SIPN² Sea Ice Prediction Network

Welcome

Sea Ice Prediction Network—Phase 2 (SIPN2) Webinar Series

"Advancing Predictability of Sea Ice"

Presented by:
Uma Bhatt, University of Alaska Fairbanks
Cecilia Bitz, University of Washington

10 July 2018

#SIPN2

Participant Questions

- Questions will be addressed at the end of the presentation.
- Type your question in the chat window at any time throughout the presentation.
- A facilitator will ask your question for you during the presentation Q&A.

Advancing Predictability of Sea Ice

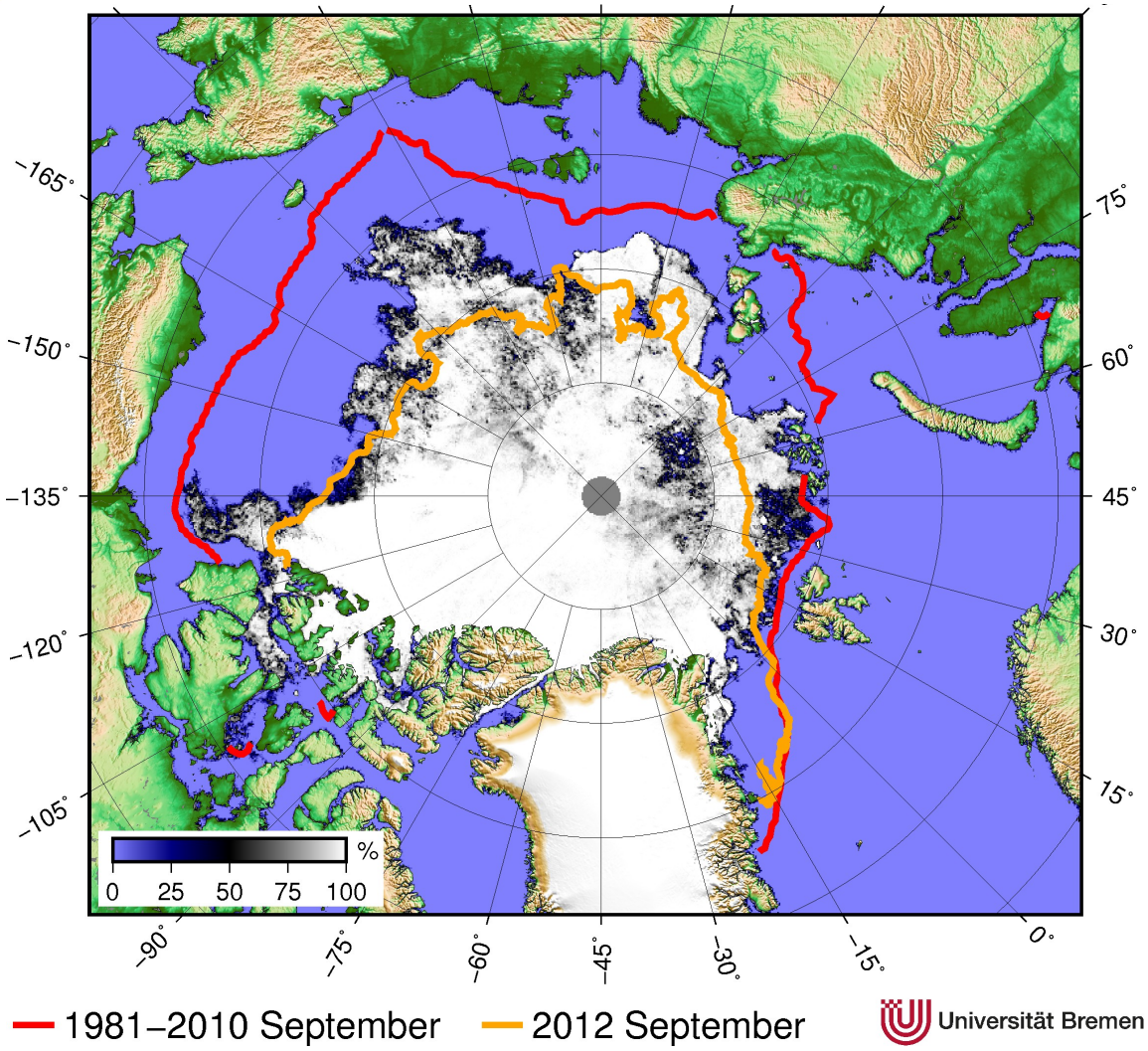
U. Bhatt (overview) & C. Bitz (prediction portal)

SIPN2 Webinar, Tuesday July 11, 2018

SIPN2

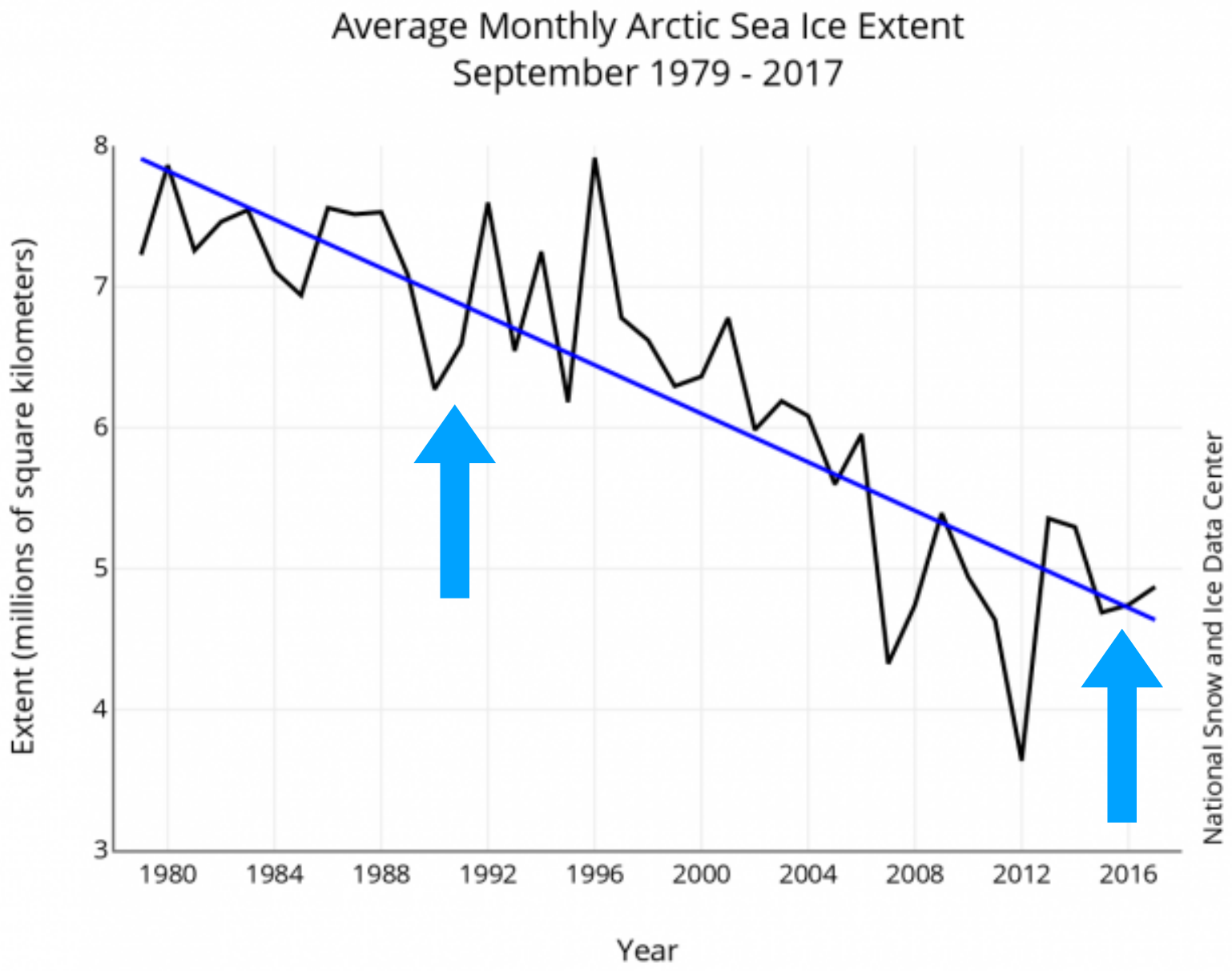
Sea Ice Prediction Network

www.arcus.org/sipn

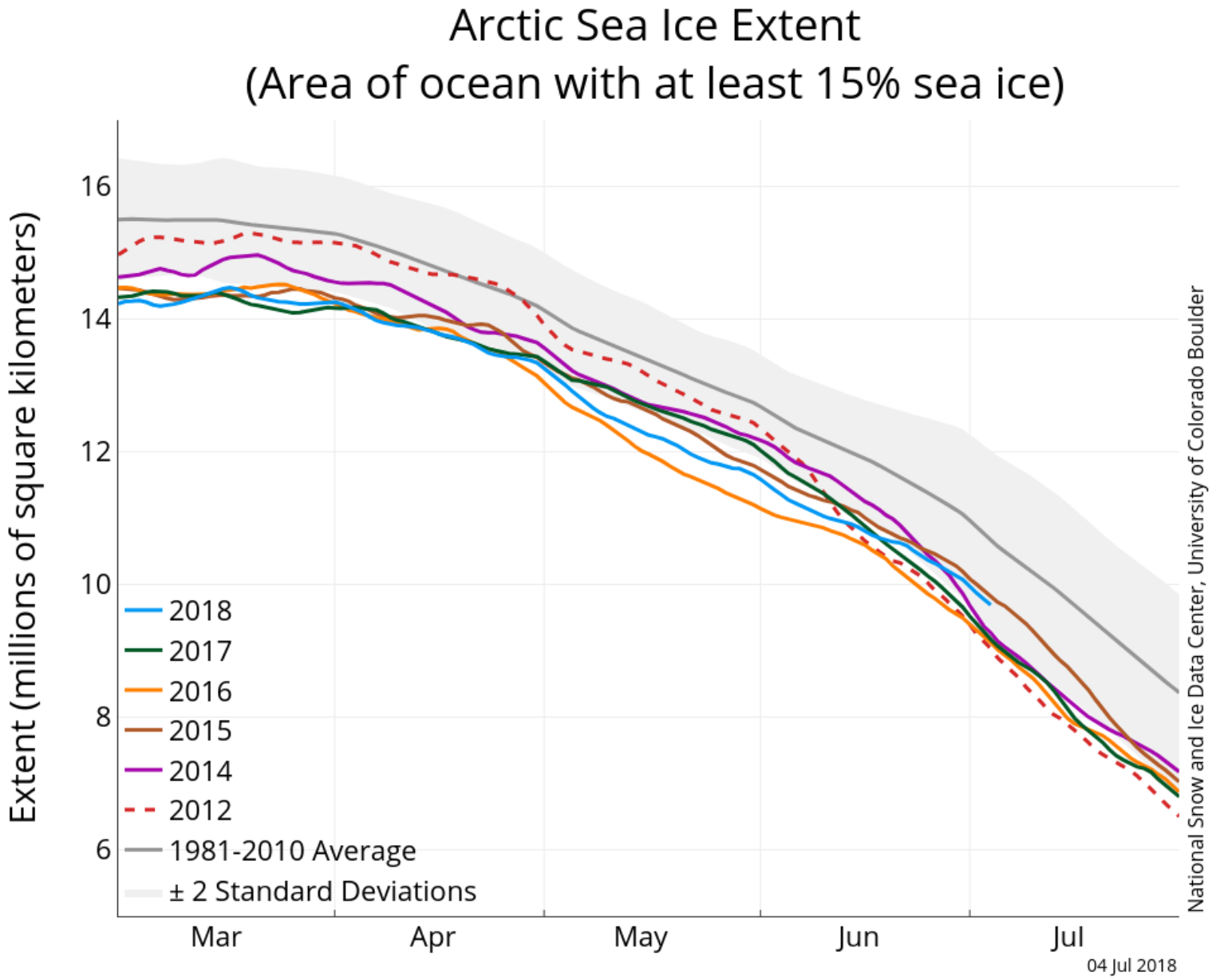


2017 Minimum
Spreen et al. 2008

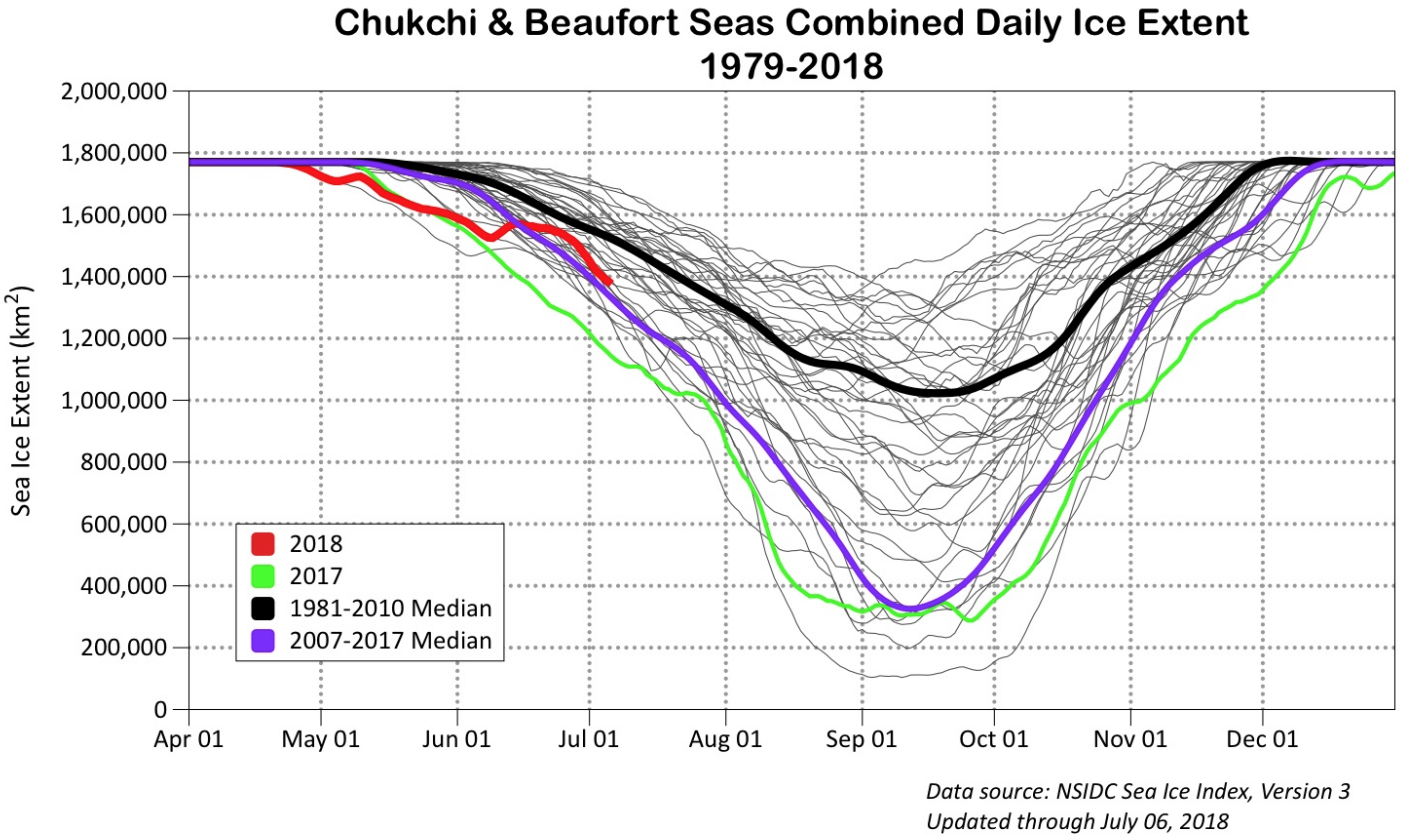
Upward trend of Sea ice minimum during the past 3 years



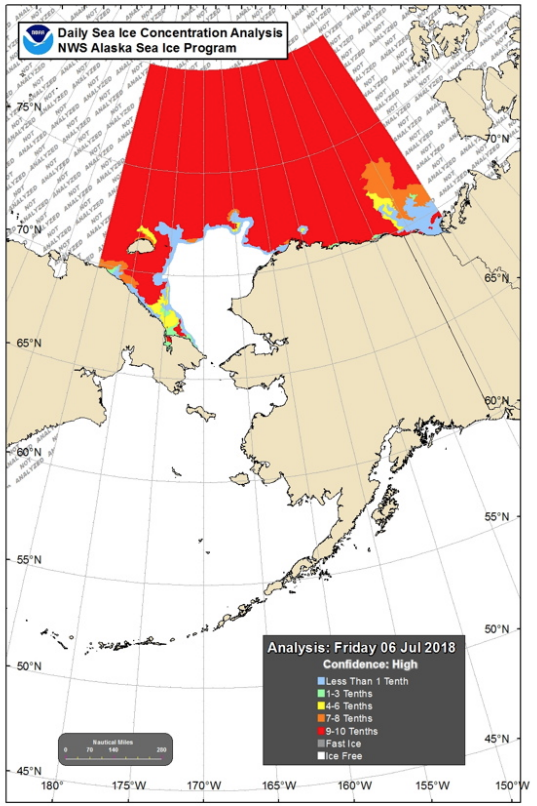
Sea ice retreat slower than expected in 2018



Chukchi-Beaufort sea ice below long-term median but above recent median

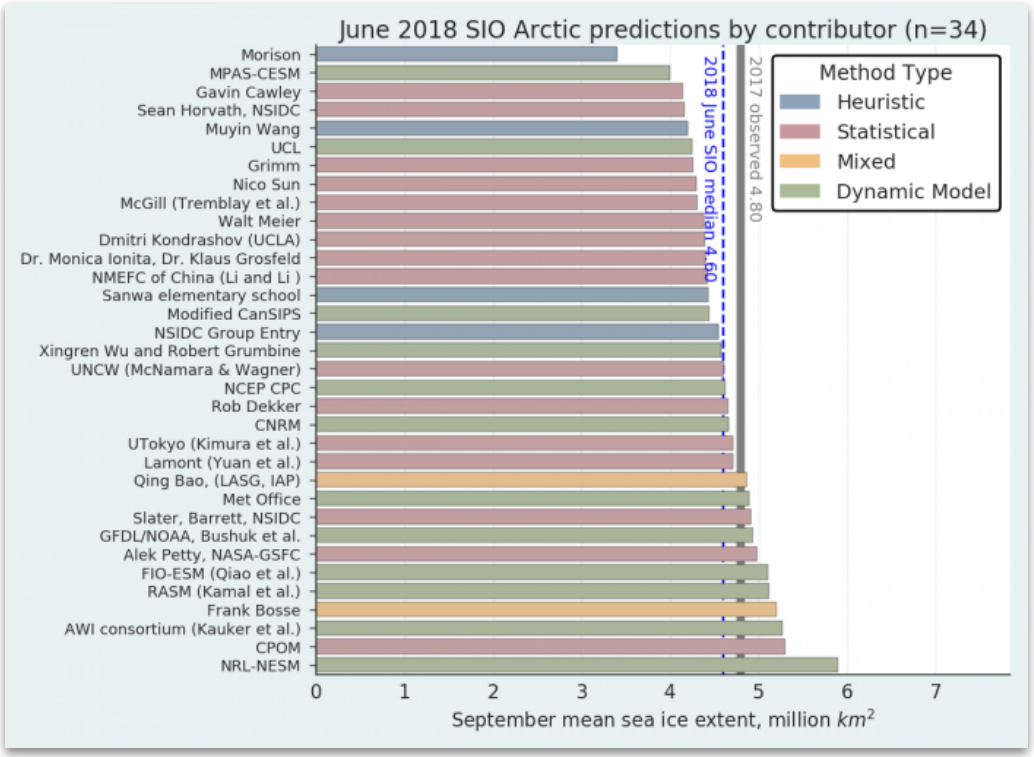


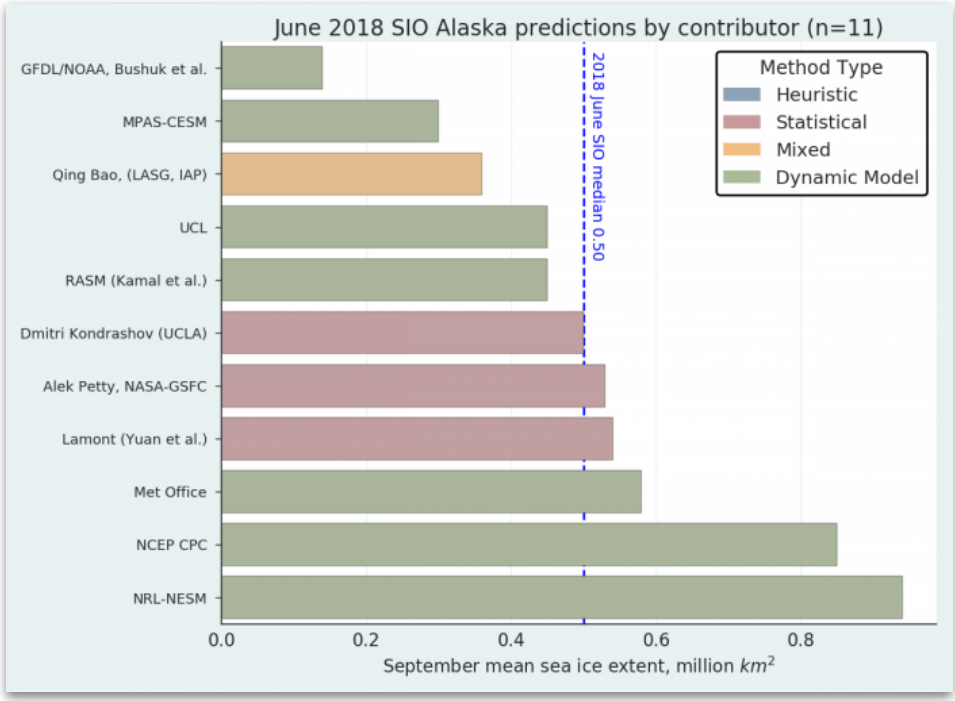
Data source: NSIDC Sea Ice Index, Version 3
Updated through July 06, 2018



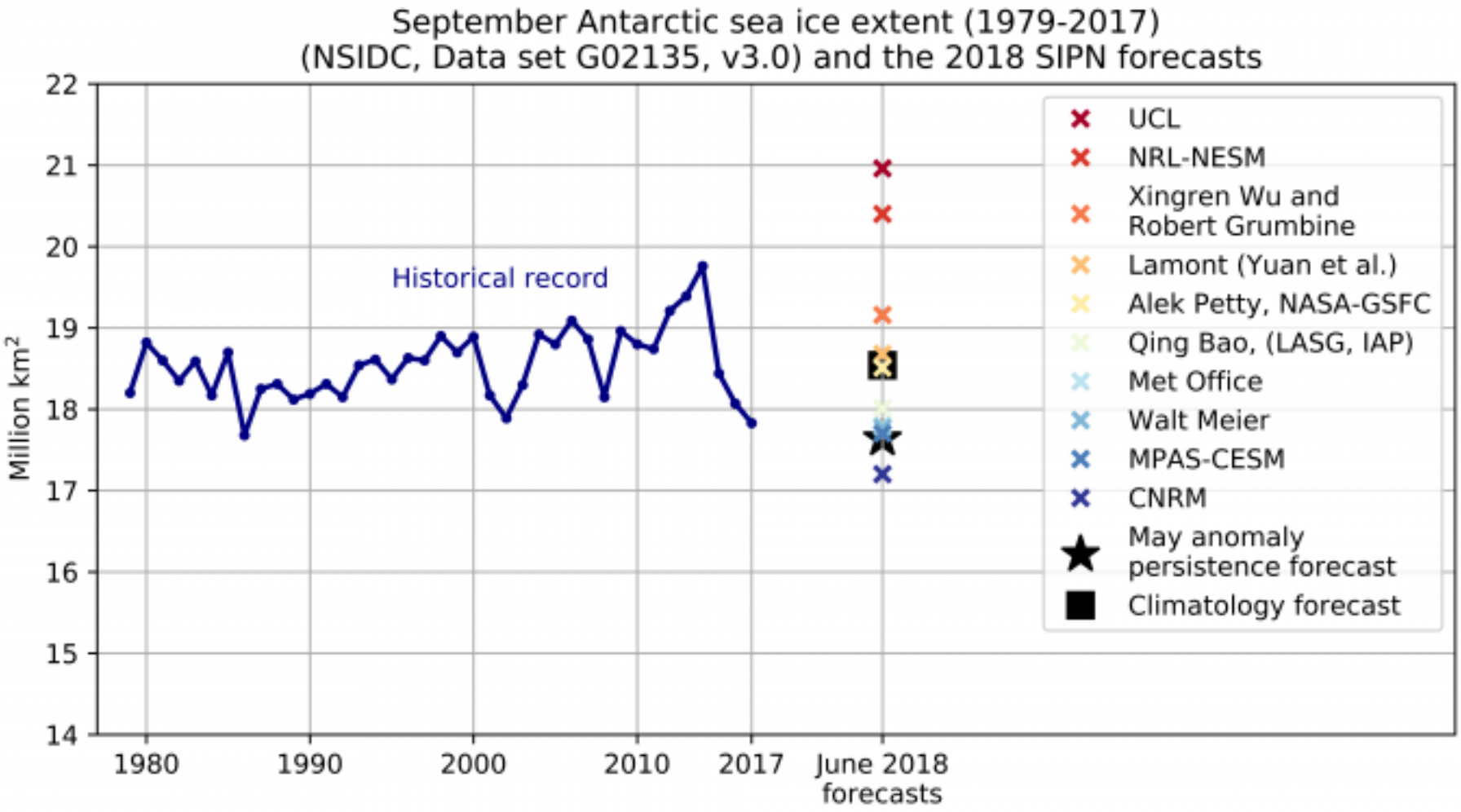
Rick Thoman, NOAA/Alaska

Sea Ice Outlook (SIO) Pan-Arctic and Alaska Regional





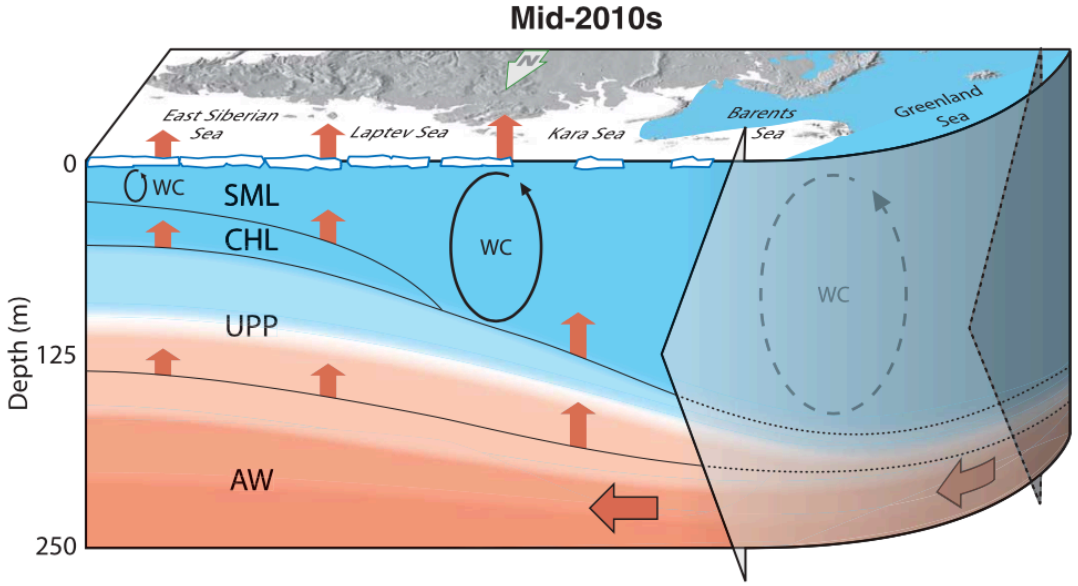
Antarctic Sea Ice: SIPN South



François Massonnet, University of Louvain

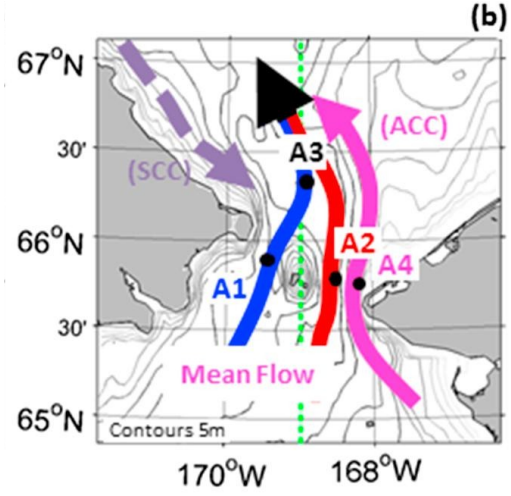
How do ocean heat anomalies impact seasonal sea ice predictability?

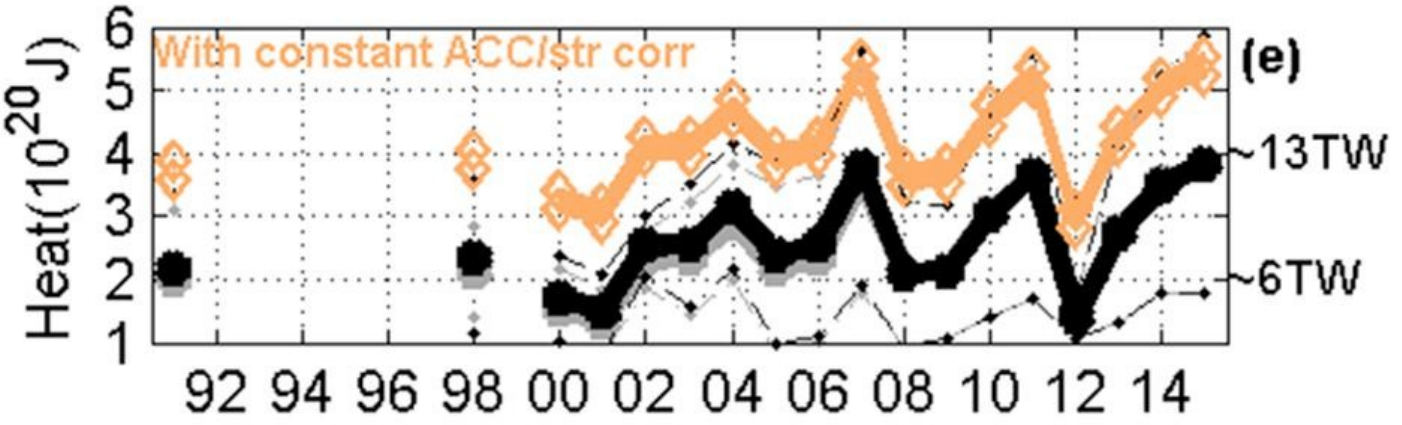
Atlantic Layer Heat reaching the surface layer



Polyakov et al. 2017

Pacific Heat Inflow into the Arctic





Woodgate 2018

What types of information about sea ice is needed by the Alaska marine shipping & can we provide it?

- **How does Alaskan marine shipping incorporate sea ice prediction in planning and operations?**
  - *Relationship between length of season, timing, volume and frequency of shipping.*
  - *Long-range planning*
- **What are the obstacles/limitations of sea ice prediction?**
  - *Reliability and accuracy of prediction within short and medium terms*
  - *Variability of forecast (especially long term) and relationship to risk and investment.*
- **What dimensions of sea ice prediction most contribute to safety of operations and firm profitability?**
  - *Influence of predicted ice location, density, and flow on route planning (fuel costs, labor expenses)*
  - *Inter-seasonal predictions and investment in new shipping or ship overhauls (long run capital investment)*

Joseph Little, UAF

SIPN2 team

Uma Bhatt, PI SIPN2, University of Alaska Fairbanks (UAF)
Peter Bieniek, Alaska climate
Hajo Eicken, Sea ice
Joseph Little, Economist
John Walsh, Climate
Jürgen Kurts, Complex systems, UAF Chapman Chair

Helen Wiggins (co-PI) &
Betsy Turner-Bogren,
ARCUS

Larry Hamilton, University of New Hampshire, Human dimensions of climate

SIPN2 team

Muyin Wang, co-PI, University of Washington
Ed Blanchard-Wrigglesworth, Climate & sea ice
Mike Steele, Arctic oceanography
Cecilia Bitz, ONR-PI, Sea ice prediction,
Prediction Portal for SIPN Forecasts

Mark Serreze, co-PI, U. Colorado, Arctic Climate

Julienne Stroeve, NERC-PI, University College London, Sea ice & remote sensing

Extended SIPN2 team, in-kind support

Walt Meier, NSIDC U Colorado, Sea ice, NASA

Elizabeth Hunke, Los Alamos National Laboratory, sea ice modeling, Dept. of Energy

François Massonnet, University of Louvain, Antarctic Sea Ice Network Belgium

James Overland, Pacific Marine Environmental Laboratory, Arctic climate, NOAA

Thomas Jung, Alfred Wegner Institute, EU APPLICATE project, YOPP

Funded by the Horizon 2020 Framework Programme of the European Union

Why collaborate?

- Diverse views make us all think more deeply and question our interpretations.
- More eyes/brains/perspectives makes for deeper understanding, needed for complex problems
- Prediction portal facilitates collaboration

SIPN² Sea Ice Prediction Network

A new Sea Ice Prediction Portal: year-round S2S sea ice forecasting

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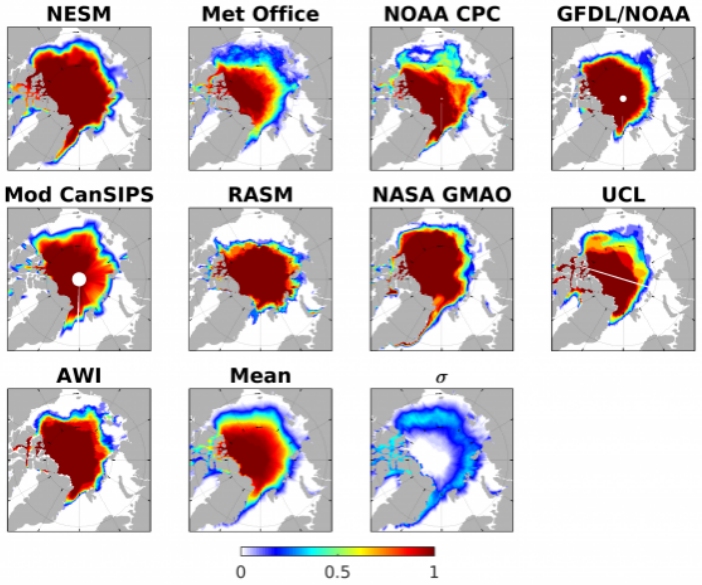
Cecilia Bitz, Nicholas Wayand and Edward Blanchard-Wrigglesworth
Atmospheric Sciences, University of Washington, USA

The 2014-2017 Sea Ice Outlook

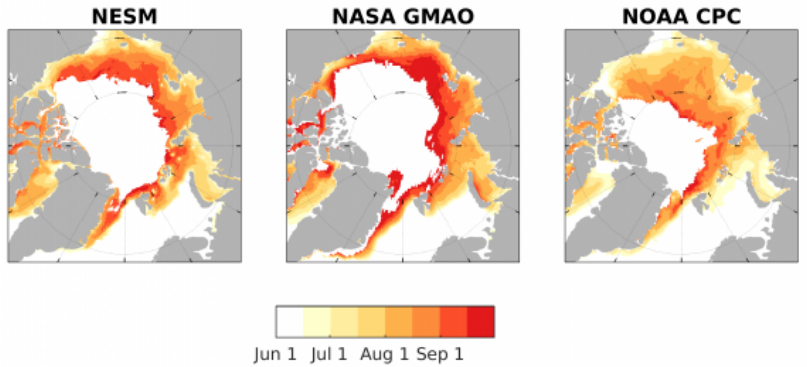
SIP from June 2017 SIO report



Figures by Ed Blanchard-Wrigglesworth

- Focused on September minimum
- 1-3 month lead times
- Participants computed full-field metrics: **Sea Ice Probability (SIP) and first Ice-Free Day (IFD)**

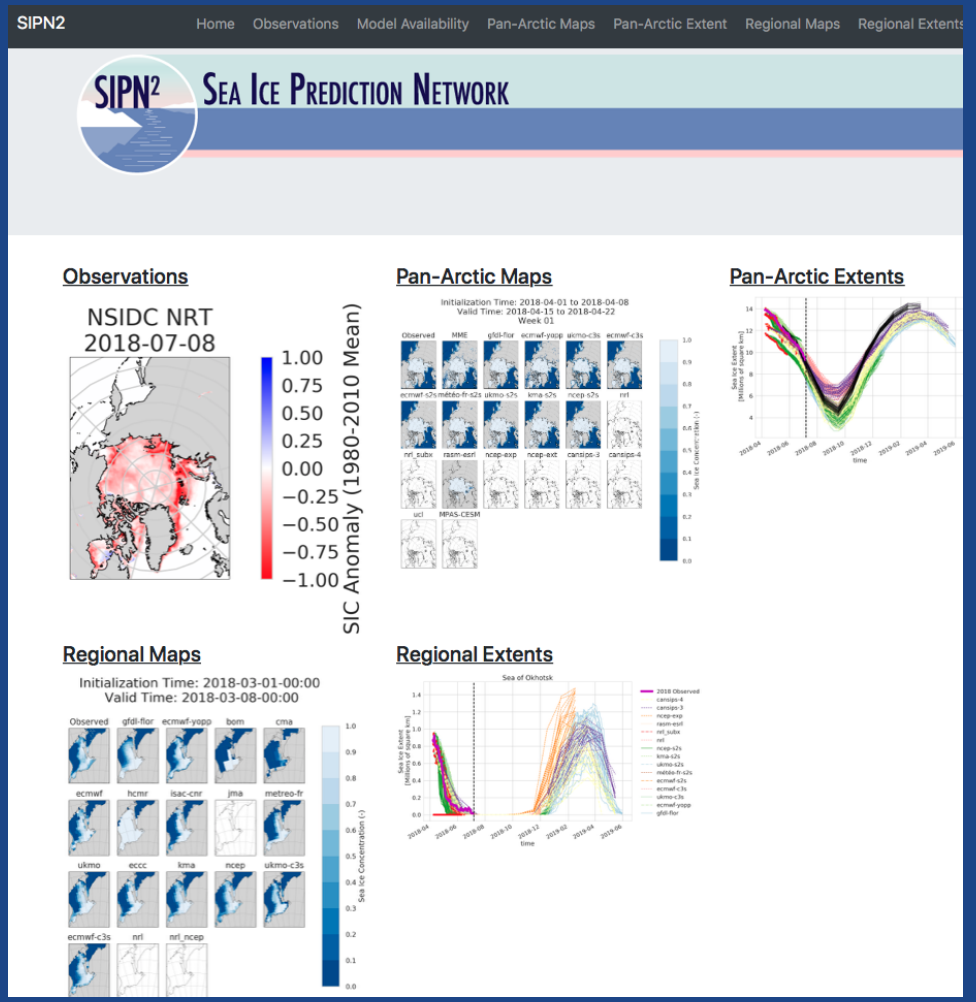
IFD from June 2017 SIO report



New SIPN Prediction Portal atmos.uw.edu/sipn

Goals:

- Analyzing year-round forecast evaluations: **Sea-ice Concentration, Thickness, Ice Free Day, Ice Edge etc.**
- 1 week - 1 year lead times
- Easier for participants to submit data (native formats, raw output)
- Portal automatically regrids, post processes, and computes metrics



Henceforth, all figures by Nic Wayand

How it works, each day

Forecasts uploaded

Rsync, gathered from S2S & C3S at ECMWF, etc.

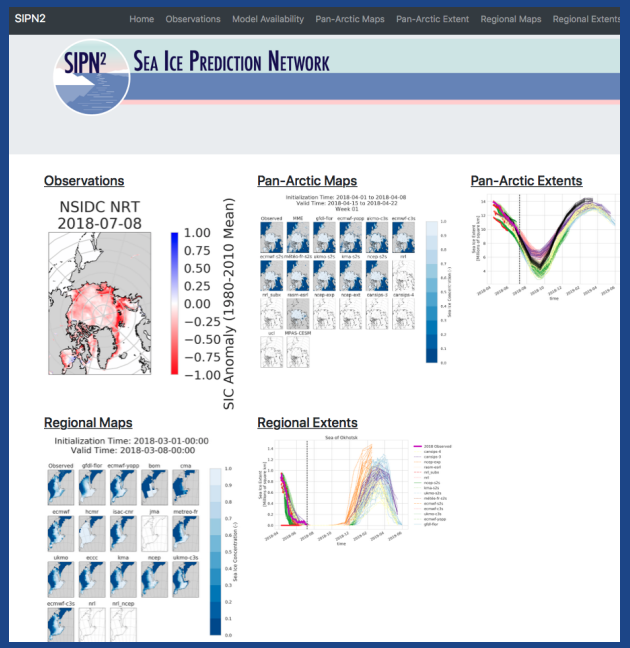
Observations uploaded

Gathered from NSIDC, etc.

Post Process & Analysis

Regridding to NSIDC polar stereographic grid in netcdf format and apply bias correction (soon)

Compute metrics & plot



Open Source on Github:
https://github.com/NicWayand/ESIO

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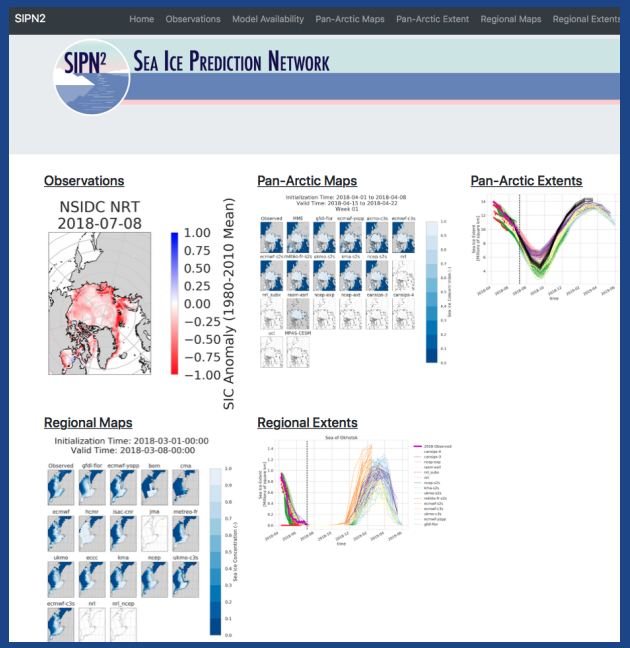
Participant Access (coming soon)

jupyterhub



Open Source on Github:
https://github.com/NicWayand/ESIO

Variable to Plot:
- (•) Sea ice concentration

Metric:
- ( ) Ensemble Mean
- ( ) Sea Ice Probability
- (•) Anomaly

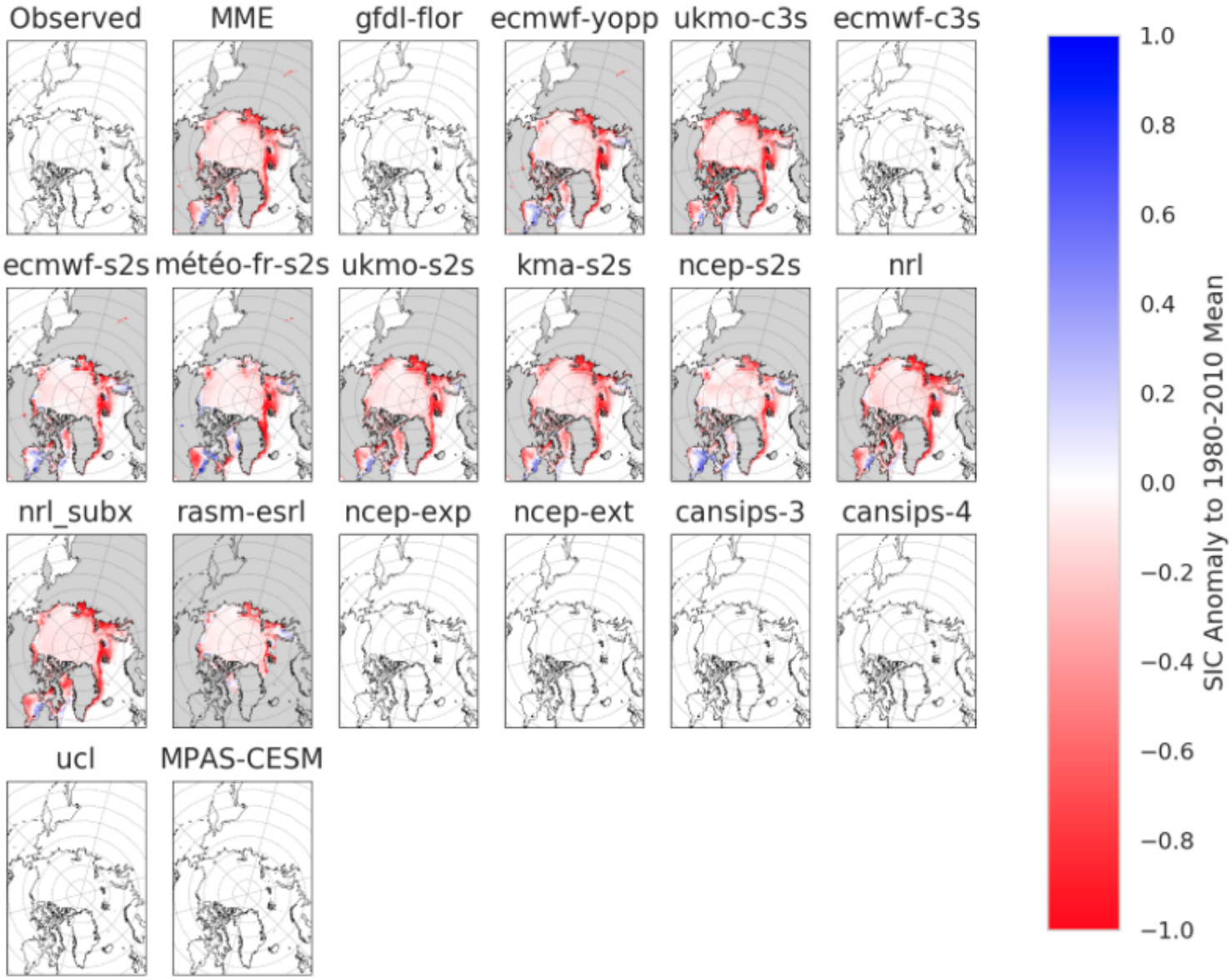
Initial time :
2018-06-17

Lead time:
- ( ) Animation
- ( ) 0 Week
- ( ) 1 Week
- (•) 2 Week
- ( ) 3 Week
- ( ) 4 Week
- ( ) 2 Months
- ( ) 3 Months
- ( ) 4 Months
- ( ) 5 Months
- ( ) 6 Months
- ( ) 7 Months
- ( ) 8 Months
- ( ) 9 Months
- ( ) 10 Months
- ( ) 11 Months
- ( ) 12 Months

All model's have been regridded to NSIDC's polar stereographic projection.

Source Code.

Initialization Time: 2018-06-10 to 2018-06-17
Valid Time: 2018-06-24 to 2018-07-01
Week 02



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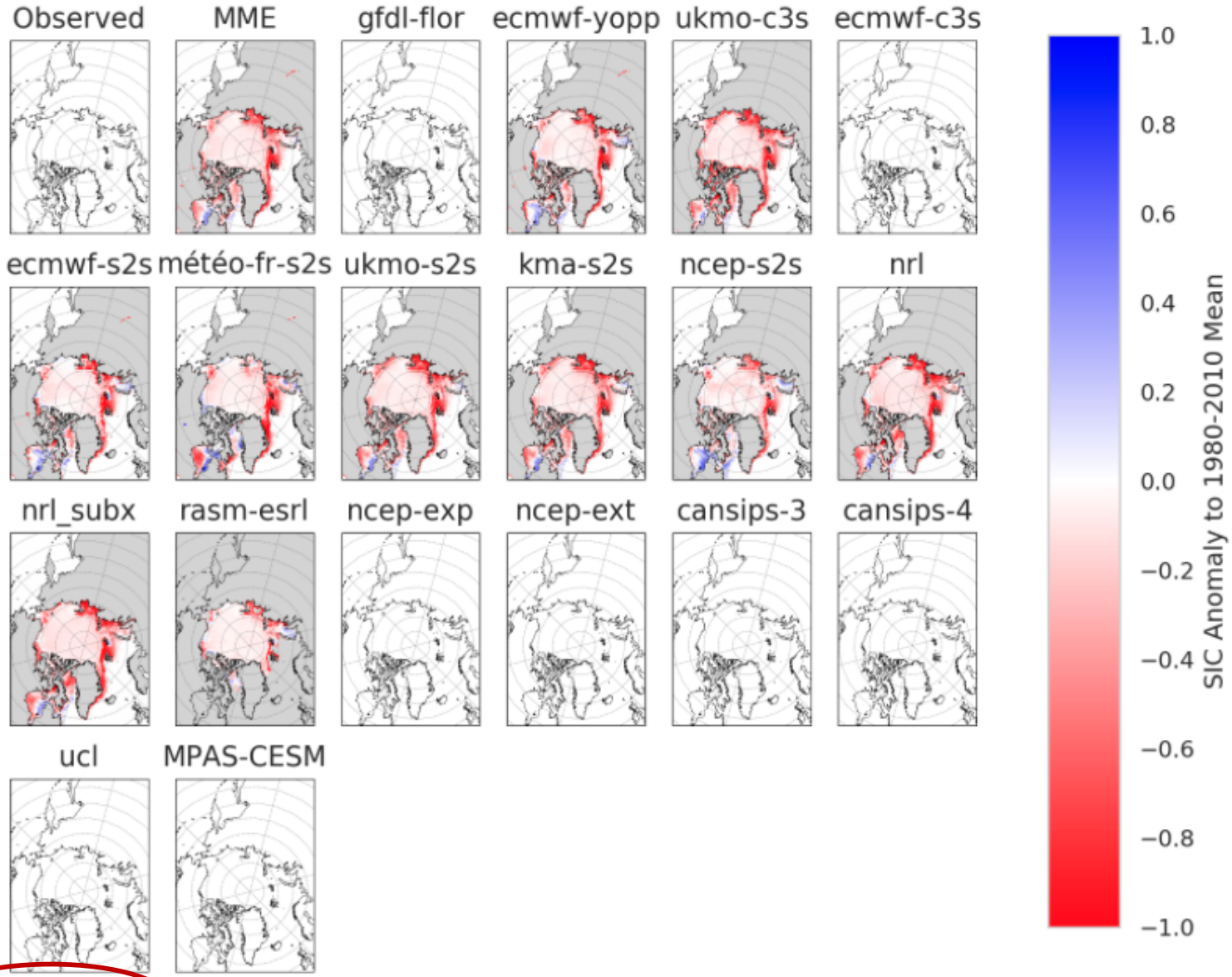
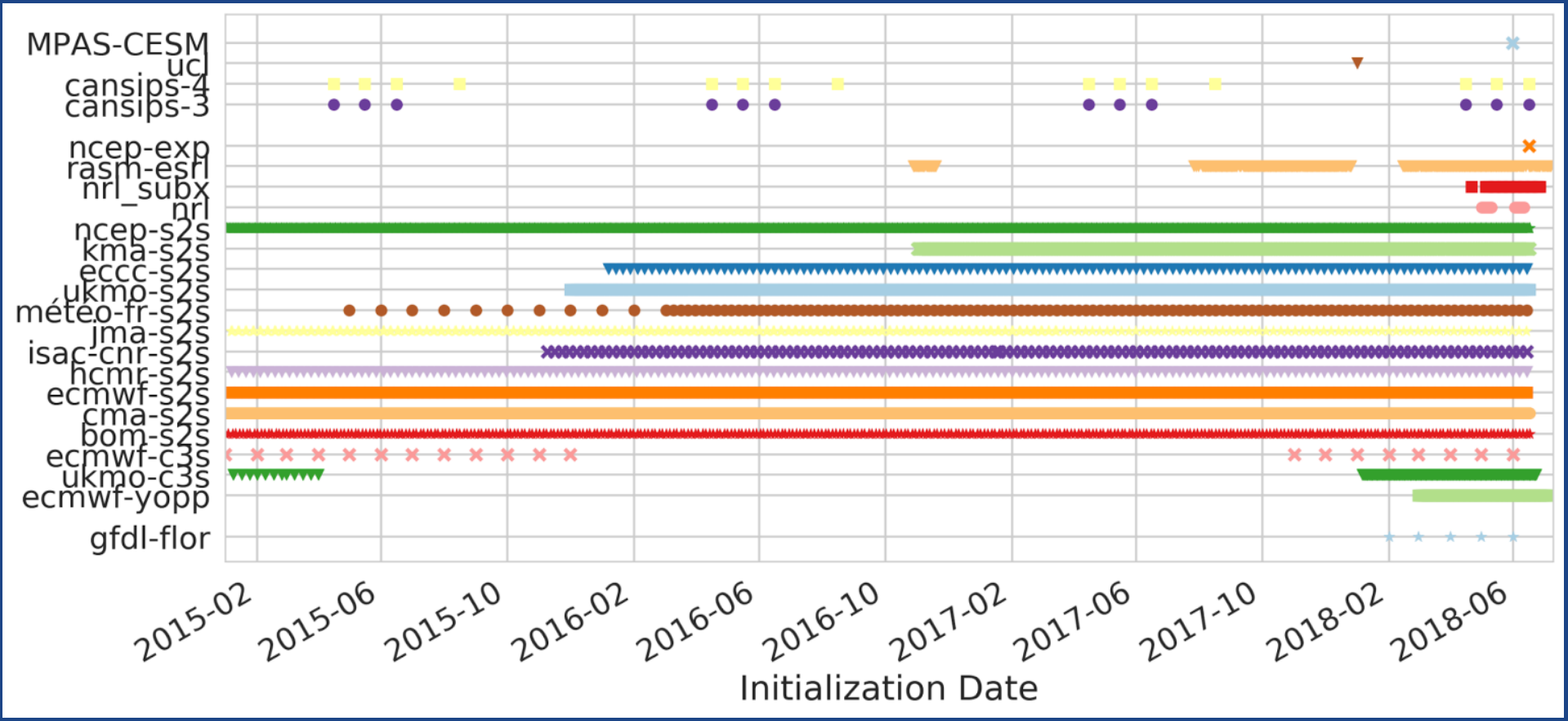
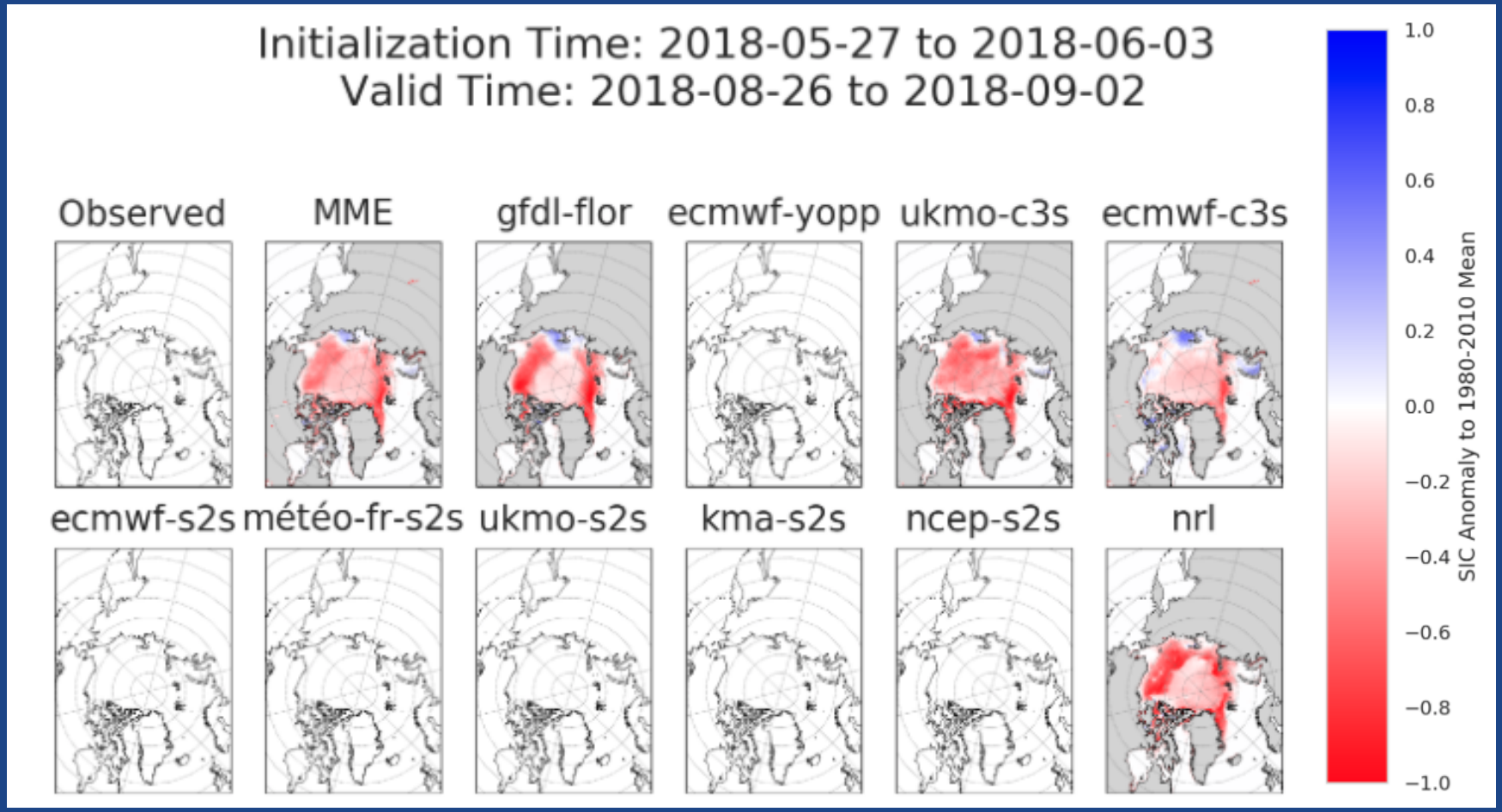


Output Availability Is Irregular

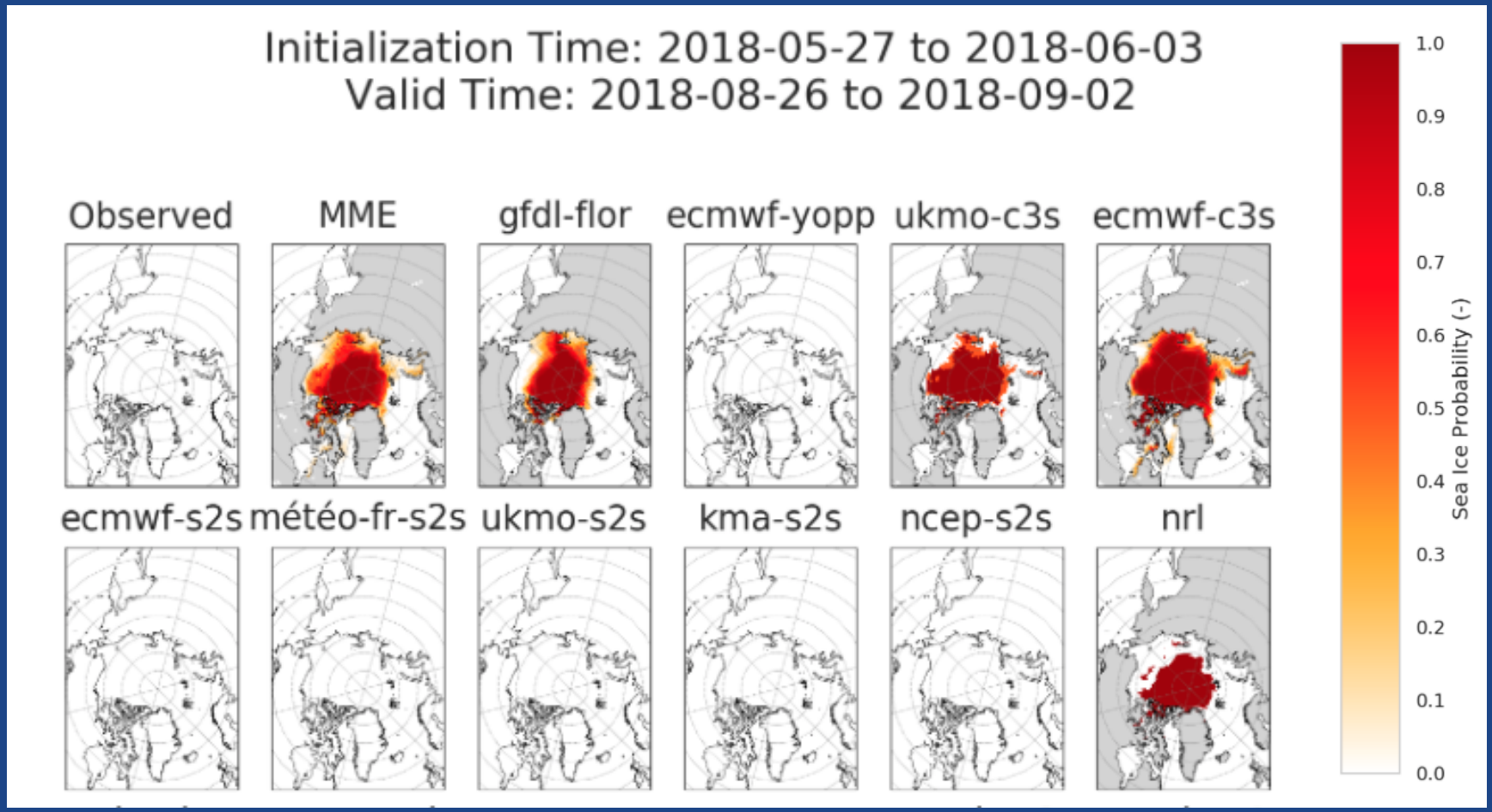


Retrospective forecasts needed for post processing and evaluation

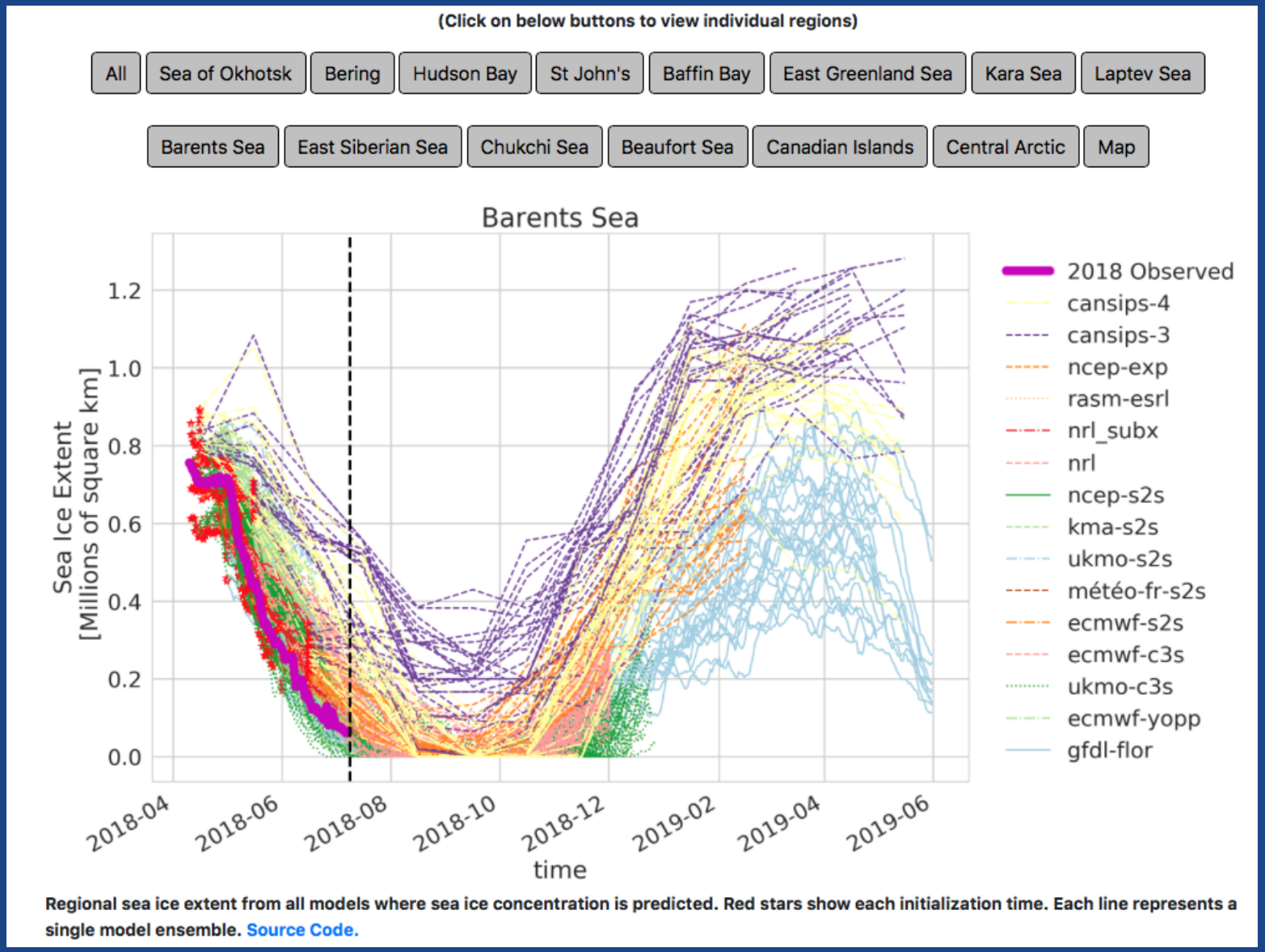
Sea Ice Concentration Anomaly Late July Forecast



Sea Ice Probability Late July Forecast



Pan-Arctic and Regional Extent



Coming soon: Participant access via Jupyter Notebook connection through your browser

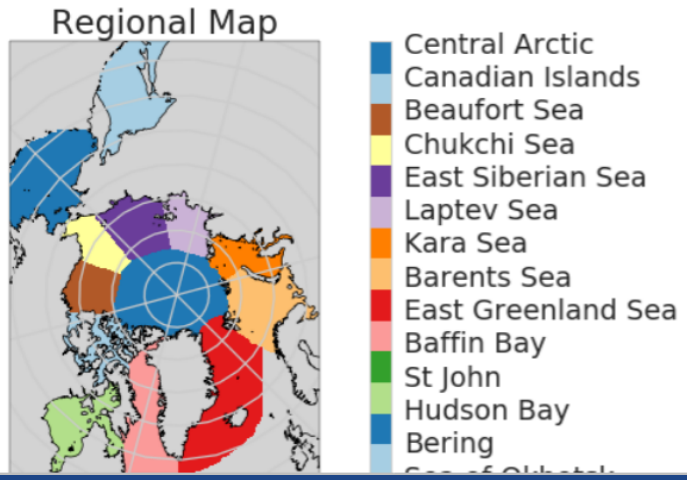
Regrid_S2S_M | plot_observatio | Calc_Model_A | Reformat_for_c | download.py | import_data.py

Code

In [10]:

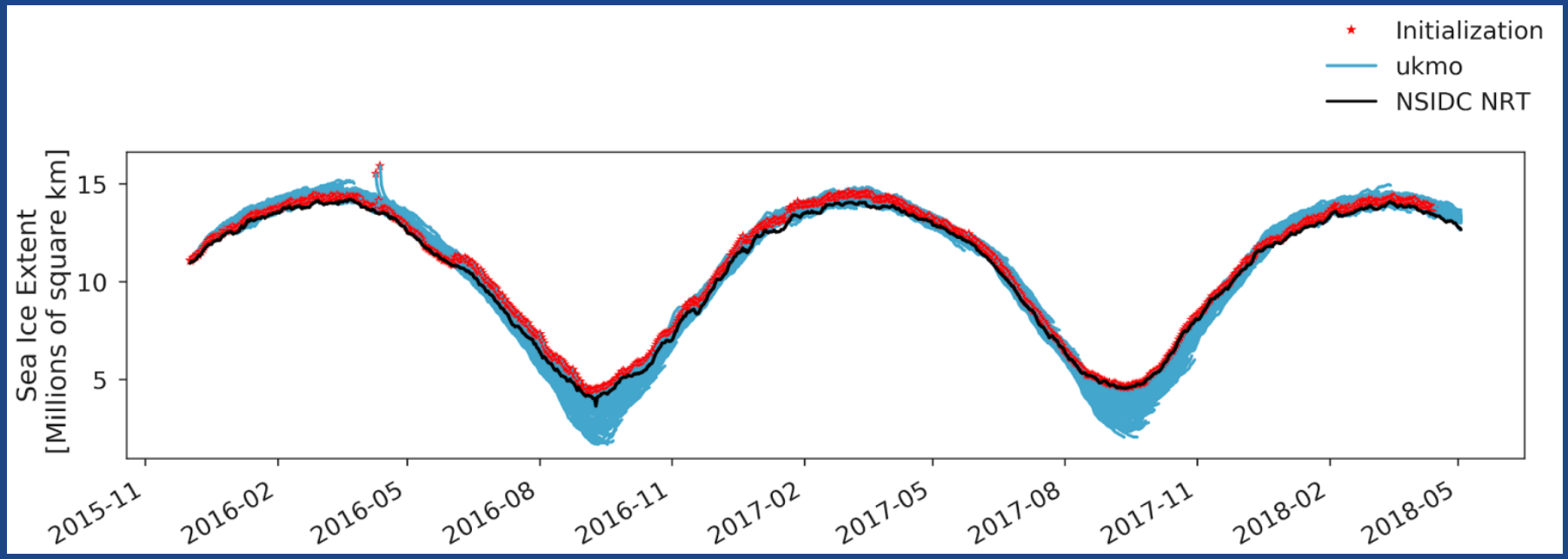
```
# Plot regional  map(s)
# Mask out other areas to missing
mask_plot = ds_region.where(ds_region.mask.isin(ds_region.ocean_regions))

(f, ax1) = ice_plot.polar_axis()
f.set_size_inches(10, 5)
p = mask_plot.mask.plot(ax=ax1,  x='lon', y='lat',
                        transform=ccrs.PlateCarree(),
                       cmap=cmap_reg,
                       cbar_kwargs={'label':'','ticks': ds_region.ocean_regions});
#                                  'labels':mask_plot.region_names.sel(nregions=plot_regs)})
ax1.set_title('Regional Map')
plt.tight_layout()
cb = p.colorbar
# X = list(plot_regs.values)
# X.append(16)
# X = np.array(X)-0.5
# cb.ax.set_yticks(X);
cb.ax.set_yticklabels(mask_plot.region_names.sel(nregions=ds_region.ocean_regions).values);
f.savefig(os.path.join(fig_dir,'Regional_Map.png'),bbox_inches='tight',dpi=200)
```



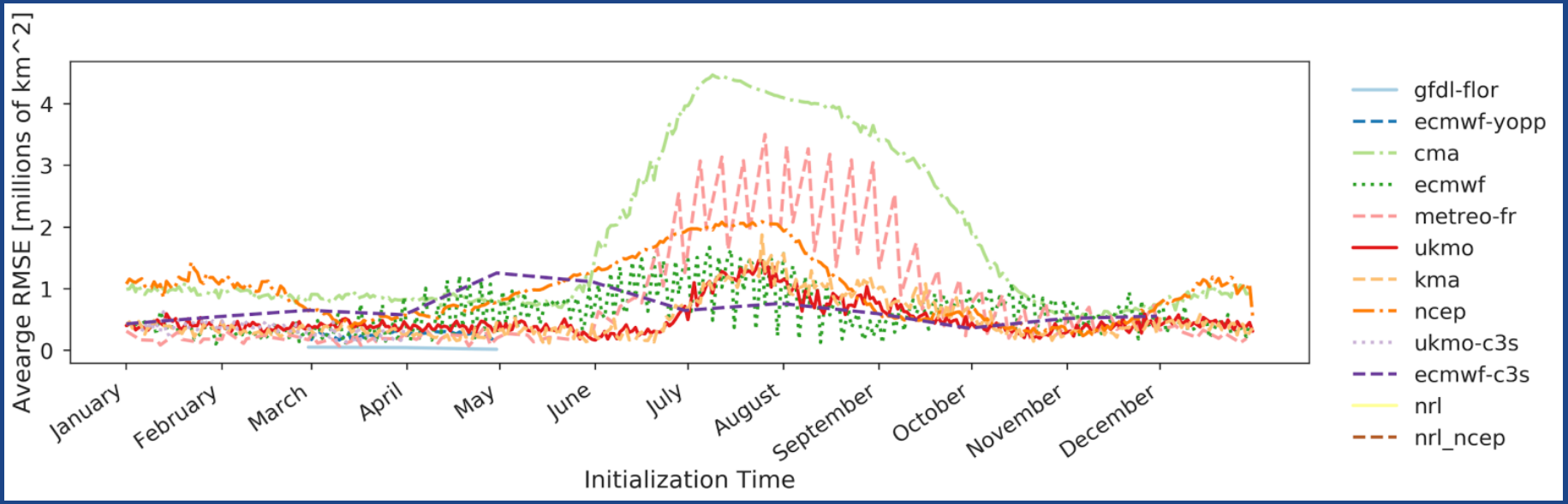
Study example: UKMO S2S

Pan-Arctic Extent (where grids overlap)



Study example: All models

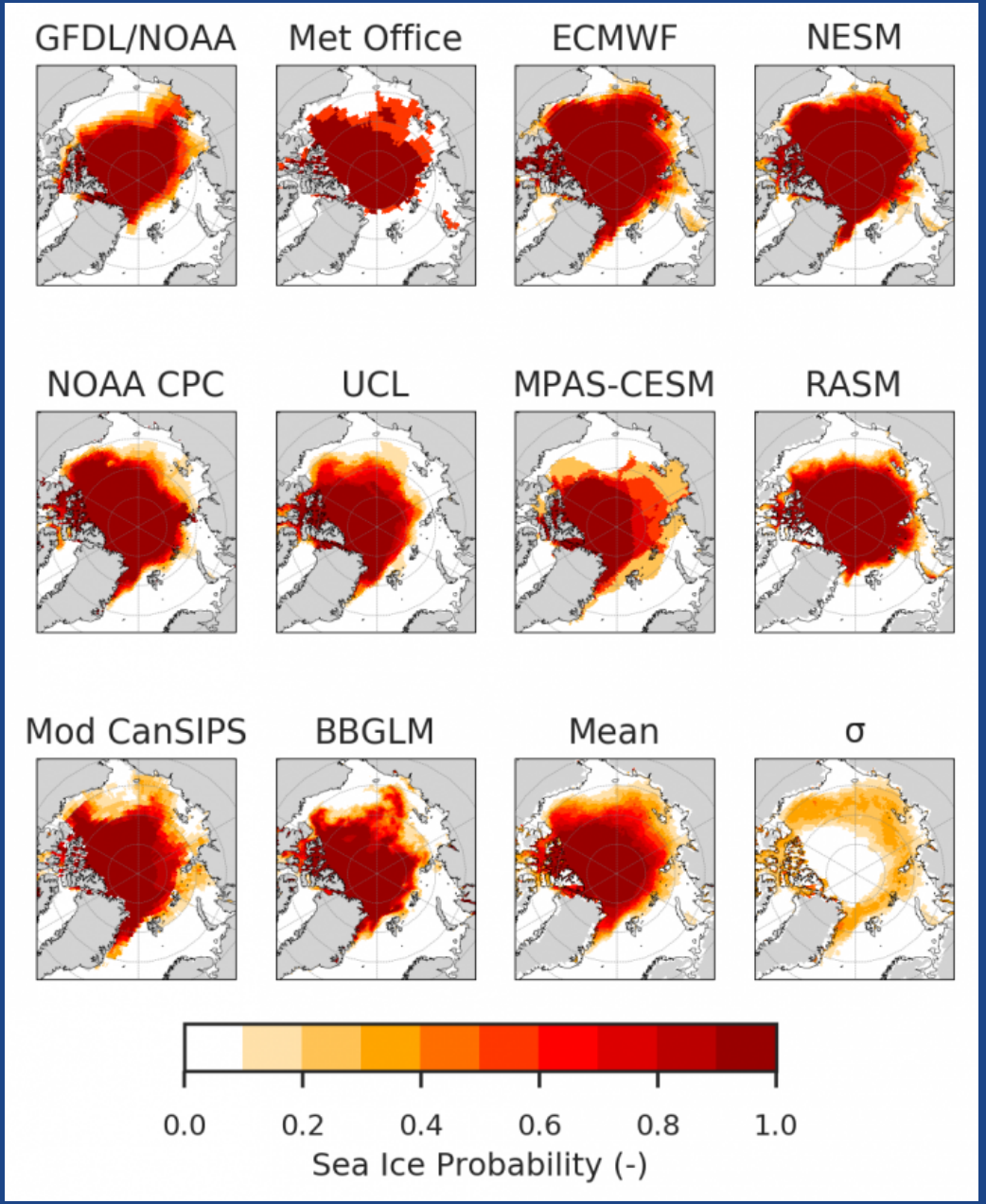
RMSE versus initialization date (for all lead times)



2018 Sea Ice Outlook

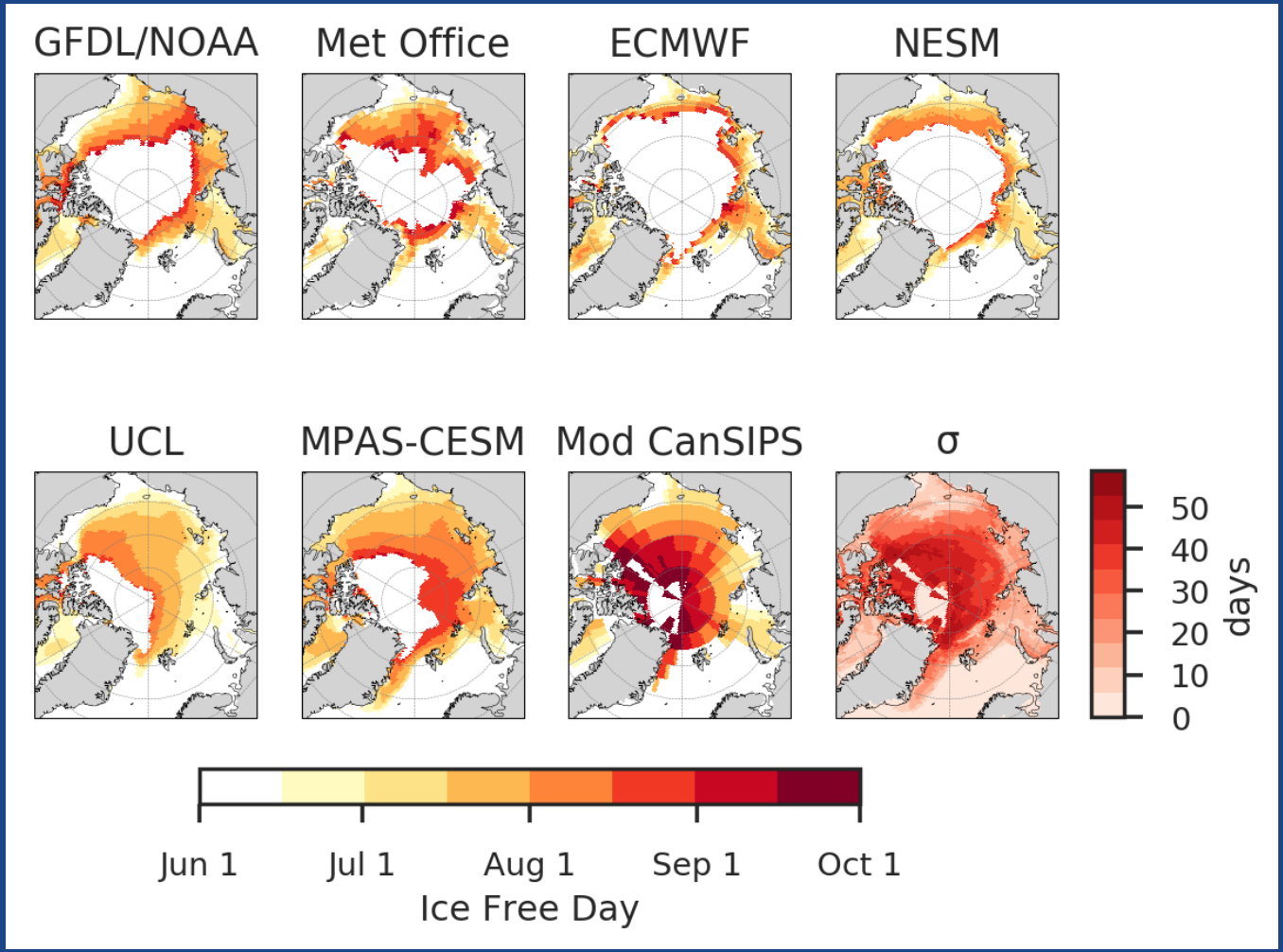
- We'll compute SIP & IFD for you (or you can send us yours)
- Soon we'll apply bias correction methods to all contributions so raw output is our preference

- Low ice cover in the Barents and Bering are associated with low SIP in the Alaskan region



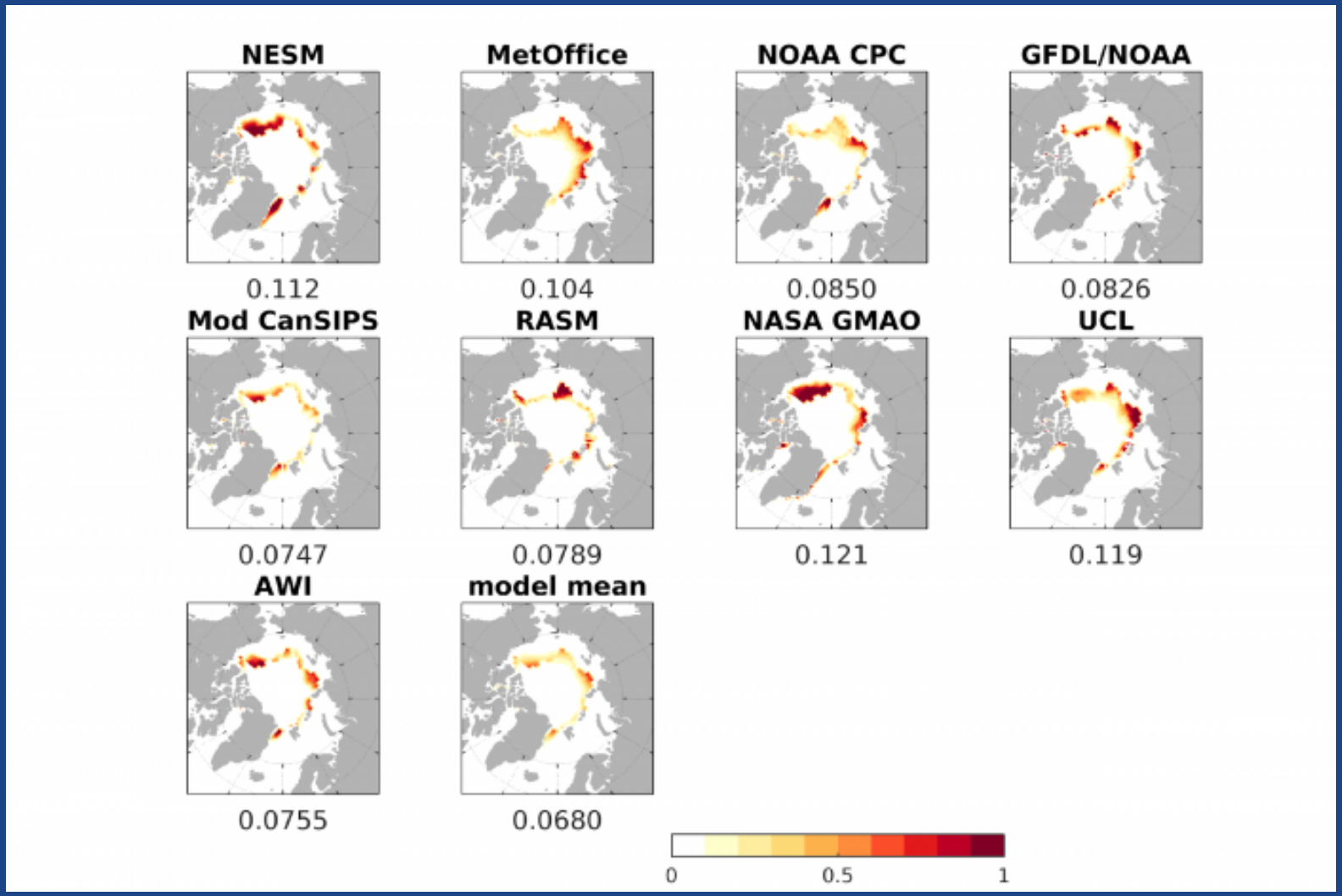
2018 Sea Ice Outlook

- Low ice cover in the Barents and Bering are associated with early first ice-free dates this year



Post Season Sea Ice Outlook

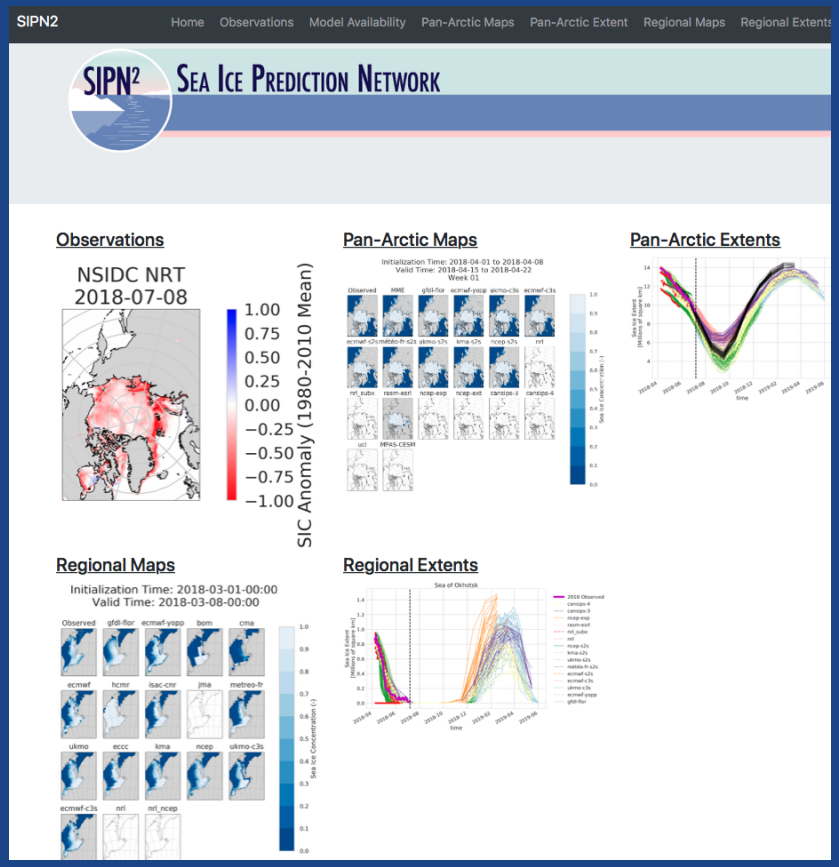
- We'll evaluate these forecasts, like we did last year



Summary

atmos.uw.edu/sipn

- Beta SIPN Prediction Portal is available (started in February)
- Stay tuned for expanded post processing, more variables, new model metrics, and access using Jupyter Notebooks
- Contact us to include your forecasts or give feedback



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nicway@uw.edu

Thank You!

- This presentation will be archived online at: https://www.arcus.org/sipn/meetings/webinars
- Please respond to the quick online survey following the conclusion of today's event.
- Would you like to know more about future Sea Ice Prediction Network activities and events? Join the SIPN email list at: https://www.arcus.org/sipn/mailing-list