Historical Climate Data Resources in the North Pacific – Arctic Region

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with contributions from

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Detecting change is an historical problem

What is different today compared to yesterday, the 1950s, or the 19th century?

Are there large-scale or low-frequency patterns that aid (or confound) understanding?
We search the past for clues

Historical resources

- Instrumental time series & fragments
- Descriptive records (written & visual)
- Climate proxies (ice cores…)

Constraints

- Quality, homogeneity, metadata
- Other noise issues...

~200 years

MS met. records

Published records

Revenue steamer Corwin at Nome, June 1st 1901

100s of years (1600s in Russia)

Minimum thermometers (1881).
Photo: Deborah J. Warner NMAH

Russian instrument shelter, 1868

Met. station at Taimir’s winter quarters, 1914
(Russian Hydrographical Expedition to the Arctic, 1910-15)
An example: Air temperature variations on the Atlantic – Arctic boundary since 1802

What we see

Irregular pattern of SAT fluctuations

ETCW event is the most striking historical example

No obvious AMO cycle

Wood, Overland, Jónsson & Smoliak (2010), Geophysical Research Letters
Independent data are consistent

- Composite SAT locations
- Ice cores
- SST anomaly records

### Table

<table>
<thead>
<tr>
<th>Correlation</th>
<th>$\delta^{18}$O</th>
<th>$SST_0^*$</th>
<th>Teigarhorn SST</th>
<th>Sea Ice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>0.67</td>
<td>0.67</td>
<td>0.72</td>
<td>-0.64</td>
</tr>
<tr>
<td>Filtered$^a$</td>
<td>0.82</td>
<td>0.92</td>
<td>0.85</td>
<td>-0.84</td>
</tr>
</tbody>
</table>

$^a$As in Figure 1.
Teleconnection with mid-latitude SST’ is seen

Contours: Mean SST’ (16-22°C)
High correlation is robust across data sets

**Hadley ISST**

Contours: Mean SST' (16-22°C)

**SST₀'** (Hadley SST2)

\[ r = 0.67/0.92 \]

Detrended and filtered (0.1 cpy)

**Atlantic SST' (AMO-like)**

(proxy reconstruction)

Detrended and filtered (0.1 cpy)
Historical data in North Pacific – Arctic

Russian America

~1820-1867

9 locations with met. records

Nowo Archangelsk (Sitka) may provide near continuous record from 1820s

Original records destroyed?

Nowo Arkhangelsk in 1829
Nowo Archangelsk – Sitka SAT’ time series

1828-2009

Also: sub-daily barometric pressure from 1847 awaits digitization
Correlation with SST anomaly

Sitka SAT'
Ann. 1950-1996

Nome/Kotzebue
Ann. 1950-2004

HadISST
Historical ocean & sea ice data

First Bering Strait transect by Dall for U.S. Coast Survey, Sept. 5, 1880.

On the 3d of September we sailed from Chamisso Harbor for Bering Strait, arriving off East Cape of Asia about 6 A.M. of the 5th. Broken ice intervened between us and the shore, and the bight southward from the cape was packed full of ice. We could not approach nearer to the shore than four miles.
Historical ocean & sea ice data

U.S. Hydrographic Office Report, 1890.
August-September ice edge for 1879, 1885, 1886, 1887, 1888, 1889
Biogeography of bowhead whale fishery

Map 4.—Total documented daily ship locations and bowhead captures, 1849–1914. The yellow dots represent all documented ship locations, which were recorded daily in the logbooks and journals. More than one ship could, of course, visit the same location, and the same ship could remain at, or revisit, a location. The red dots represent the total documented bowhead captures. This map does not indicate the intensity (number of times) that ships visited a location.

Bockstoce (2005) Marine Fisheries Review
Historical ocean & sea ice data

Tracks of Vaigach and Taimir, 1910–1915

Russian Hydrographical Expedition to the Arctic, 1910–1915

Vaigach near Wrangel Island, 1913

Do data still exist?

Transehe (1925) Geographical Review
Historical ocean & sea ice data

ГИЦРОПОГИЧЕСКИЕ НАБПЮДЕИЯ МОРСКИХ ЭКСПЕДИЦИЙ 2-ГО МРГ, 1932-33 Г.

Dansk Nautisk-Meteorologisk Aarbog (1901-1956)

Ice map from the Soviet
Aug. 10 – Sep. 23, 1932

A. Sibiryakov under jury-rigged sails after loss of propeller shaft near North Cape

Hydrological Observations of the Second IPY Sea Expeditions, 1932–33 (multiple ships).
Historical ocean & sea ice data

800 stations

147 casts

1932 Track of trawler Dalnevostotchnik
(State Hydro. Inst. & Pacific Fish Inst.)

Hydrocasts in the RUSALCA region 1930-1940
(including Russian IPY-2 sea expeditions) in NODC-WOD09
Objectives for the coming year:

Find and collate a wide range of historical data

Construct continuous regional time series and indexes where possible

Case study approach (compare 1930s with data obtained during RUSALCA?)

Contribution for Climate Data Modernization Program (CDMP), Int’l Env. Data Rescue Program (IEDRO) & extended reanalysis (NCEP & ACRE)

Develop Int’l and interdisciplinary collaboration
Supplemental Slides
Regionally distinct SAT curves

Winter (DJFM) SAT anomalies from land-based stations north of 60° N in the Atlantic sector (90°W – 45°E) and Pacific sector (135°E – 90°W)

CRUTEM3v data (Brohan et al. 2006).
Systematic influence

The consistency of correlation coefficients as y-intercepts shift is an indicator of systematic forcing in the system.
F. Litke