Comparison of Hydrographic Databases in the Arctic

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MS research: compare data coverage in available hydrographic databases, eventually leading to a merged data set. This work follows in the footsteps of Inger-Lise Aasen and Cecilie Mauritzen's analysis of the EWG AOA database.

My goal here at AOMIP: find new data sets & get some feedback to make sure we do things correctly, avoid duplication, etc.

Space-time Domain

- 60^{o}-90^{o}N (no Baltic Sea), 1900-2009
- Surface-only measurements were removed from all databases
- All data were vertically interpolated to the WOD standard levels (e.g. 0,10,20,30,50,75,etc…)

Databases Considered

- **World Ocean Database 2005** (WOD05, nodc.noaa.gov)
  - Quality Control: NODC
  - Dates: 1900-2009
  - Data types: OSD, CTD, MBT, DRB, XBT, PFL, SUR, GLD
- **International Council of the Exploration of the Seas** (ICES, www.ices.dk/Ocean/data.asp)
  - Marine Data Management (MDM) quality control
  - Dates: 1900-2009
  - Data types: CTD, Bottle Data
    - » Shares some data with NODC
- **HydroBase2** (H2, www.whoi.edu/science/PO/hydrobase/)

  (Combination of WOD01, WOCE, NSIDC, ICES, BarKode, among others)
  - Dates: 1900-2009
  - Quality Control: only North Atlantic – Arctic is raw data
  - Data types: CTD, Bottle Data, Some Float Data

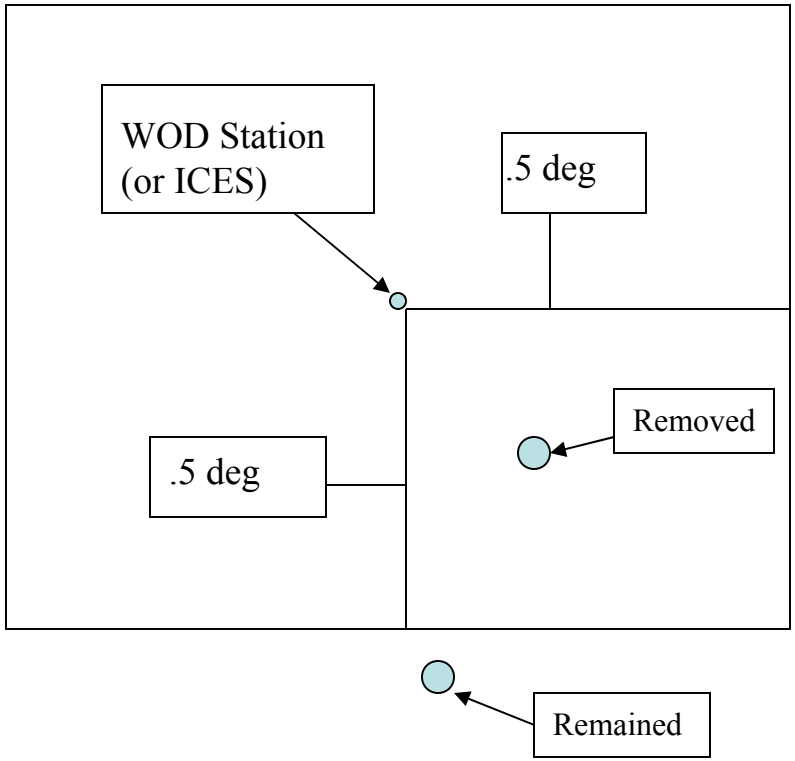
Other data

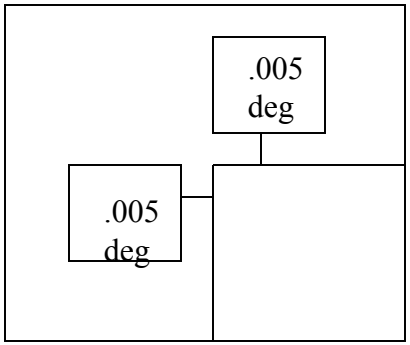
- **Ice Tethered Profile Data (ITP, www.whoi.edu/itp)**
  - Used level II qc data
  - Adds ~20,000 observations unique to WOD and ICES

Analysis Procedure

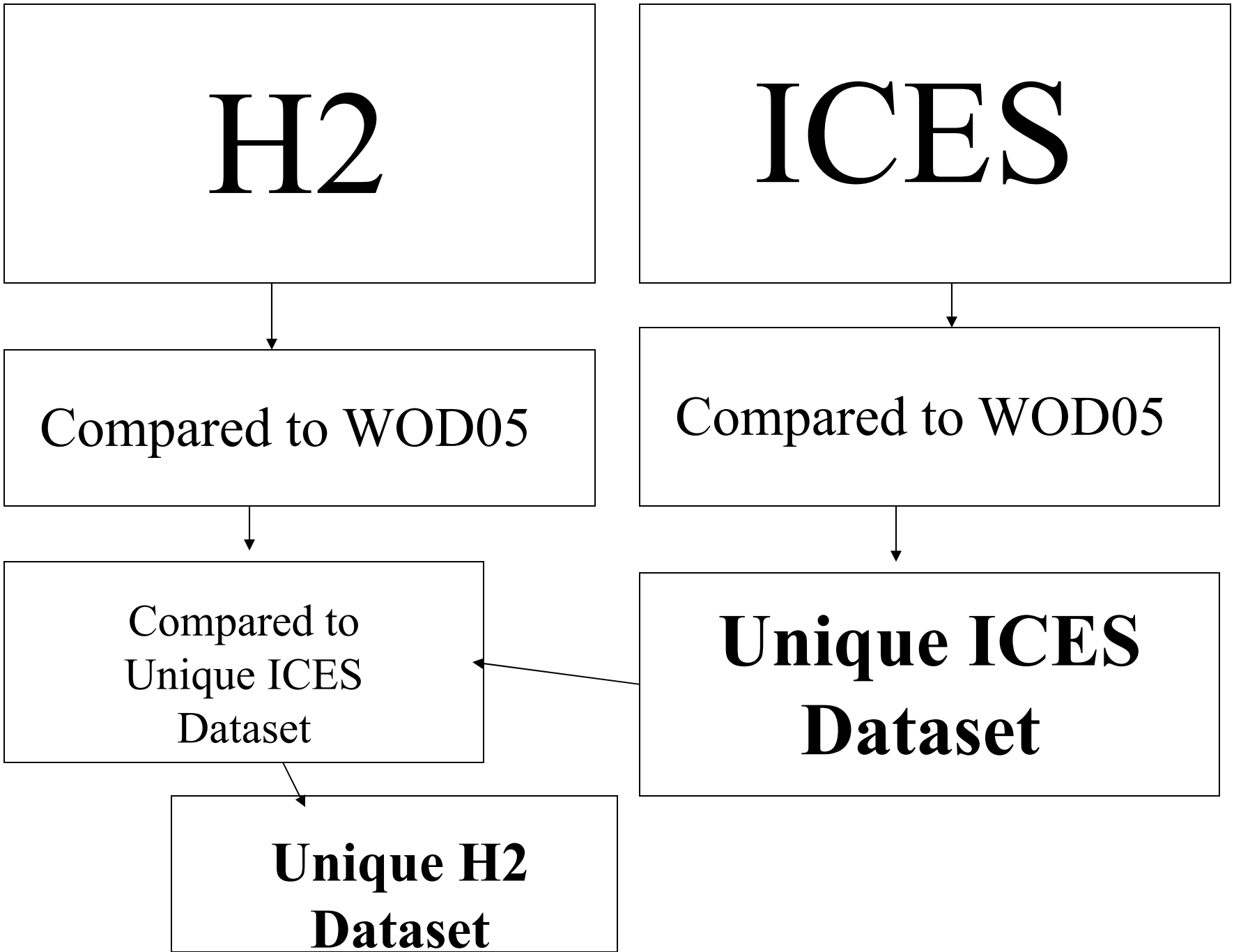
- H2, ICES, and ITP compared to WOD05 (see next slide)
- Performed weak quality control to WOD05, ICES, and ITP that tested the stability of each observation
  - potential density vertical gradient check (decrease by more than .05 kg/m^3 at the next lowest level then obs. removed).
    - Also, if the depth was greater than 200m, then the potential density at the surface was compared to the potential density at the lowest level, if the surface was found to be greater than it was considered unstable and removed.
  - H2 was left out of this qc test because of some very erroneous data…
- Temperature, salinity, and potential density were compared separately

Identification of Duplicates





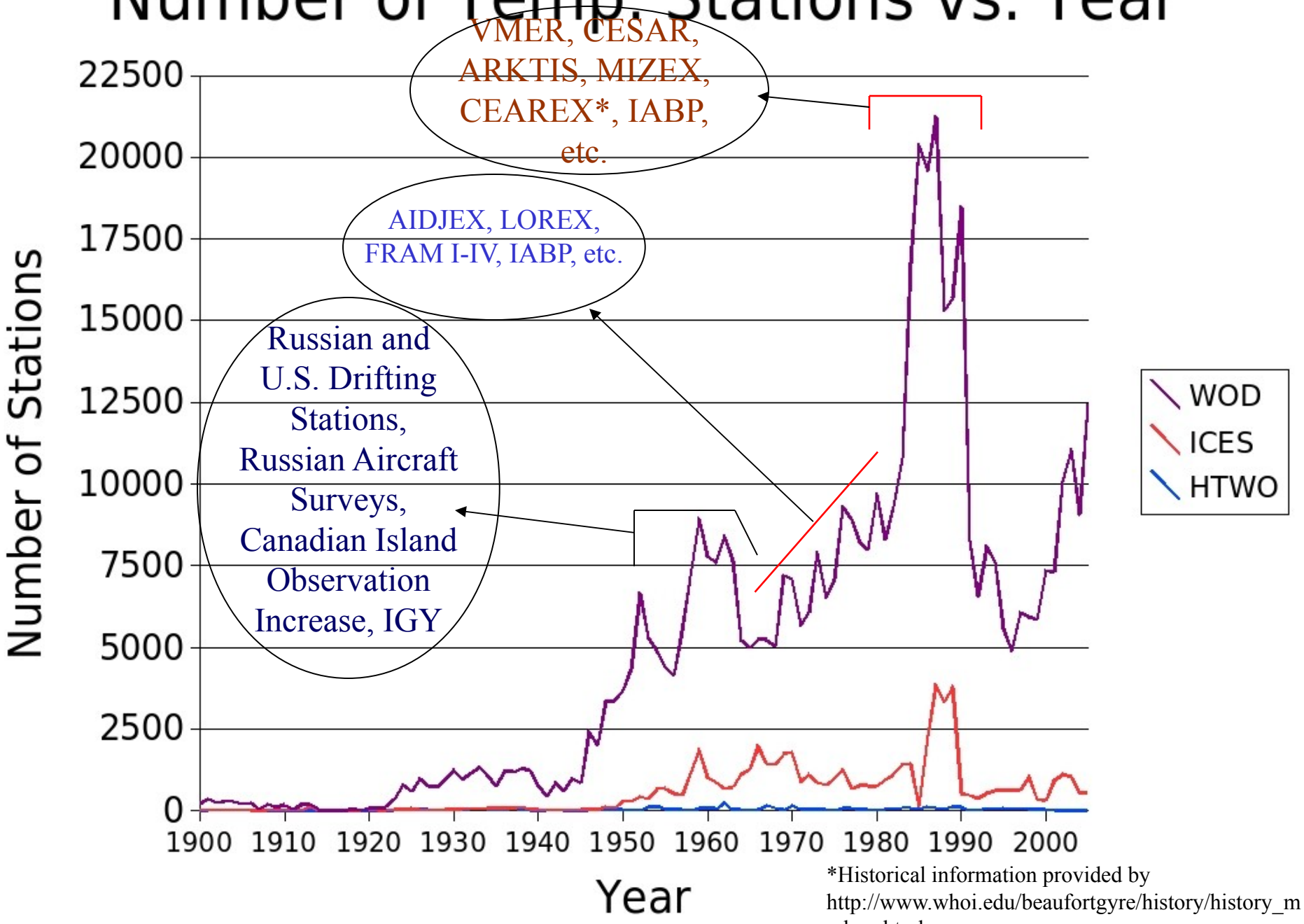
- Station was only unique if it did not lie within a .5 degree radial box of the comparing station
  - Checked stations on a smaller radial box, and did not see a significant jump in number of station observations indicating most stations were exact duplicates…
- Of course, dates must be the same as well when comparing observations


H2
ICES
Compared to WOD05
Compared to WOD05
Compared to Unique ICES Dataset
Unique ICES Dataset
Unique H2 Dataset

Results of Comparison

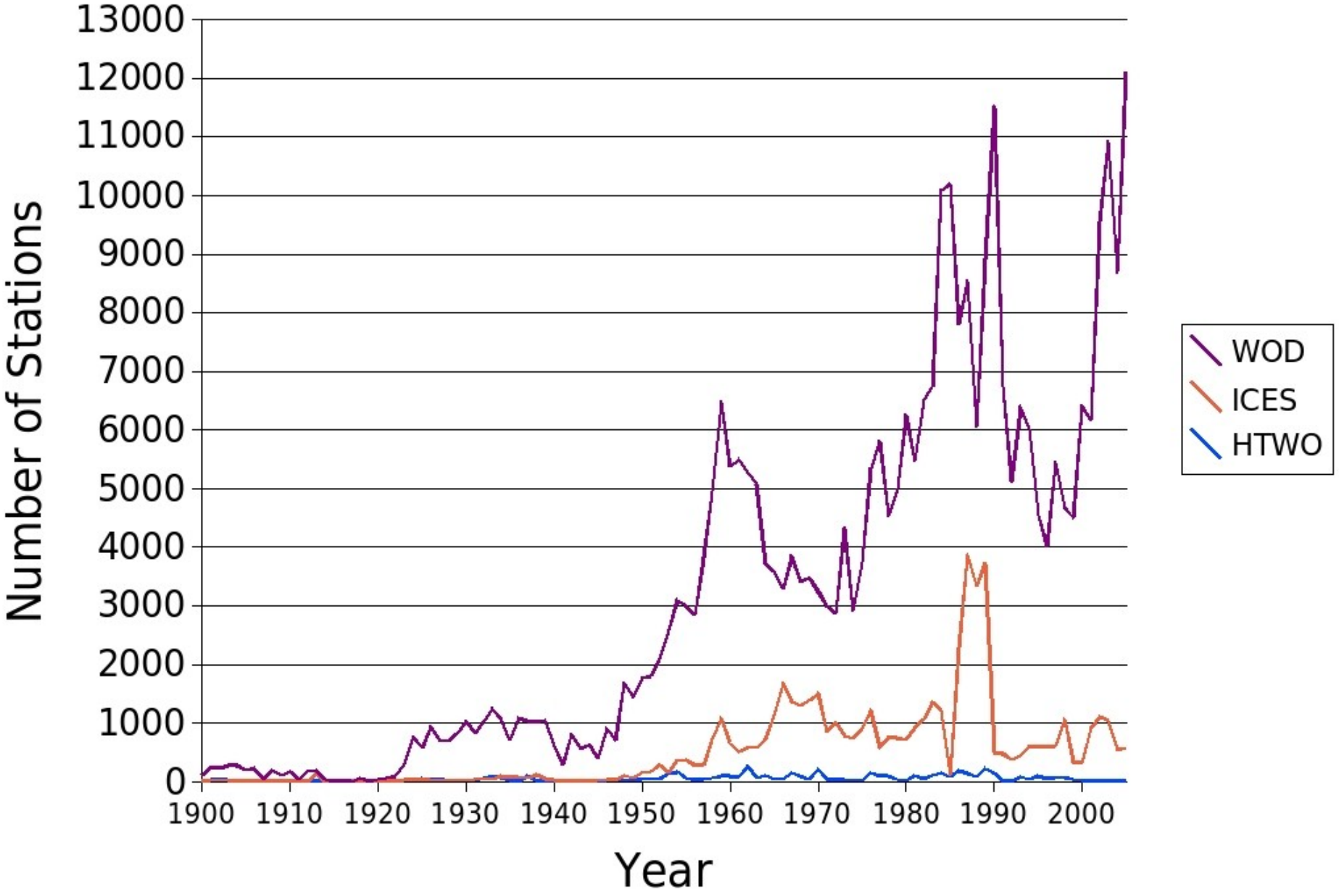
	Temperature Stations	Salinity Stations	Unique Temperature Stations	Unique Salinity Stations
WOD05	~590,000	~390,000	~520,000	~340,000
ICES	~350,000	~350,000	~65,000	~60,000
H2	~260,000	~260,000	~4,000	~5,000

Number of Temp. Stations vs. Year



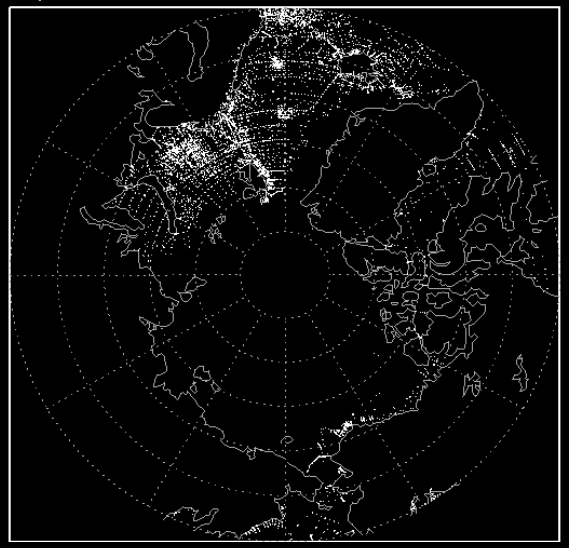
*Historical information provided by http://www.whoi.edu/beaufortgyre/history/history_modern.html

Number of Salinity Stations vs. Year

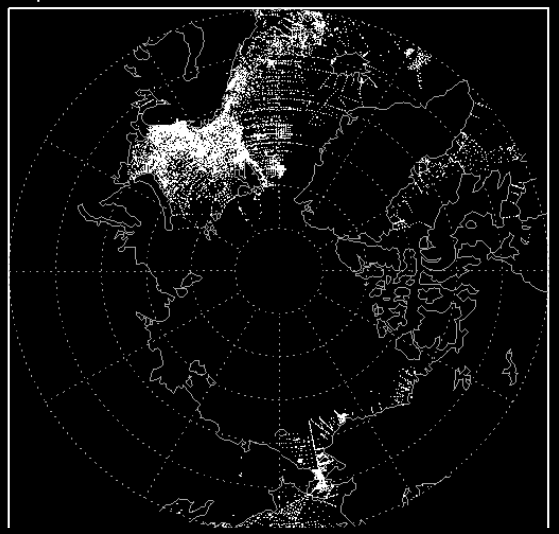


Spatial Distribution of 1980's Temp. Observation Increase

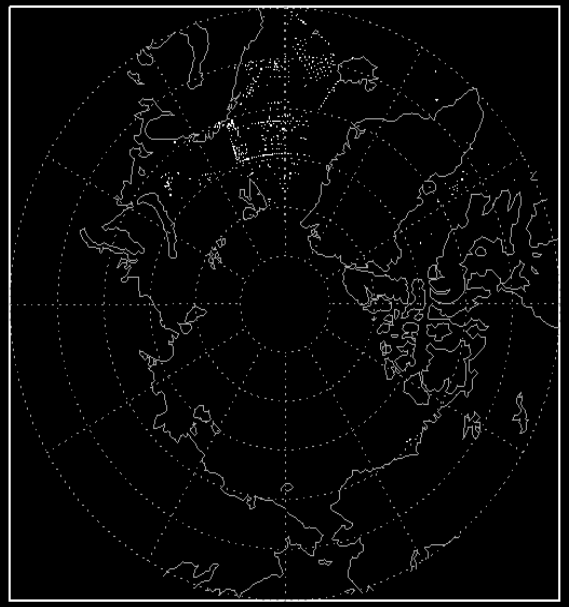
1977 Temperature Observation Locations WOD, Lev = 10m



1987 Temperature Observation Locations WOD, Lev = 10m



1977 Temperature Observation Locations ICES, Lev = 10m



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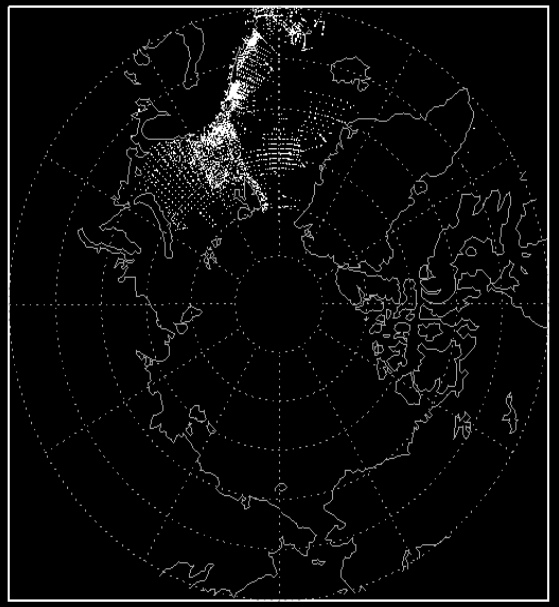
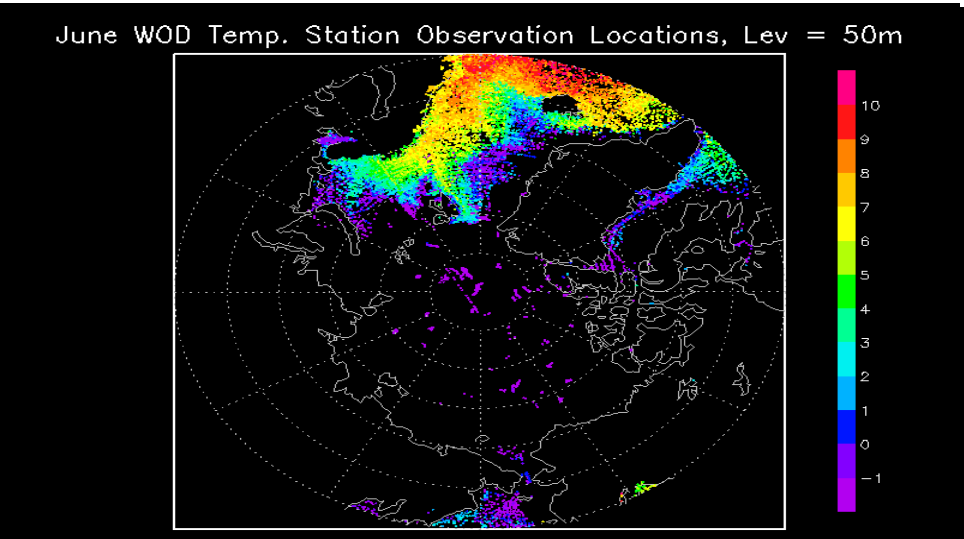


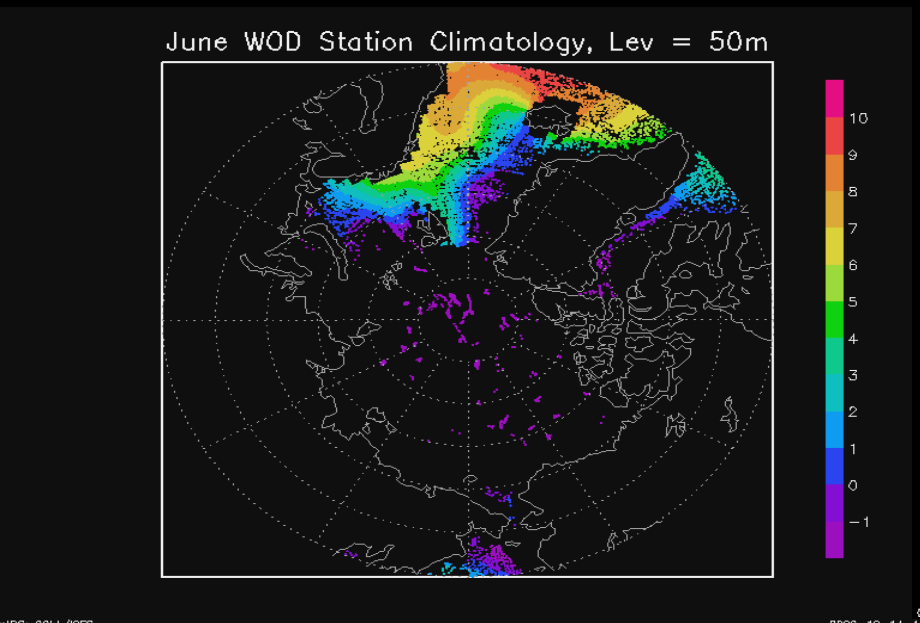
Comparison of WOD05 and ICES to PHC 3.0

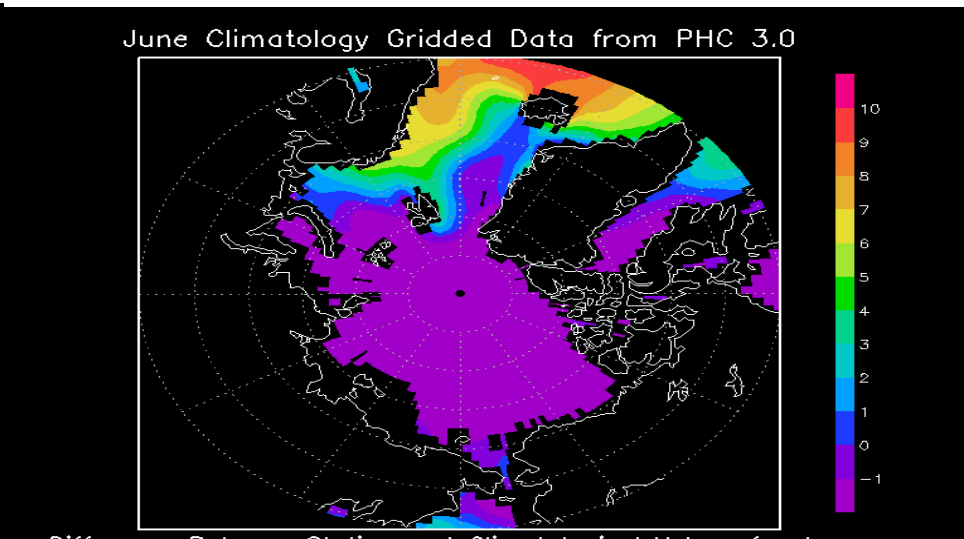
(http://psc.apl.washington.edu/Climatology.html)

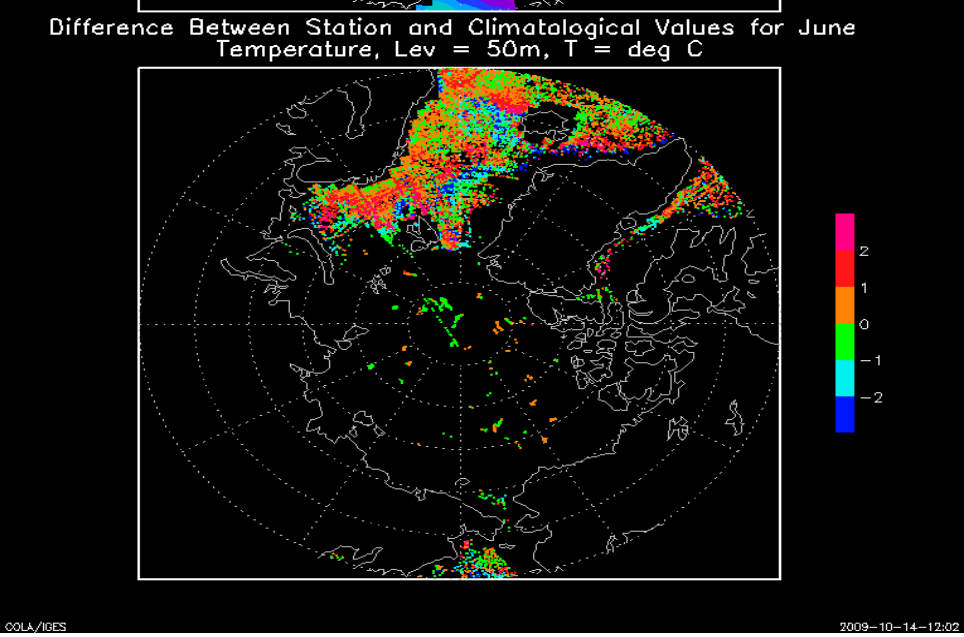
at Z = 50m and 300m (Motivation?)

Methodology:

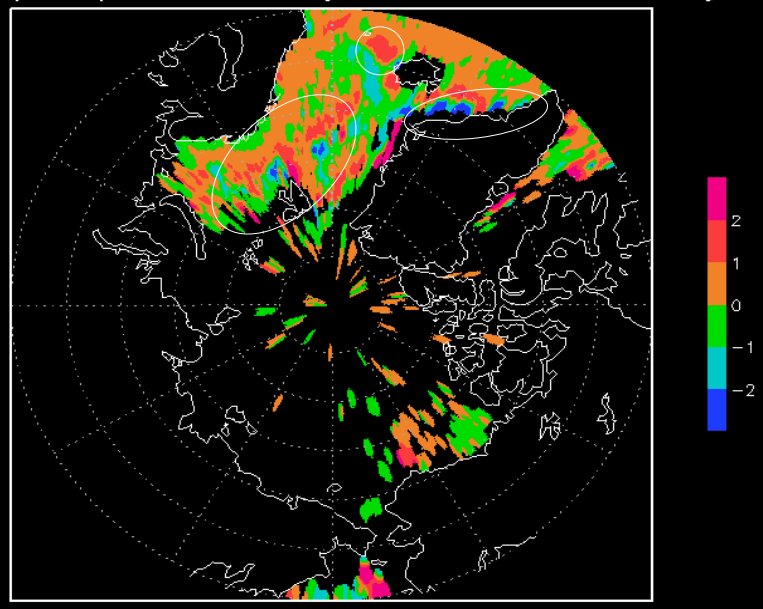




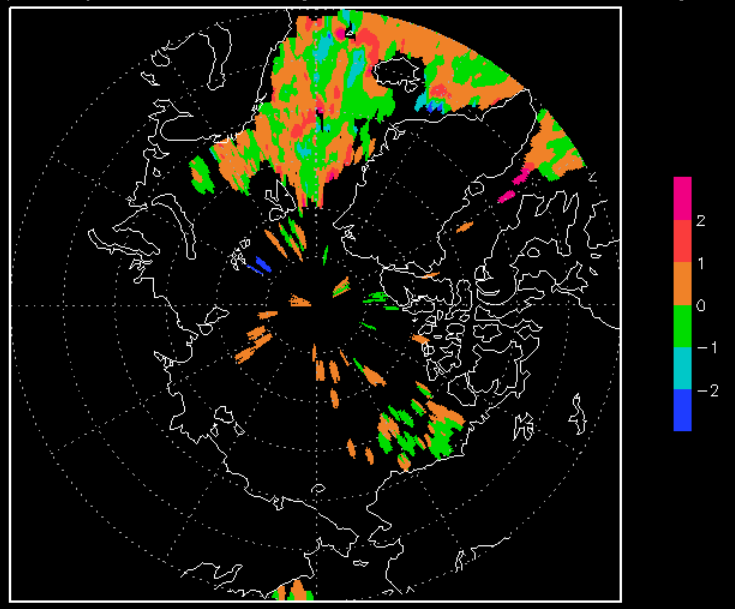




Difference Between March WOD Temp. Station Data and Bilinearly Interpolated Climatological Data Z = 50m, T = deg C



Difference Between March WOD Temp. Station Data and Bilinearly Interpolated Climatological Data Z = 300m, T = deg C



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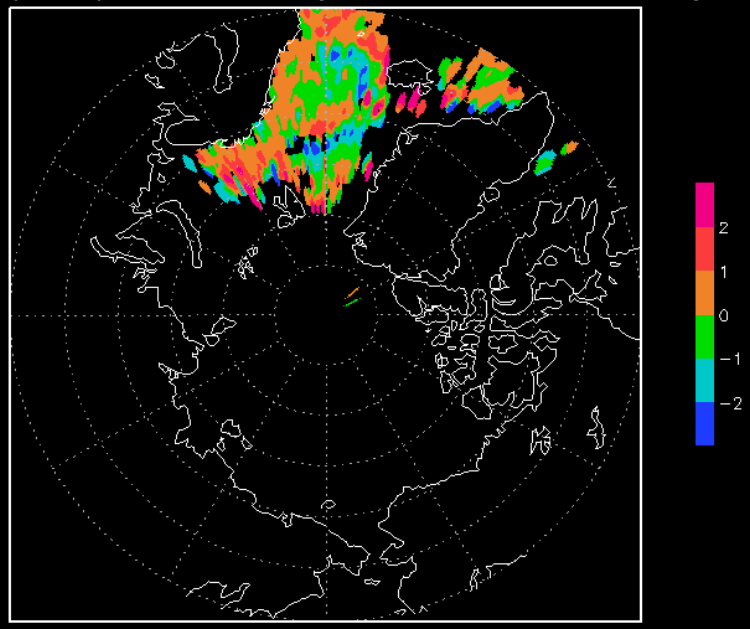

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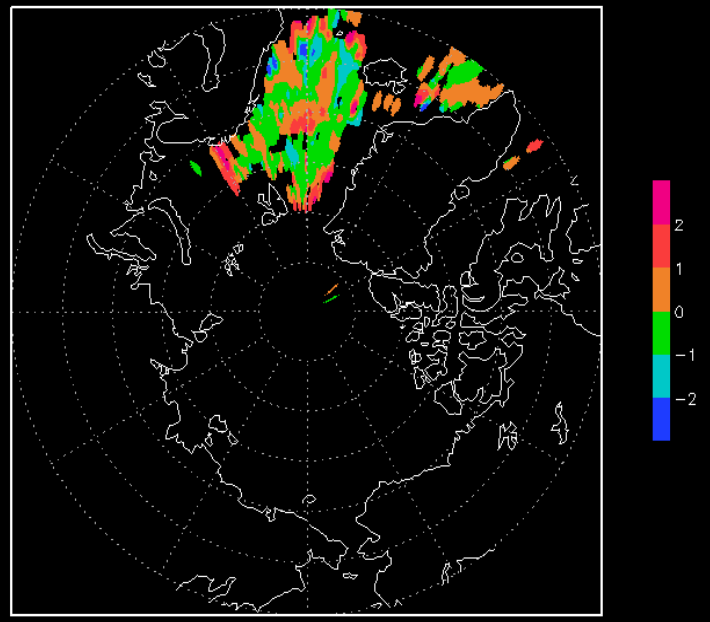
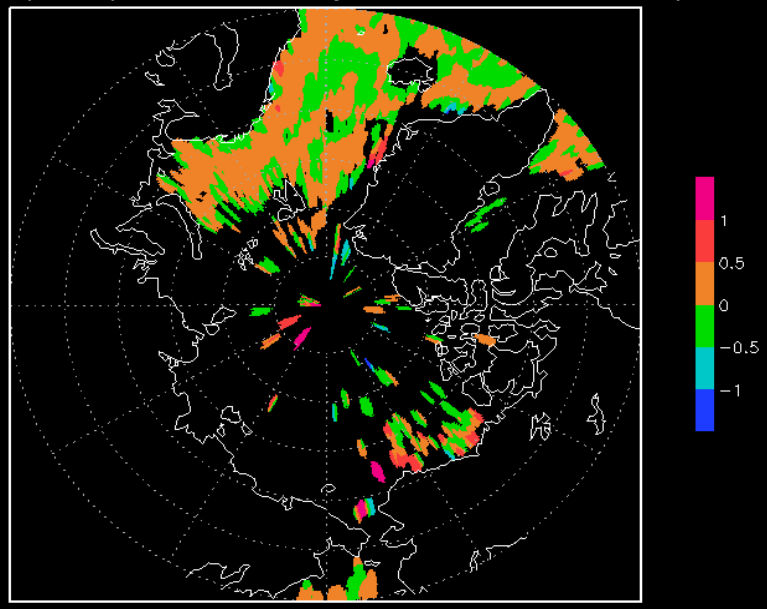


Difference Between March WOD Salinity Station Data and
Bilinearly Interpolated Climatological Data Z = 50m, S = psu



GrADS: COLA/IGES

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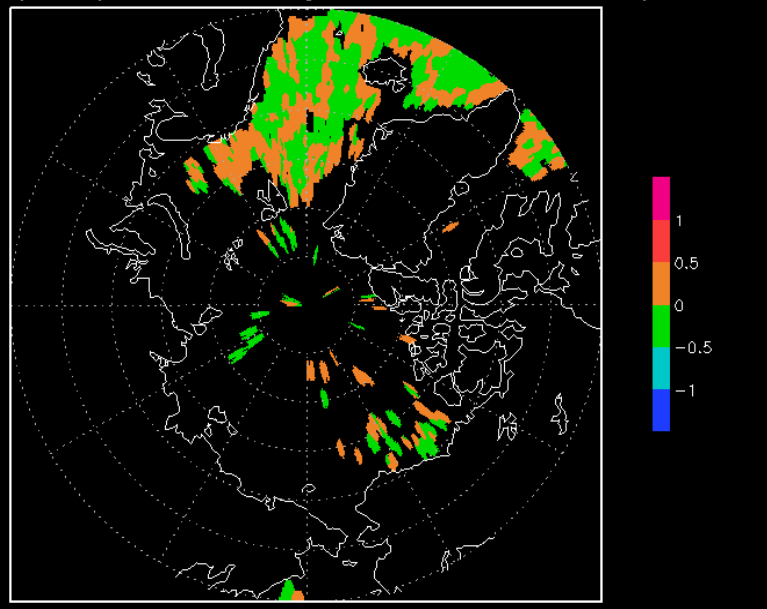

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Difference Between March ICES Salinity Station Data and
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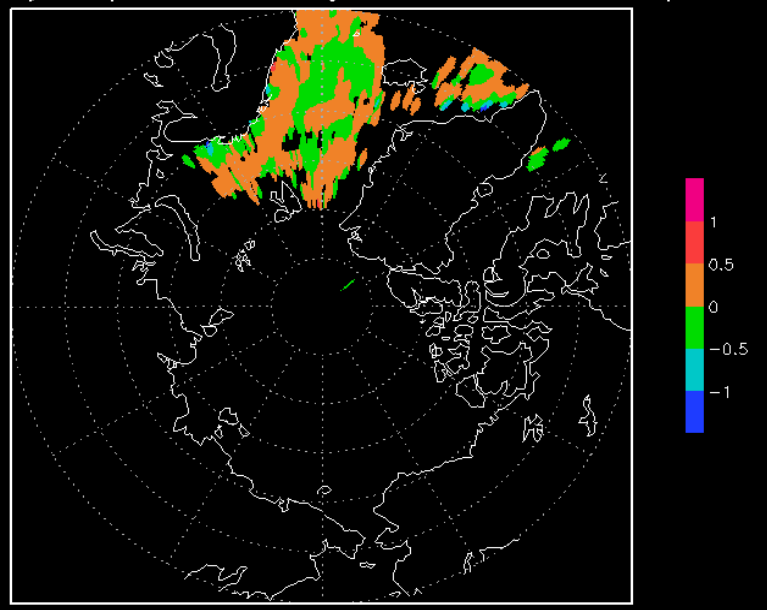

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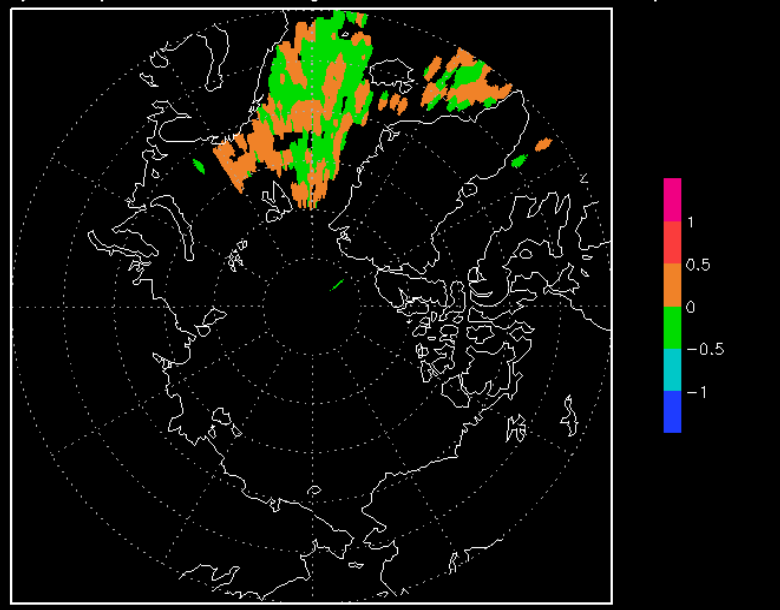

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Concluding Remarks

- ICES, Hydrobase2, and ITP Data add nearly 75,000 unique station observations (10% increase) to WOD05
- WOD05 and ICES show similar temperature and salinity differences WRT PHC3.0

{Analyzed J-CAD Buoy data but then discovered most of data included in WOD05}

Things Still to Do

- Nansen and Amundsen Basins Observational System(NABOS) Data
- North Pole Environmental Observatory Data
  - Bottom-Anchored Mooring Data
- Polar Ocean Profiling Systems(POPS) Data?
- Comparison with DAMOCLES & Inger-Lise Aasen's data sets

Some Science

- Analysis of decadal changes of, e.g. Atlantic Water in comparison with the Environmental Working Group atlas
- Analyzing decadal variability to see if the anomalous temperature and salinity values (previous two slides) have changed in time...