PAG fall 2017 (06 November 2017, PMEL/NOAA in Seattle, WA, USA)

2017 Atmospheric State and Experimental Weather Forecast in the Arctic

Joo-Hong Kim

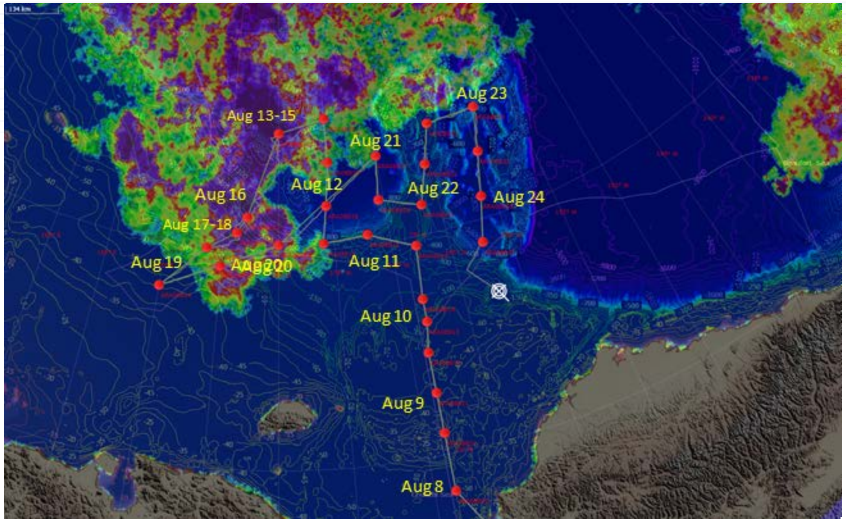
Korea Polar Research Institute

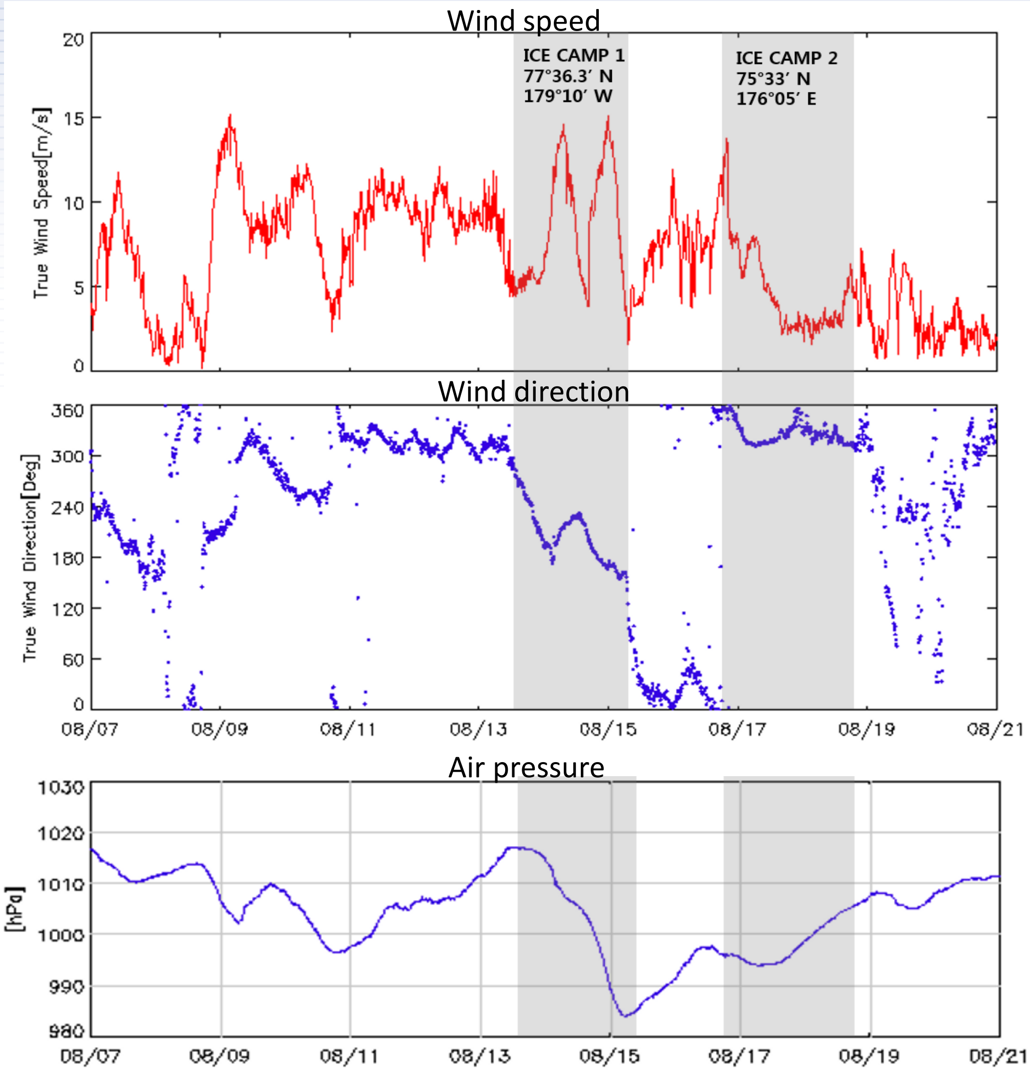
KOPRI 극지연구소

KOPRI

Korea Polar Research Institute

Atmospheric state along the Araon track



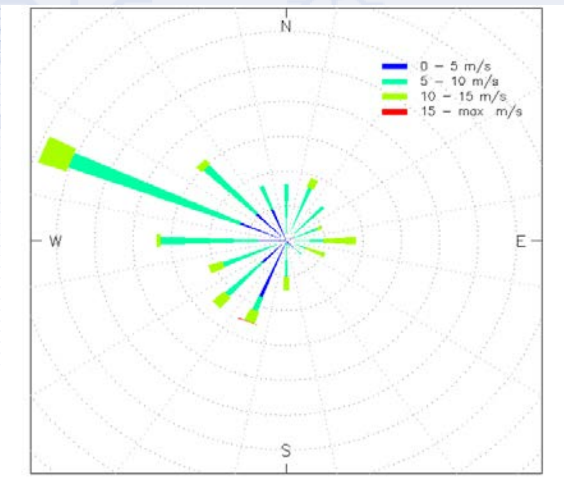


KOPRI 극지연구소

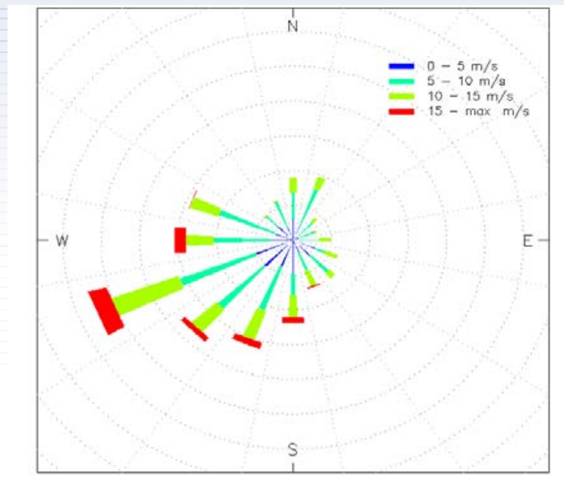
Interannual variability of Arctic atmospheric state

Araon observed near-sfc winds

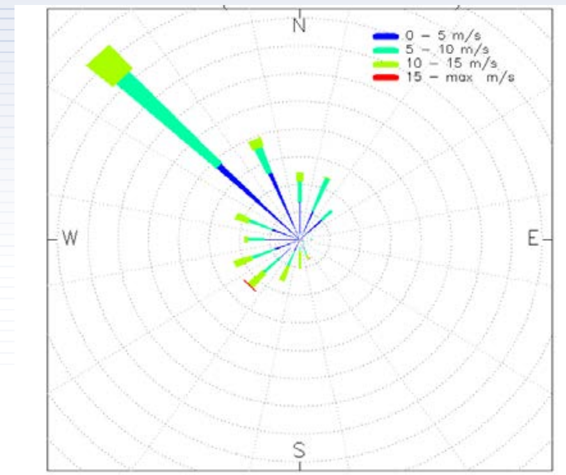
2015



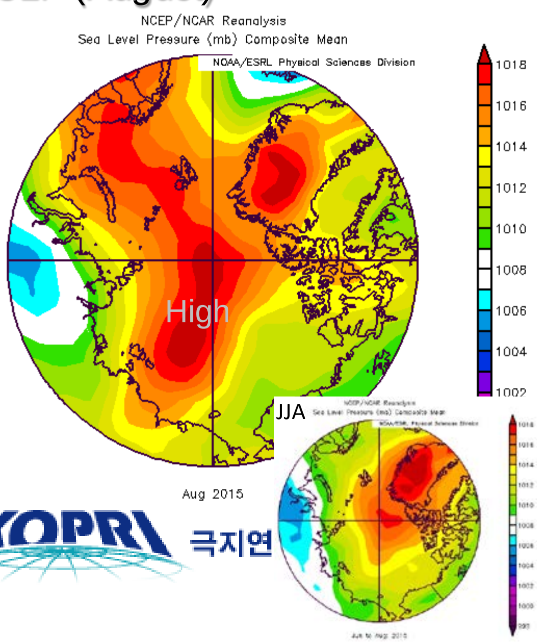
2016

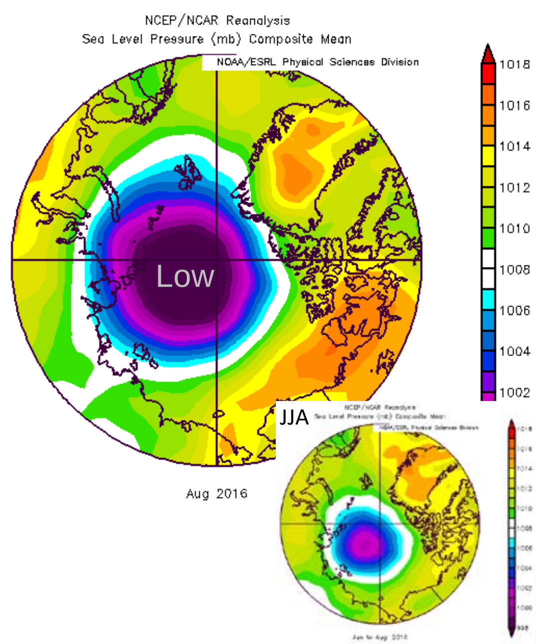


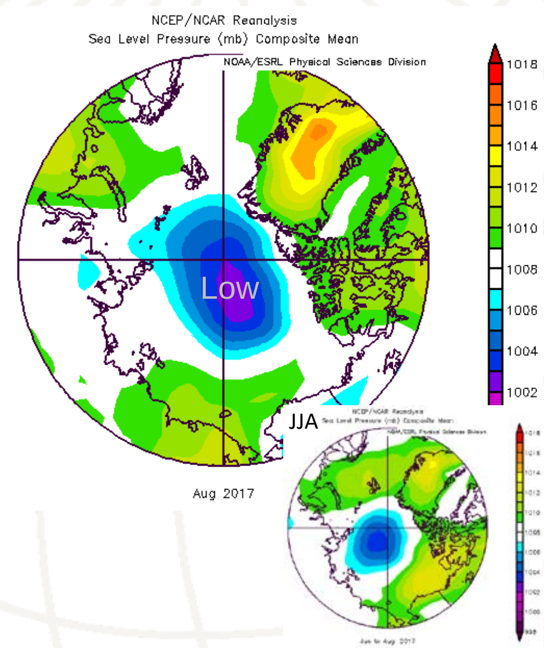
2017



NCEP SLP (August)







KOPRI 극지연

Radiosonde upper air observations on IBRV Araon

(2015) August 2 ~ August 20 (Only for the leg-1 period of Arctic cruise)

- Frequency
  - Twice daily (00, 12 UTC)
  - 4-times daily (00, 06, 12, 18 UTC) around the ice camp period (18 UTC 11 Aug. ~ 12 UTC 14 Aug.)
- Total number of launch: 50

(2016) August 5 ~ September 9

- Frequency
  - Leg 1 (5 Aug ~ 21 Aug): Twice daily (00, 12 UTC) – regular, 4-times daily (00, 06, 12, 18 UTC) around the ice camp period, and 8-times daily during the ice camp period (00 UTC 14 Aug. ~ 06 UTC 15 Aug.)
  - Leg 2 (26 Aug ~ 9 Sep): Twice daily in August, 4-times daily in September with two days of 3-hourly obs (4-5 Sep)
- Total number of launch: 89

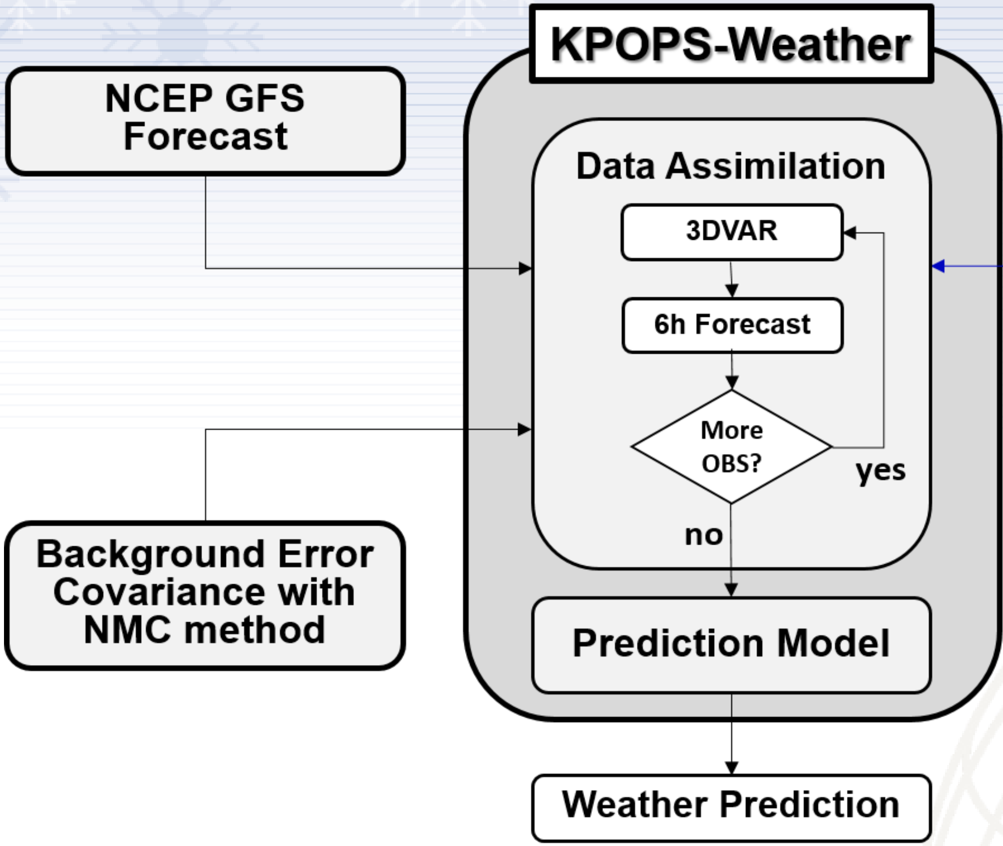
(2017) August 7 ~ September 13

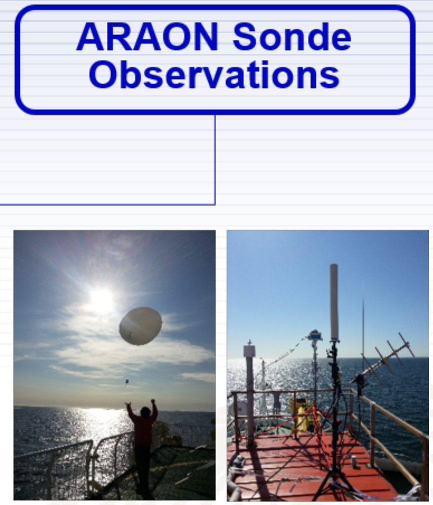
- Frequency
  - Mostly keep 4-times daily (00, 06, 12, 18 UTC)
- Total number of launch: 136
- GTS broadcasting

(2018) Early August ~ Mid-September (Special Observing Period, SOP)

KOPRI 극지연구소

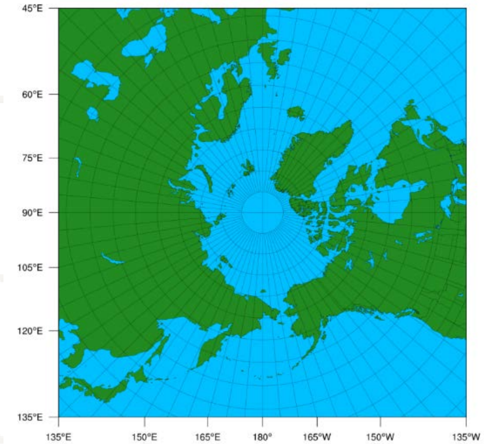
Regional weather prediction system





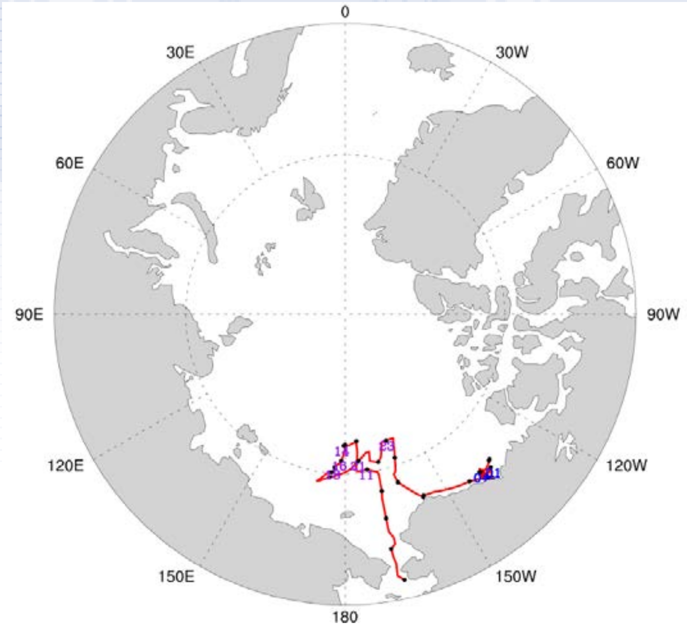
< KPOPS-Weather >

- Arctic prediction system based on Polar WRF (v3.7.1)
- Arctic-Eurasia regional prediction and forecasts during ARAON cruise

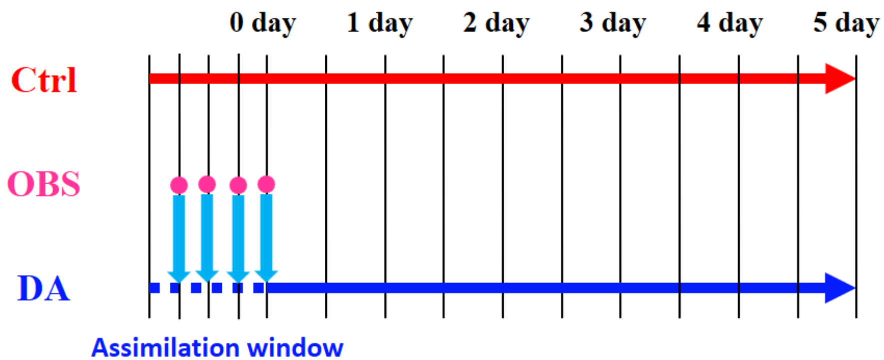


KOPRI 극지연구소

2017 near real-time forecasts during the period of Arctic cruise



- We produced 9 forecast sets during 2017 summer
  - Ctrl: NCEP GFS only
  - DA: Add extra Araon radiosonde data



Experimental configuration for DA experiments with ARAON Radiosonde observations

KOPRI 극지연구소

Forecast Notice and Table

Forecast at the location of ARAON (Beginning of assimilation window: 08/10/2017 00UTC, 24 hours window)

- Notice

There will be fog along the araon path in the middle part of forecasts.
The slight rainfall and strong wind are expected during the last half of forecast period.

- Forecast table (Beginning of Forecast: 08/11/2017 00UTC)

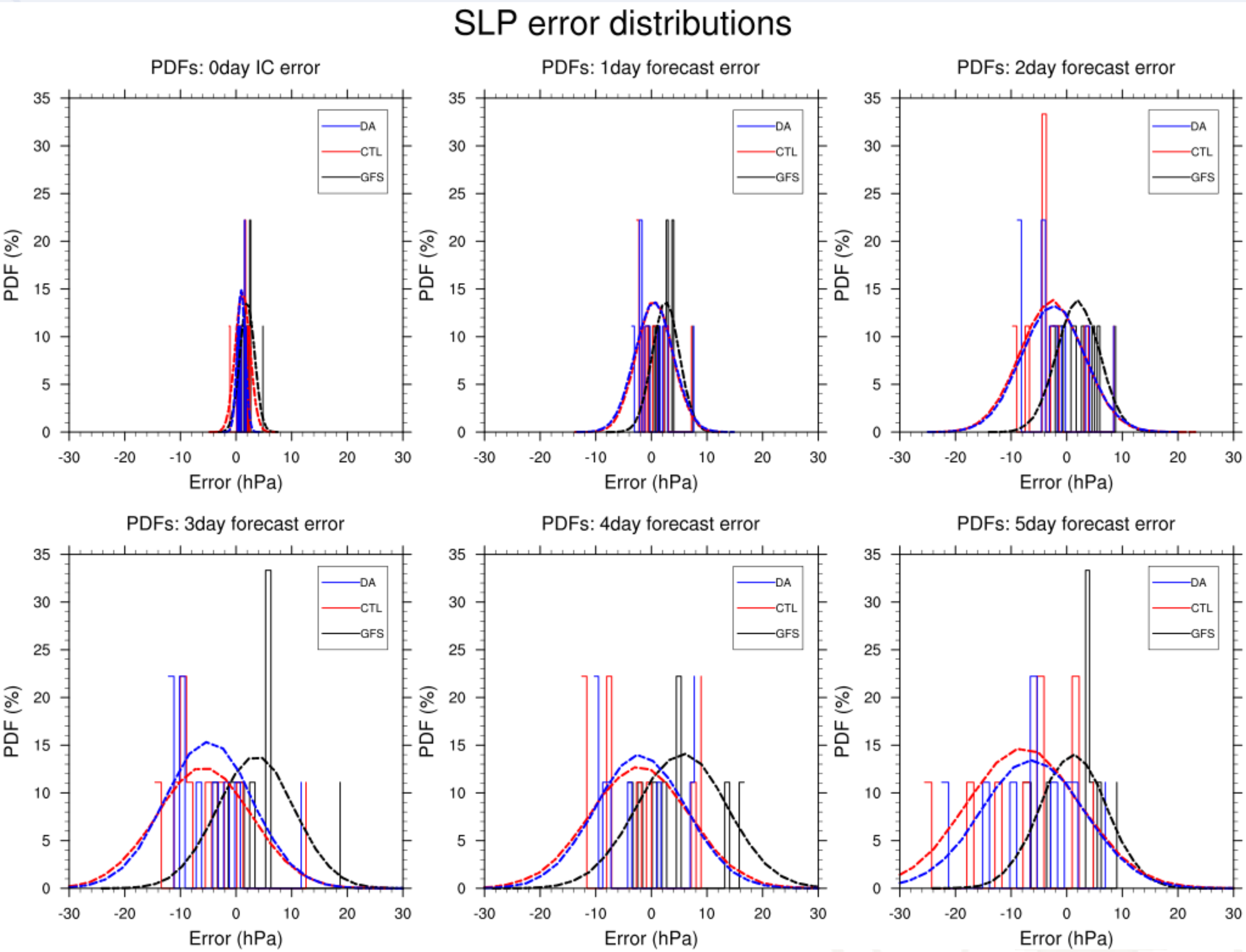
Date	Forecast start (08/11/2017)	1 days later (08/12/2017)	2 days later (08/13/2017)
Location (LAT/LON, °)	75.06N/170.26W	75.15N/179.25W	74.92N/173.31E
SLP (hPa)	998.65	1011.19	1022.36
Temp.[2m] (℃)	-1.37	-0.84	-1.76
Wind [10m] (SPD, DIR, m/s)	6.49/NW	7.84/NW	6.38/NW
Amount of Precipitation(mm/24h)	0.37	0.54	0.01
Amount of Snow (mm/24h)	0.34	0.28	0
Relative Humidity [2m] (%)	91.69	93.97	96.89

Date	3 day later (08/14/2017)	4 days later (08/15/2017)	5 days later (08/16/2017)
Location (LAT/LON, °)	75.29N/172.33E	77.63N/173.35E	79N/173.2E
SLP (hPa)	1016.68	996.50	1005.35
Temp.[2m] (℃)	-1.94	-0.40	-0.37
Wind [10m] (SPD, DIR, m/s)	11.41/SSW	5.33/SSW	10.95/NNW
Amount of Precipitation(mm/24h)	3.76	0.95	1.82
Amount of Snow (mm/24h)	-	0.03	0.16
Relative Humidity [2m] (%)	96.31	98.1	92.34

* Amount of Precipitation and Snow are 24 hours accumulated from each forecast time.

Forecast verification (along the Araon observation locations)

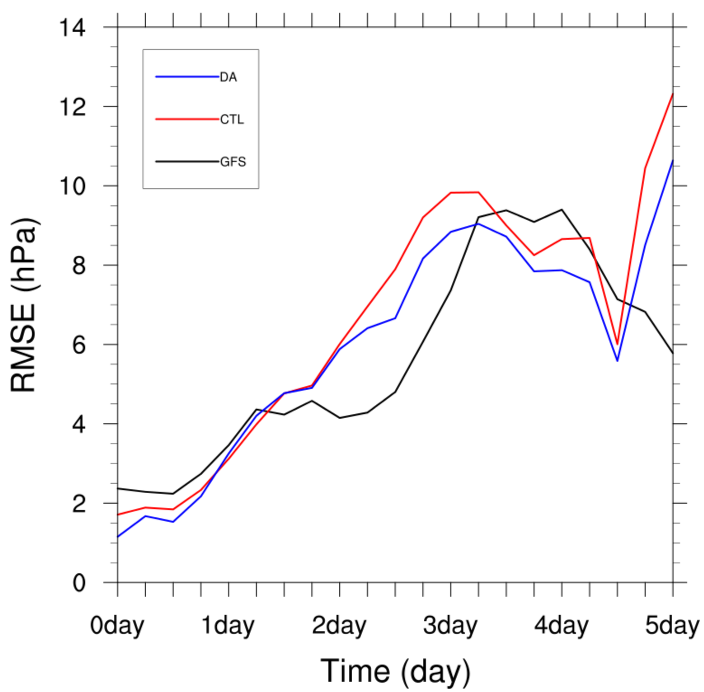
- The reference SLP data: barometer data on Araon
- Error distribution analysis (forecast minus observation)



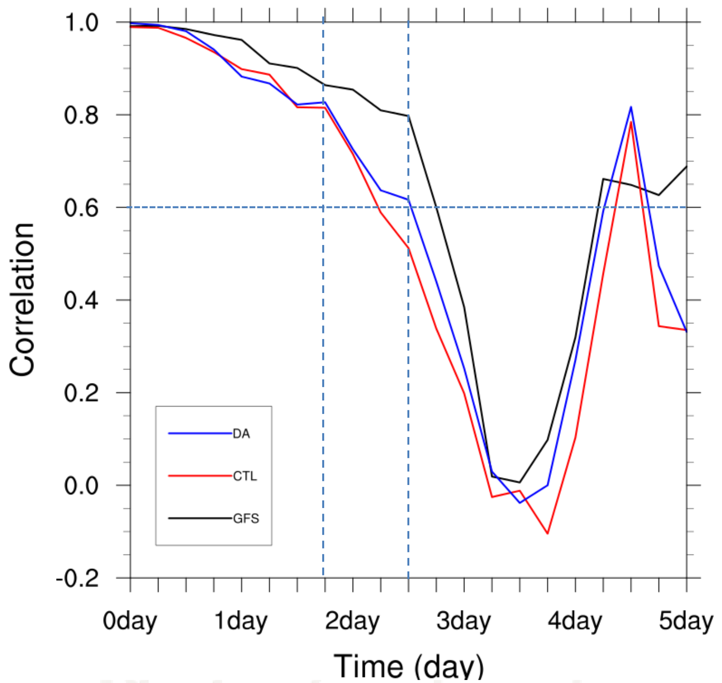
Forecast verification (along the Araon observation locations)

Averaged for nine forecasts made during the Arctic cruise

- RMSEs (Sea level pressure)



- Correlations (Sea level pressure)



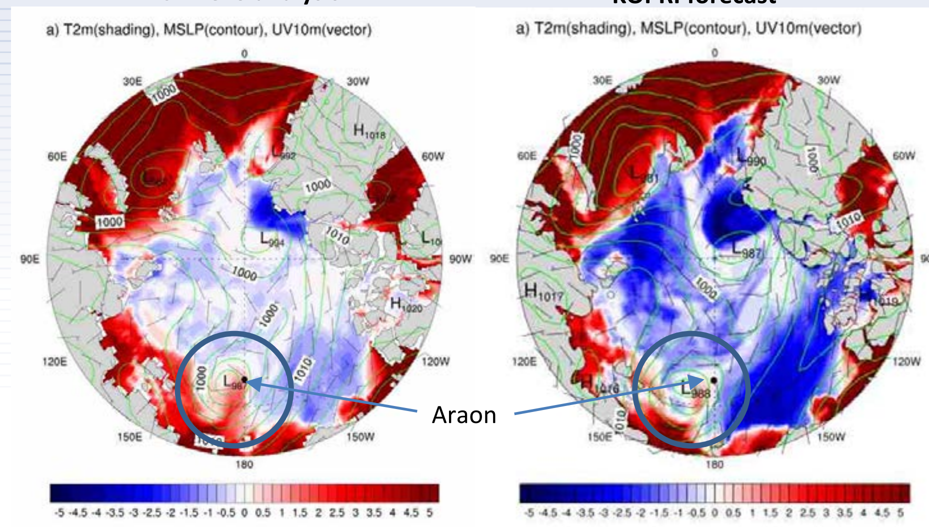
In KOPRI forecasts, the cycling assimilation of Araon radiosonde observations had positive influences (Red versus Blue; reduced RMSEs and increased correlations).

KOPRI 극지연구소

Forecast verification for an extreme weather event

Evolution of forecast errors along the Araon observation locations

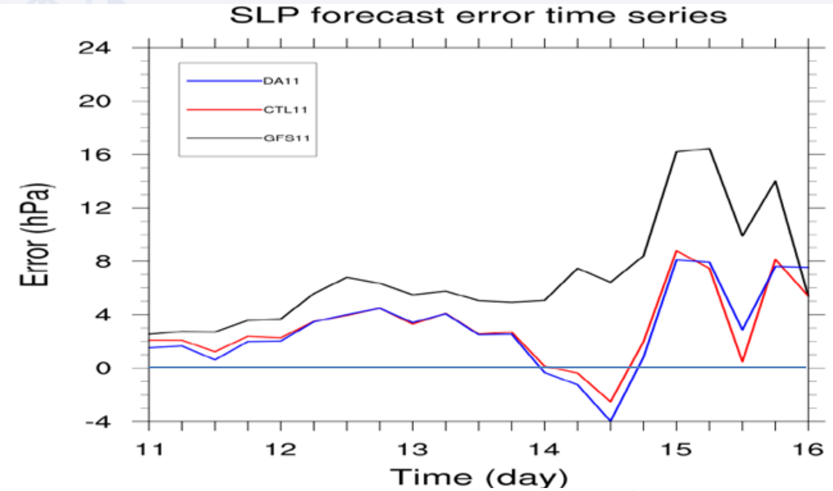
NCEP GFS analysis **KOPRI forecast**



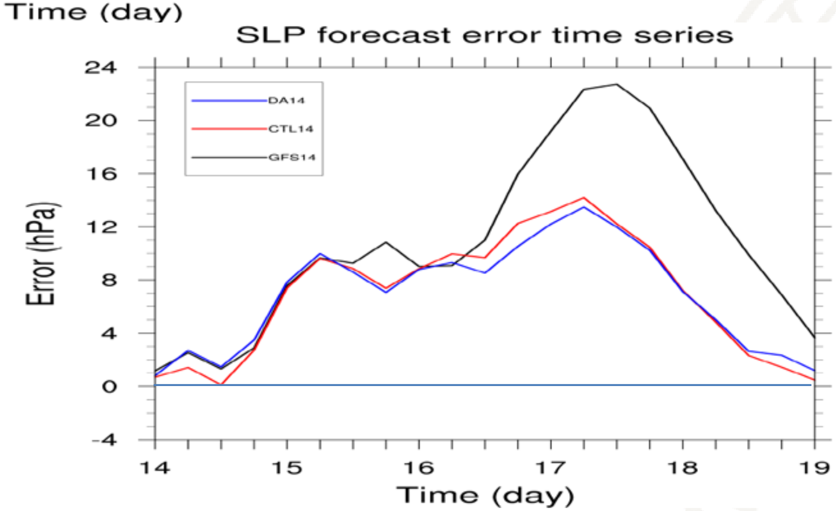
08/15/2017 00 UTC

2 day forecast field (valid at 08/15/2017 00 UTC)
[Forecast start at 08/13 00 UTC]

Forecast 1 (begin on 10 Aug)



Forecast 2 (begin on 13 Aug)



KOPRI 극지연구소

Future plans

- **Reduce model biases**
  – For example, reasons for the cold bias in surface temperature need to be investigated in the context of surface cloud radiative forcing and sea ice surface energy balance.

- **Sensitivity to the forecast boundary conditions**
  – Currently we use the GFS forecast data, but may extend to other forecast boundary conditions, such as KOPRI global forecast data and ECMWF global forecast data.

- **Increase the number of forecasts in 2018**
  – An automatic procedure of cycling data assimilation will improve the working efficiency.

- **Use of weather forecasts as boundary conditions for a sea ice prediction model**
  – If the forecast errors of surface winds are high, accuracy of sea ice drift cannot be high. The better atmospheric forecasts are essential for reducing the forecast errors of sea ice drift.

KOPRI 극지연구소