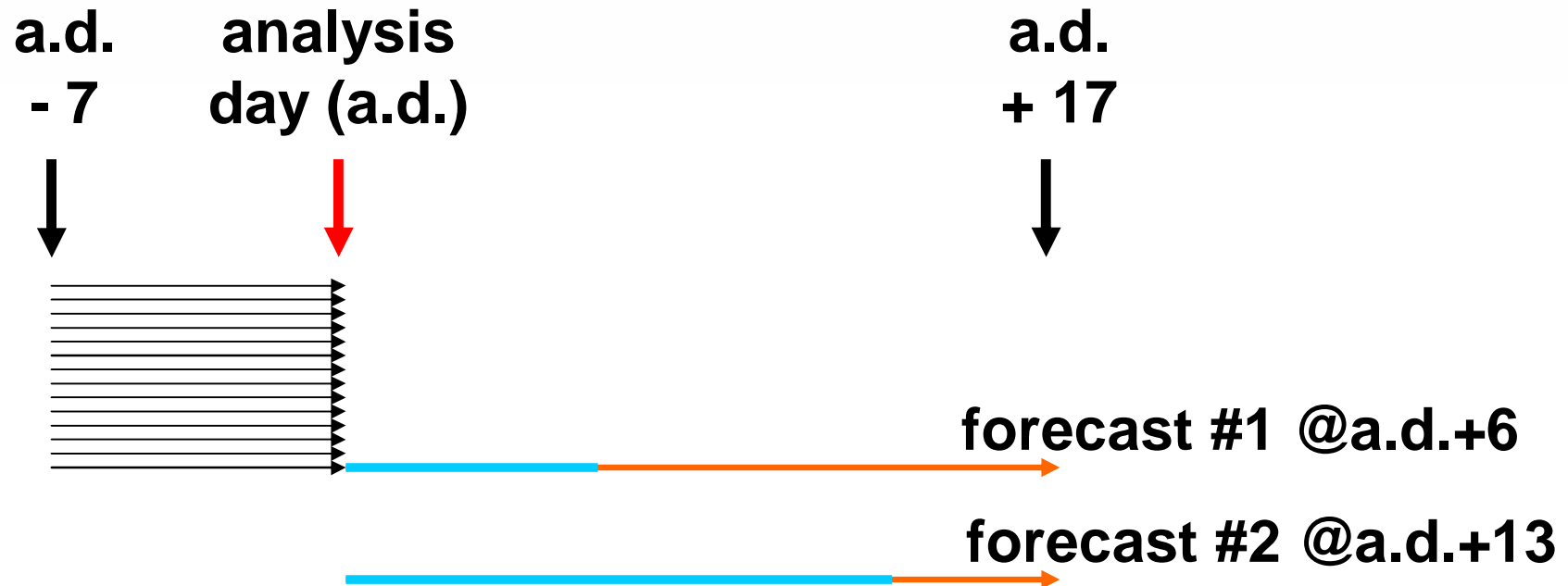
forecast #2 @a.d.+13

Blue line: model forced w/ atmospheric analysis fields
Orange line: model forced w/ atmospheric forecast fields
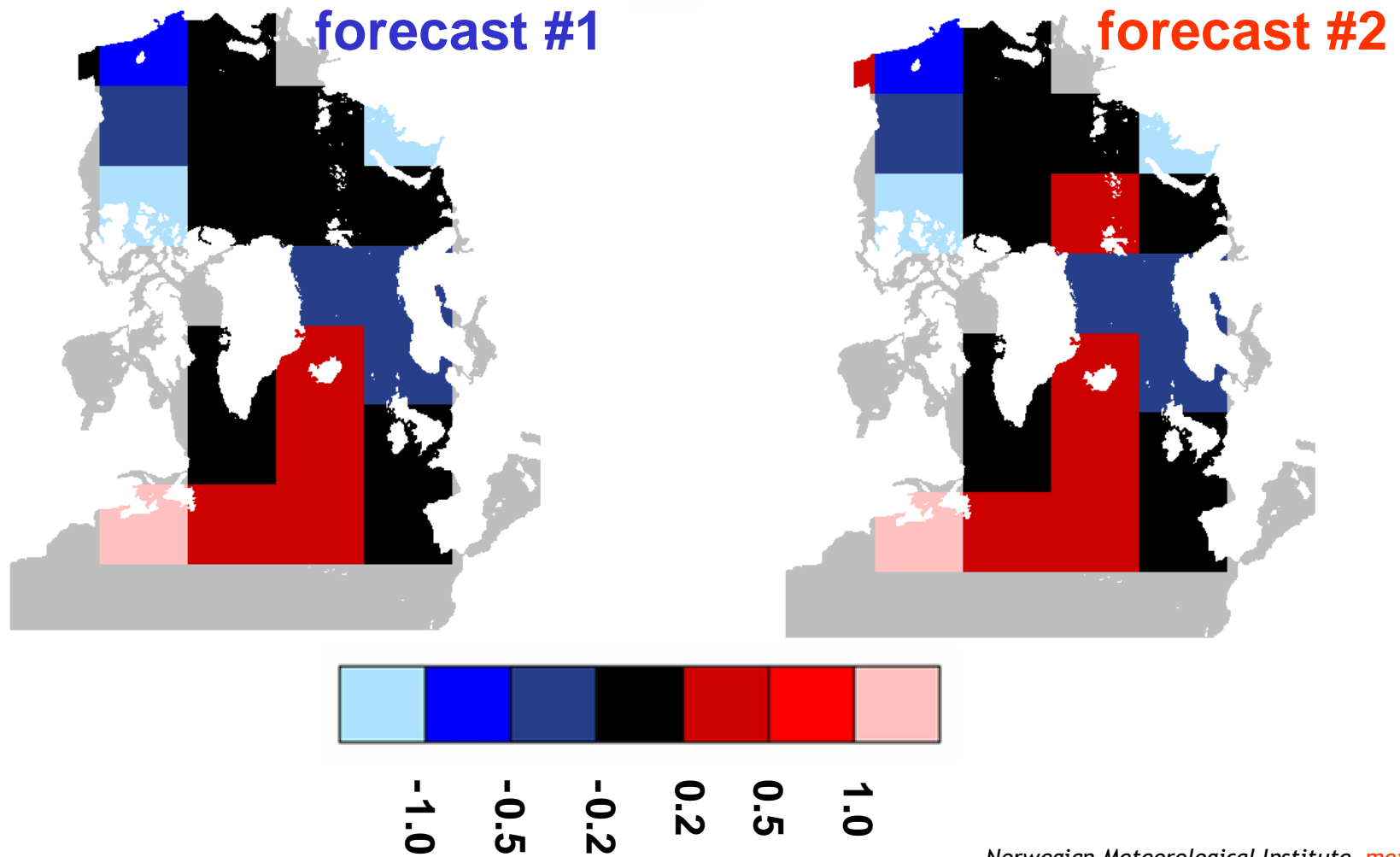
Model results vs. buoy data: Bias

Blue line:
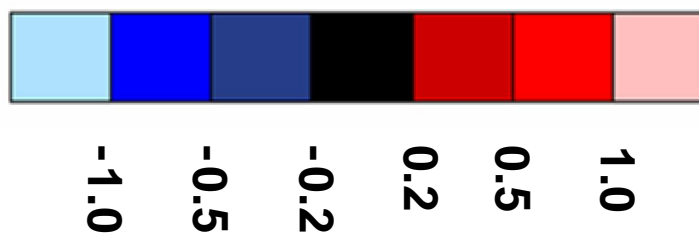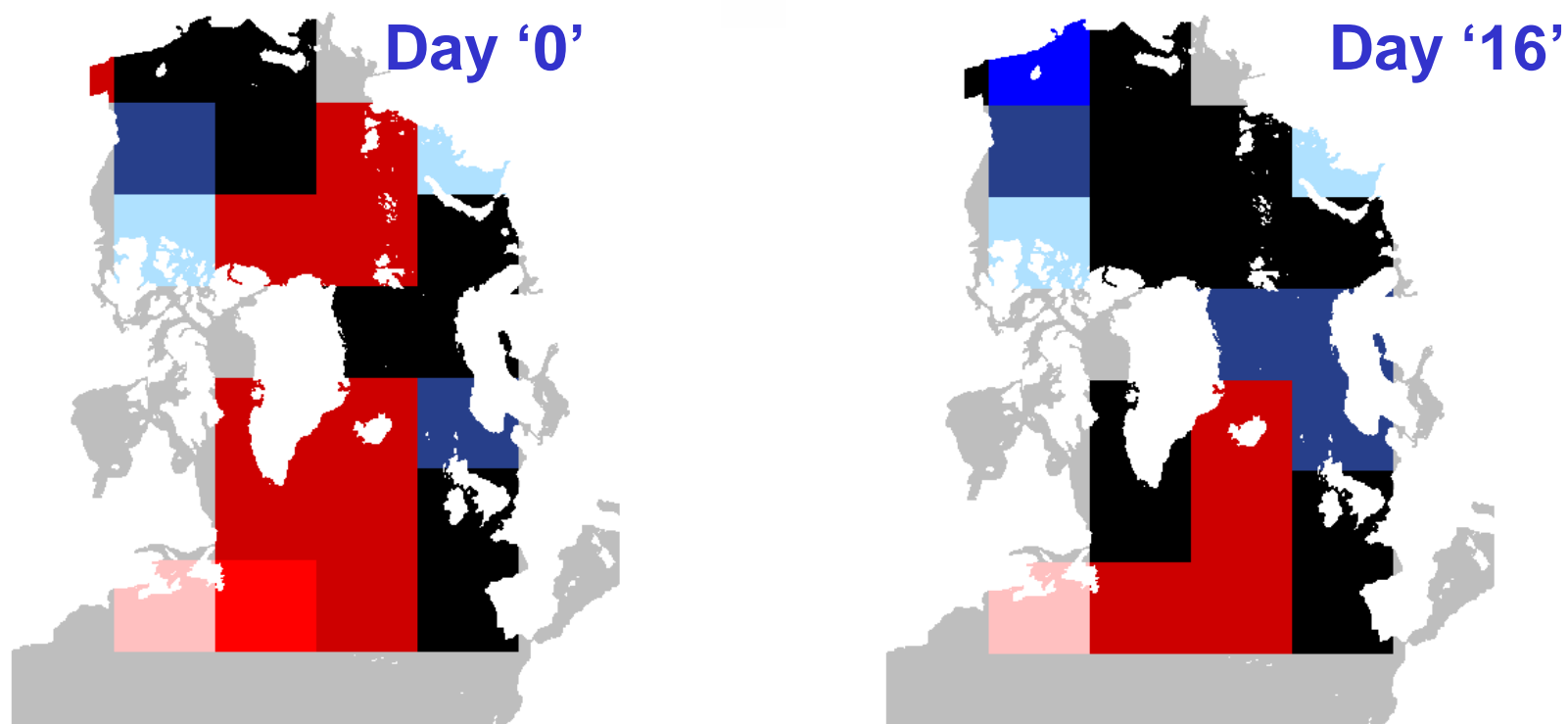 forecast #1

Red line:
 forecast #2

Model results
vs. buoy data:
Bias by regions I: last forecast day

forecast #1

forecast #2

-1.0	-0.5	-0.2	0.2	0.5	1.0	
-1.0		-0.5	-0.2	0.2	0.5	1.0

Model results
vs. buoy data:
Bias by regions II: evolution, forecast range

Day '0'

Day '16'

-1.0 -0.5 -0.2 0.2 0.5 1.0
-1.0 -0.5 -0.2 0.2 0.5 1.0

Model results
vs. buoy data: RMS
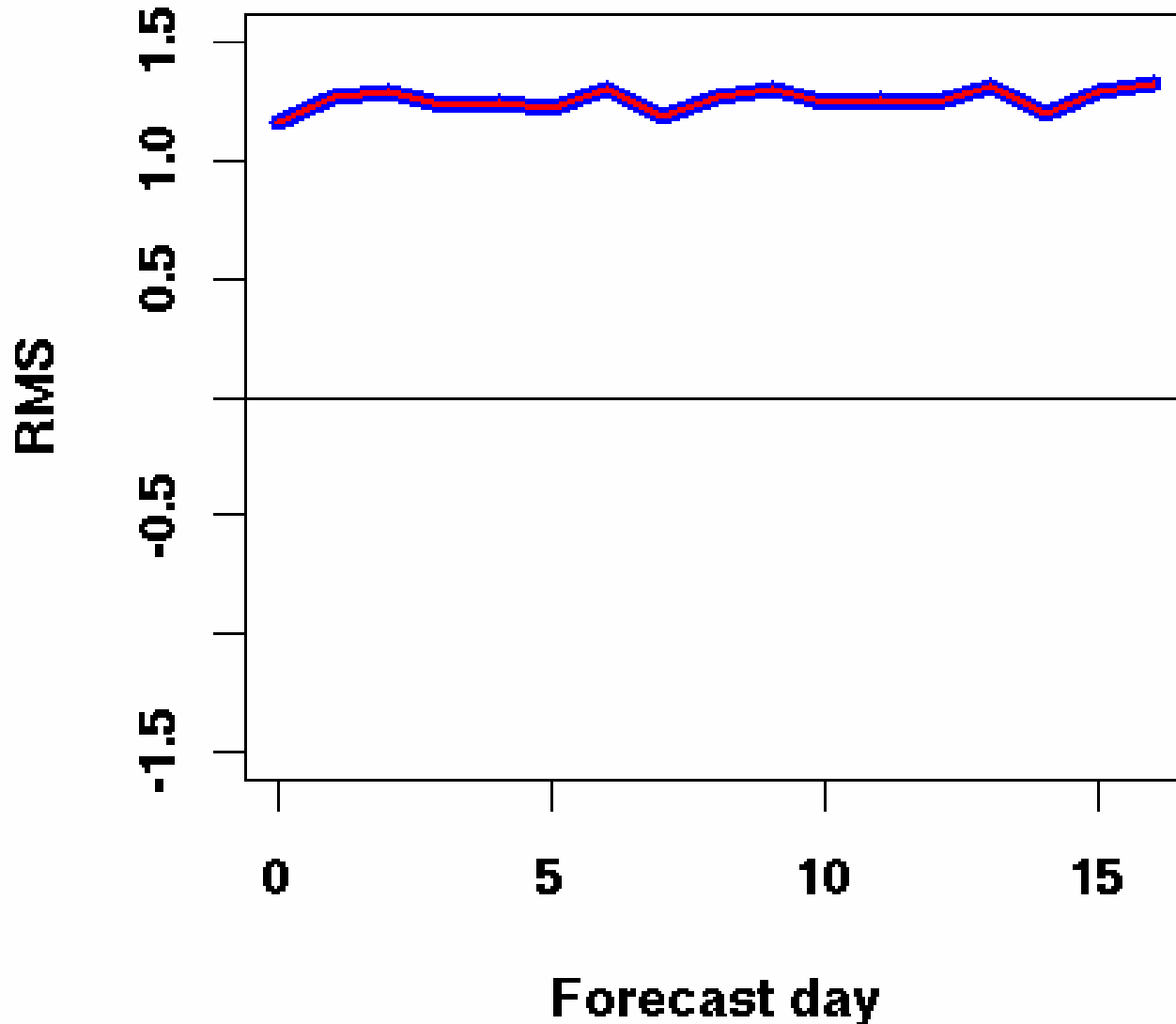
Blue line:
  forecast #1

Red line:
  forecast #2

Model results
vs. buoy data:
RMS by regions: last forecast day

forecast #1

forecast #2

No data 0.25 0.5 1.0 1.5 2.0 3.0
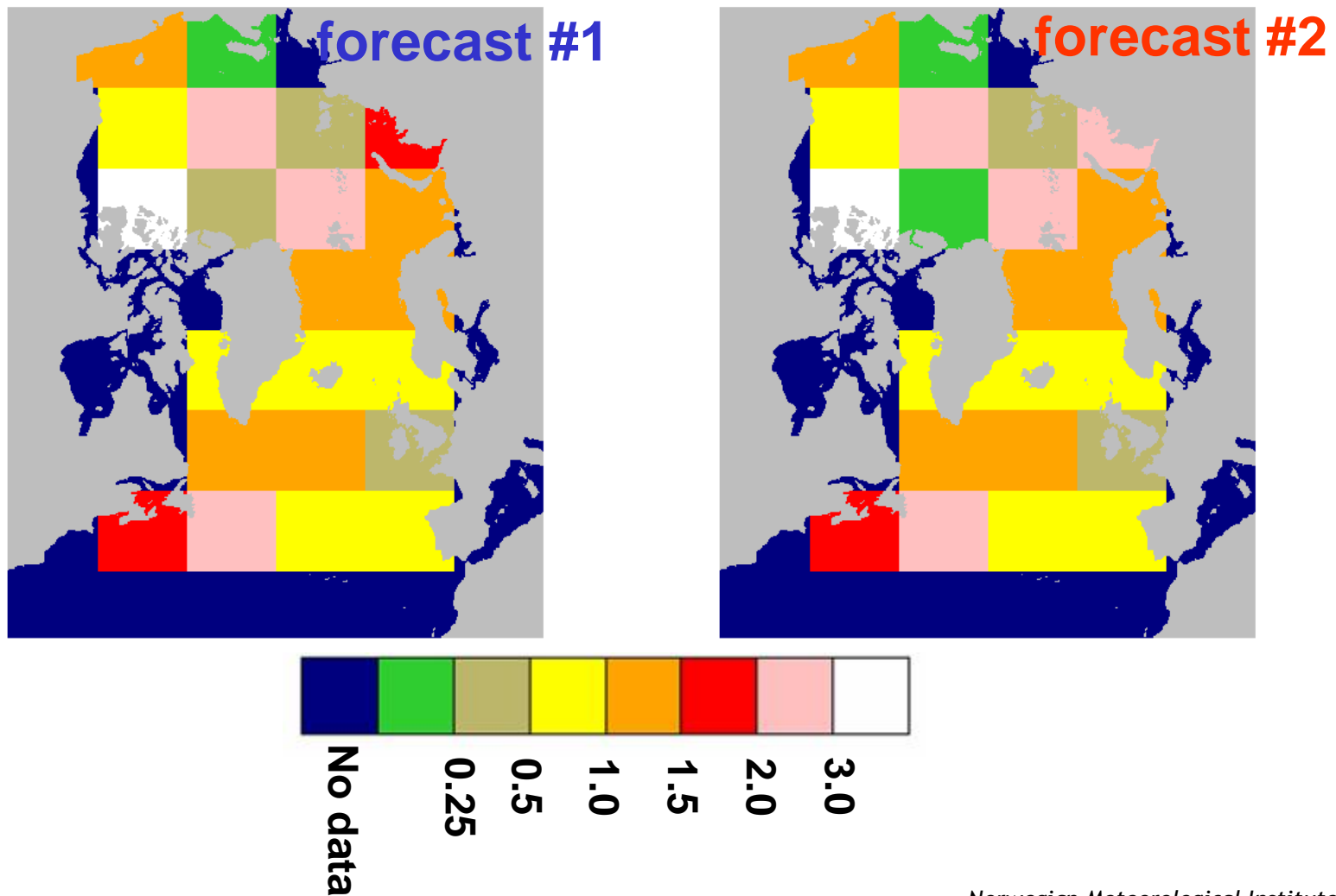
Preliminary conclusions

► analysis corrects a cooling trend in SSTs

► analysis has little effect on local errors

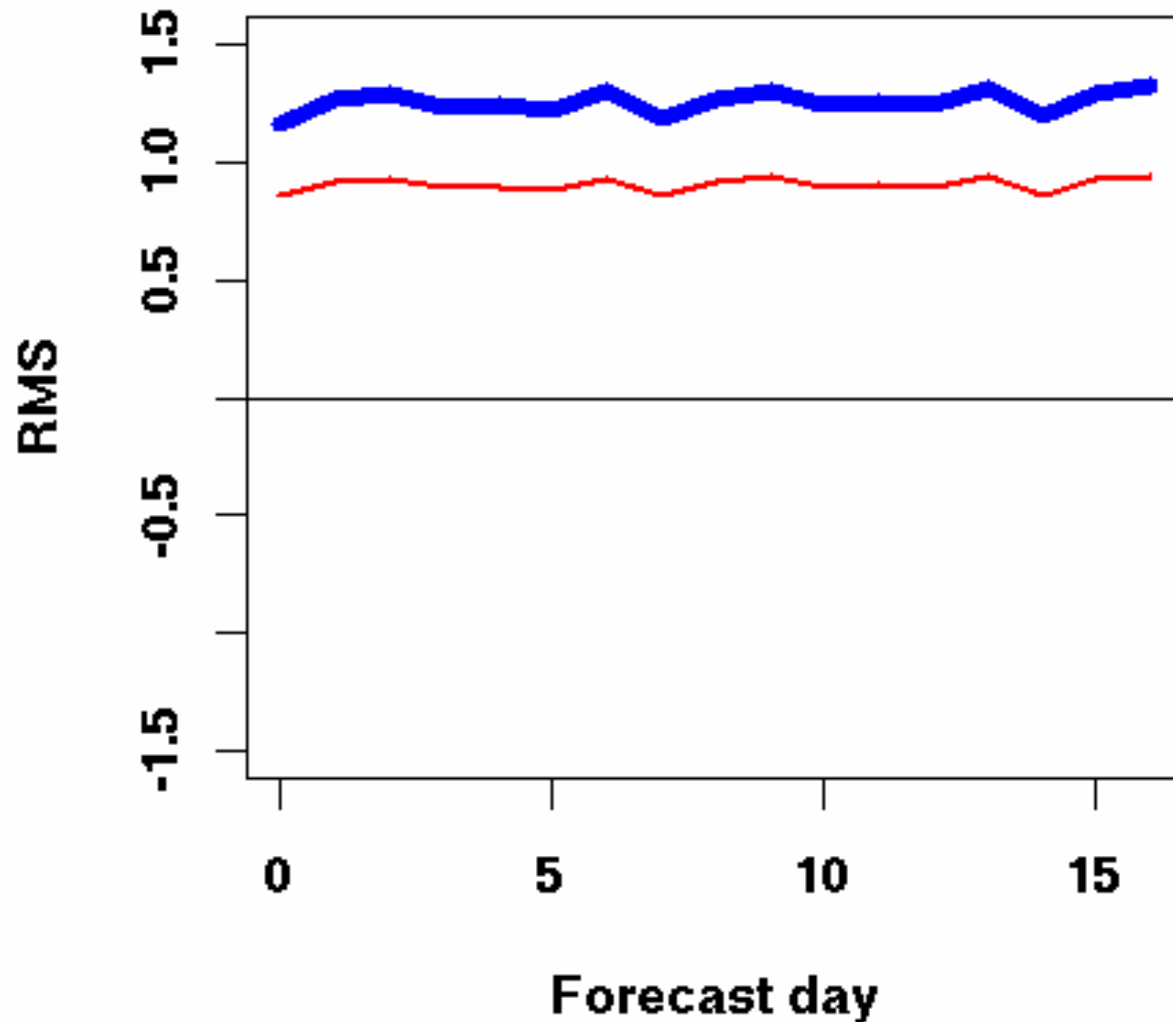► updated atmospheric forecasts has *no* effect on model results

Hypothesis

► quality of atmospheric forecast products so high that updates has no effect
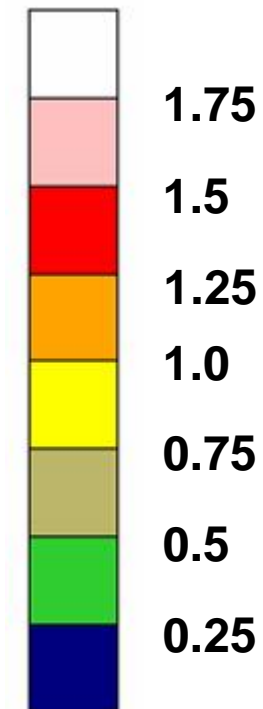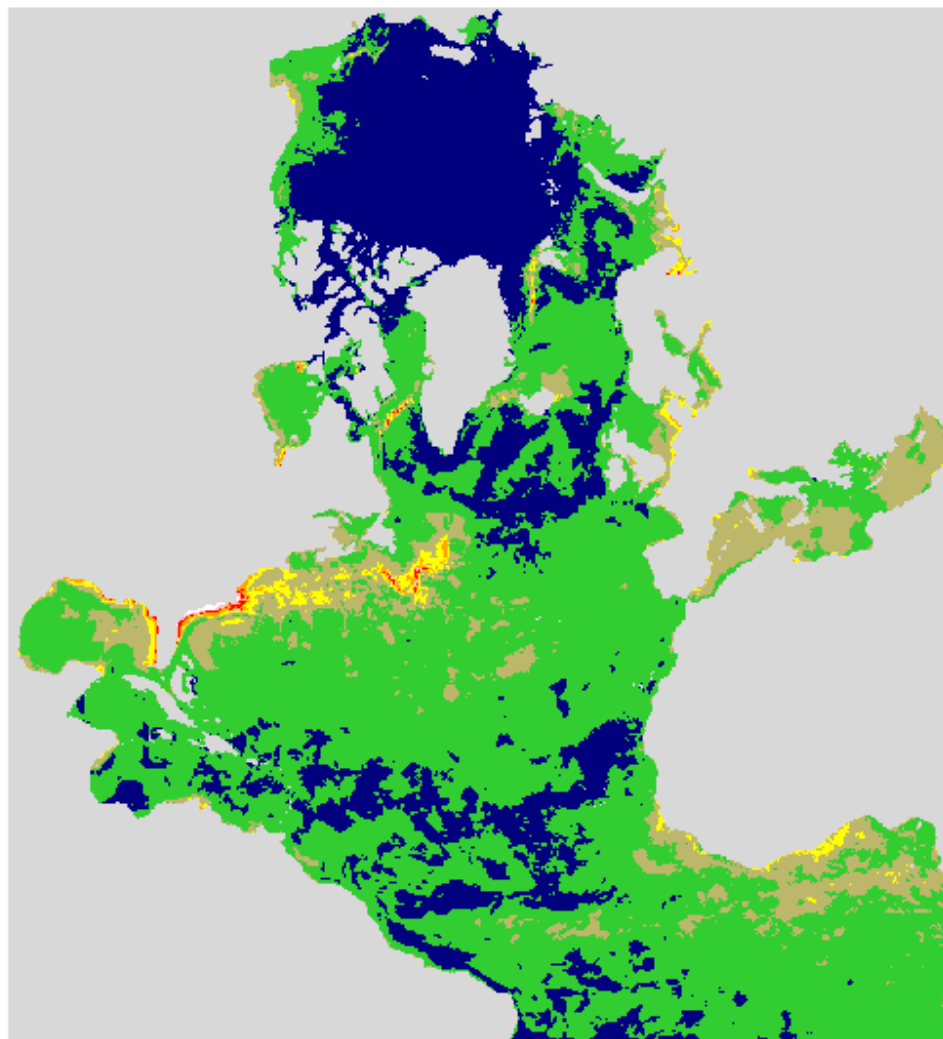
Model results
vs. buoy data: RMS, forcing offset

Blue line:
  forecast #1

Red line:
  forecast #1
  w/ 1 week offset
  in atm. forcing

Model results: variability
RMS of SST(t0 + 1 week) *vs.* SST(t0)

1.75
1.5
1.25
1.0
0.75
0.5
0.25

Buoy-by-buoy: variability
RMS of SST(t0 + 1 week) *vs.* SST(t0)
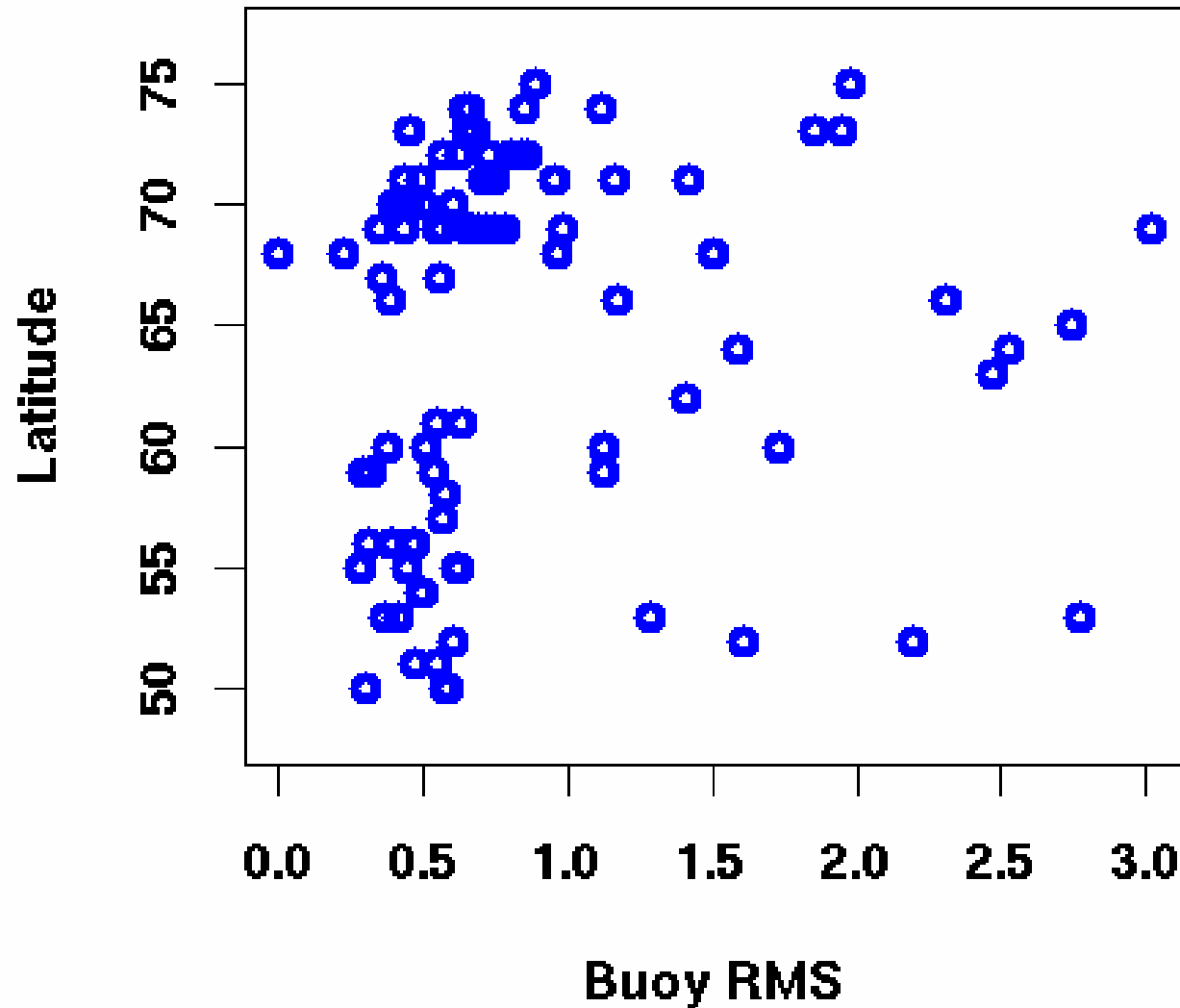
Conclusions

► too low synoptic variability in model

► room for improvement of analysis

► atmospheric forecasts not a limiting

   factor in present system

Actions

► upgrade from HYCOM v. 2.1 to v. 2.2

► upgrade data assimilation software

► monitor forecasting performance