Natural variability and tolerance:
Oslo: 18-19.10.2019

Lunar-driven control of climate and Barents Sea Eco-System

Professor Harald Yndestad

Norwegian University of Science and Technology

Research periods

1978: Master Cybernetics, NTH
2004: Dr.philos; Climate & Barents Sea Eco system
2006: Professor Simulation, NTNU

1978-1982: Signal theory, FFI Kjeller
1995-2009: Lunar => Climate & Ecosystem variability
2014-2016: Planets => Solar variability
2017-2019: Solar-Lunar => Climate variability

The fishery was growing

Until the fish disappeared, but why?

Ålesund 1960

The Motive of Science

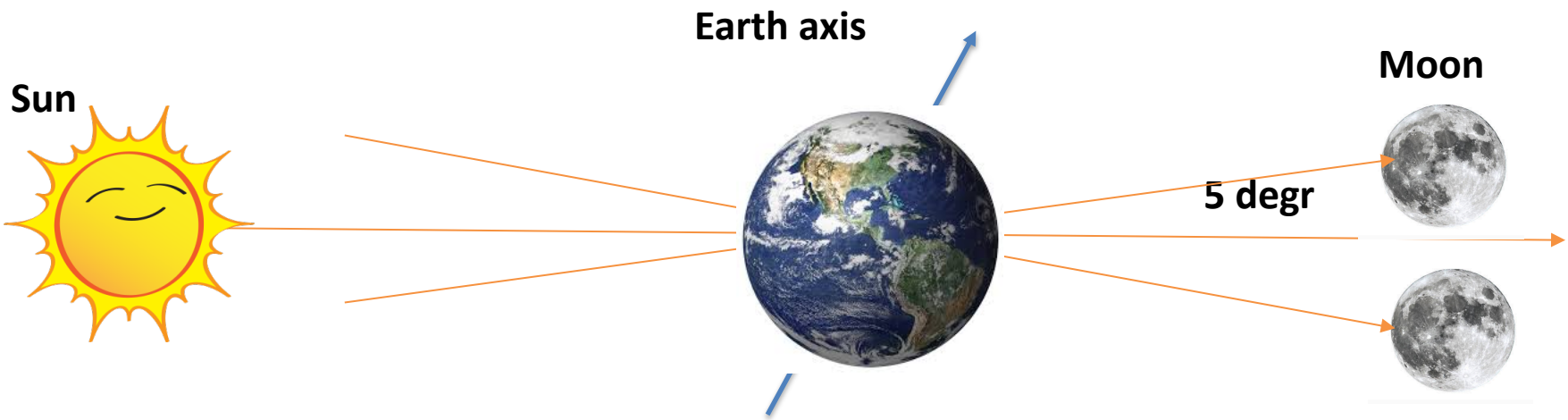
-- Francis Bacon (1561-1626)

The motive of science is:
- To predict the future
- To control the future

But, is the future deterministic?
- If not, we can only explain the past

The Earth-Moon-Sun oscillation

The 18.6-year Earth axis oscillations



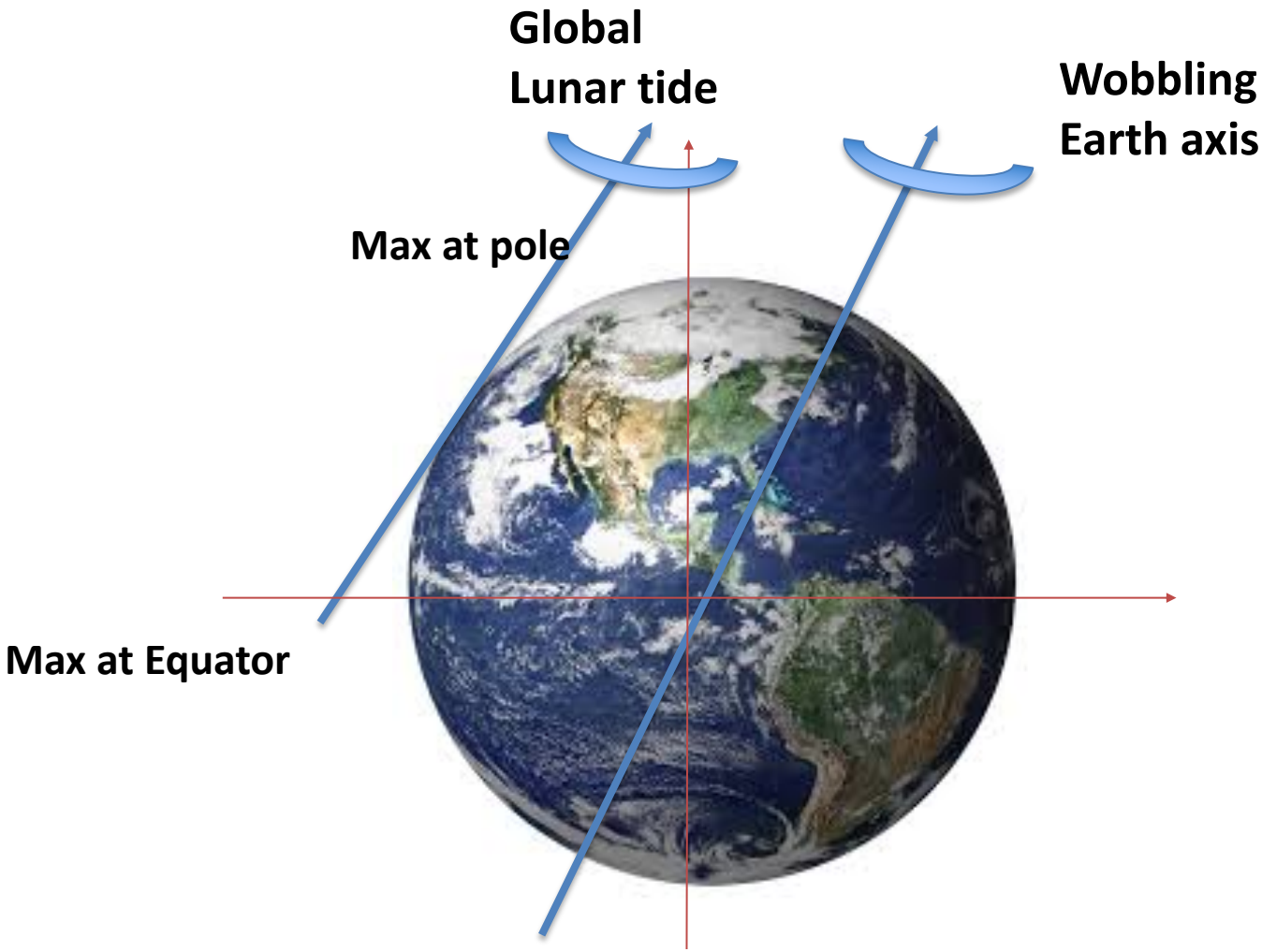
Wobbling Earth Axis: 23.5 +/- 5 degrees

Earth nutation: Dominant period of 18.6 years

(James Bradley (1693-1762)

The Lunar nodal tide

18.6-yr Lunar axis wobbling => 18.6-yr lunar tide

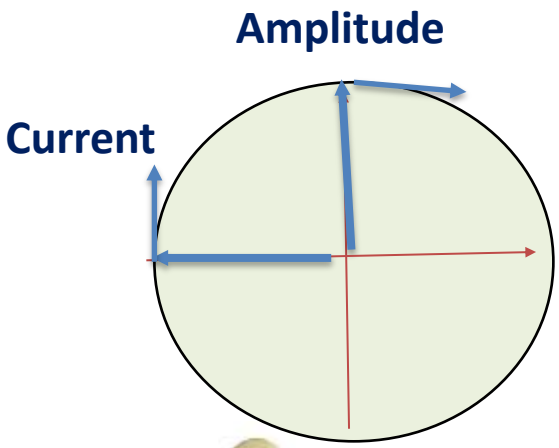


(George Howard Darwin, 1877)

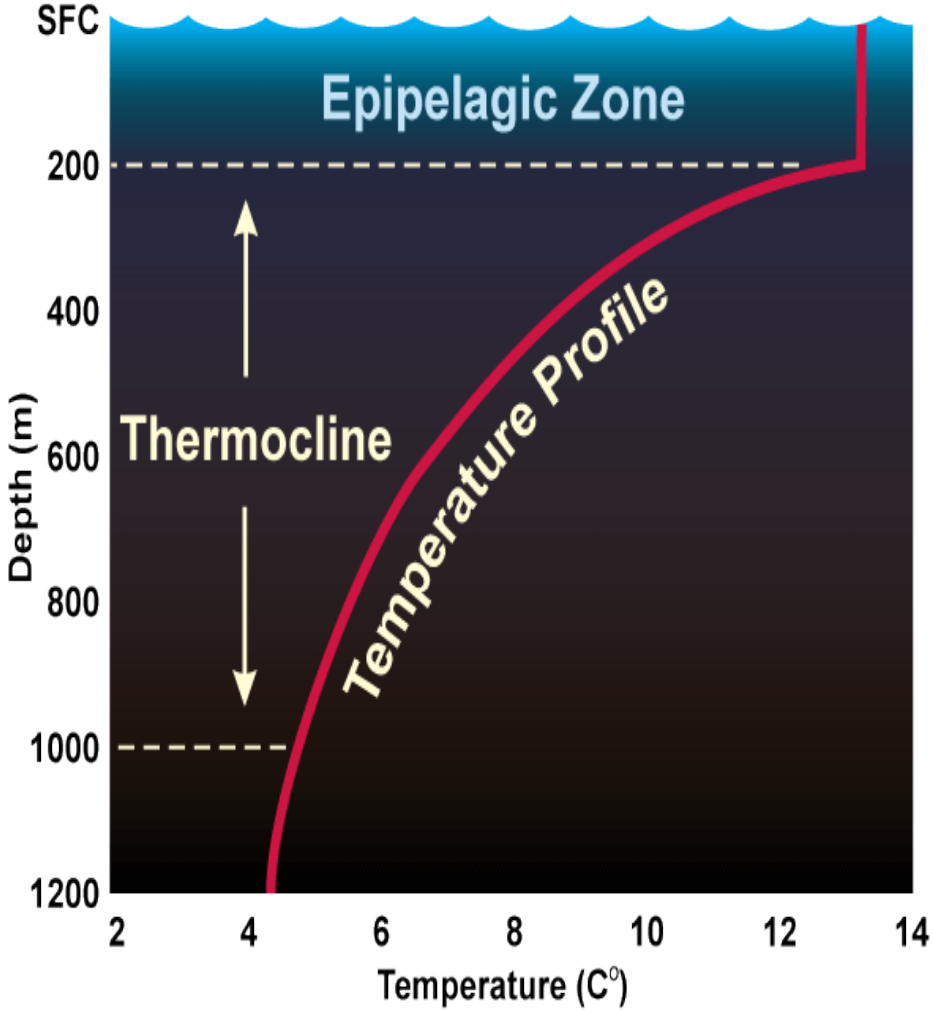
Lunar tide & Vertical Ocean Mixing

Circular Lunar tides => Circular sea temperature mixing

Vertical mixing power:
2/3 from tides

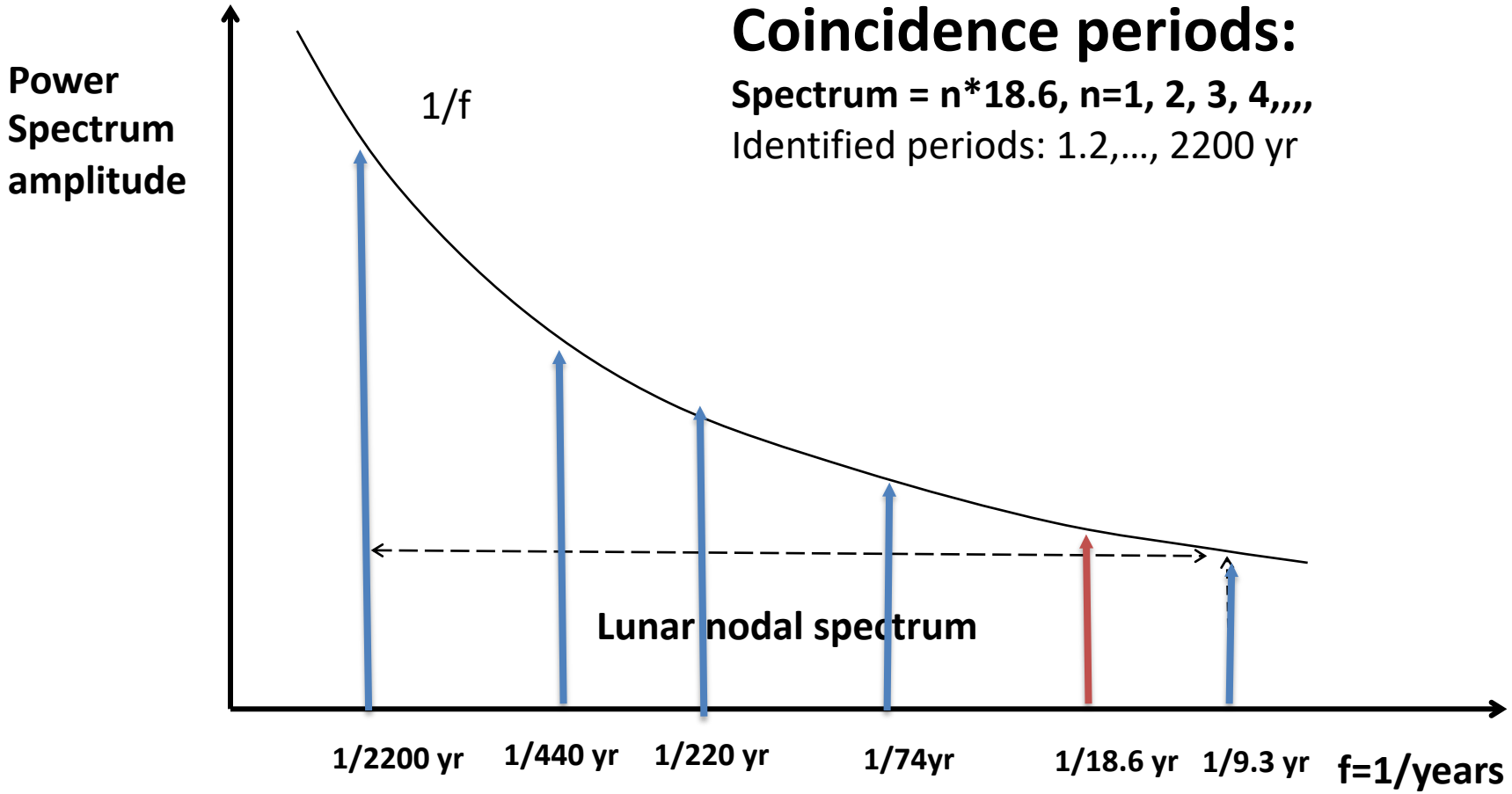


(Otto Pettersson, 1848-1941)
)



Lunar Temperature Spectrum

Stationary Lunar period => Lunar period spectrum



Coincidence periods:

Spectrum = n*18.6, n=1, 2, 3, 4,,,,

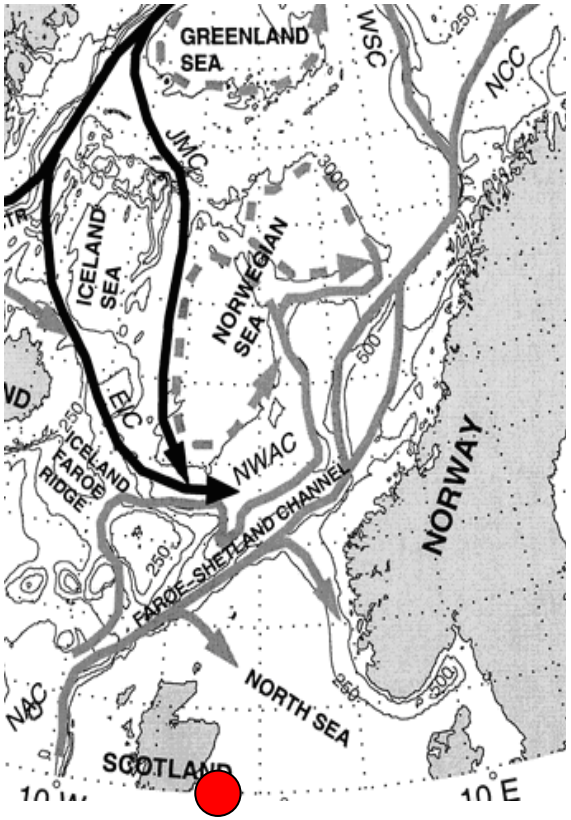
Identified periods: 1.2,…, 2200 yr

(Yndestad, 1999, 2008)

Lunar nodal tide & Sea level

Lunar nodal tide => 9.3, 18.6 yr oscillation

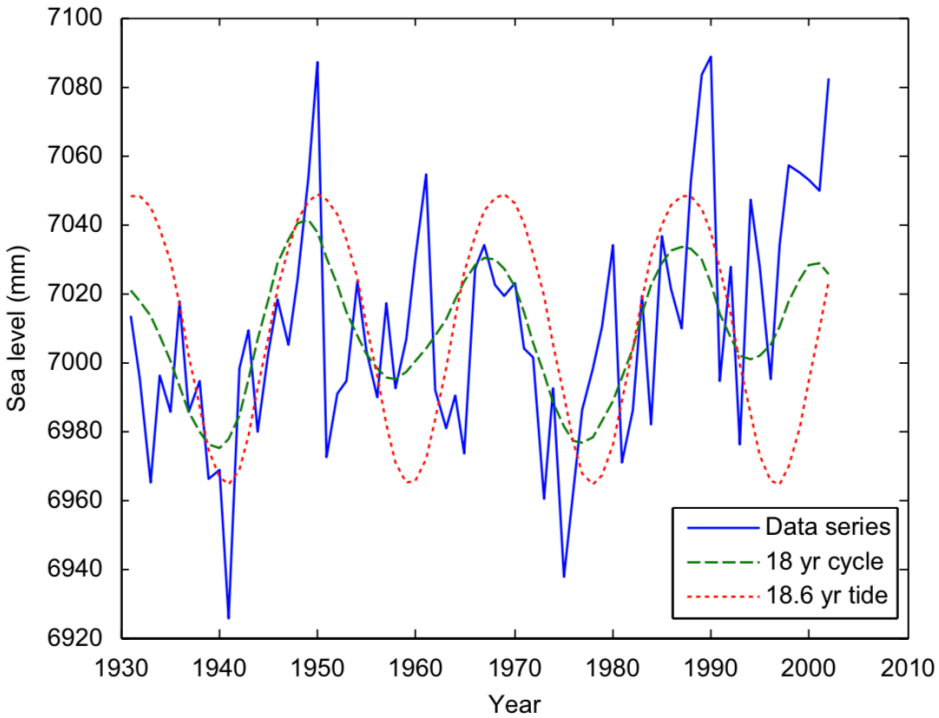
NAW inflow



(Yndestad et al. 2008)

Mean Sea level at Aberdeen

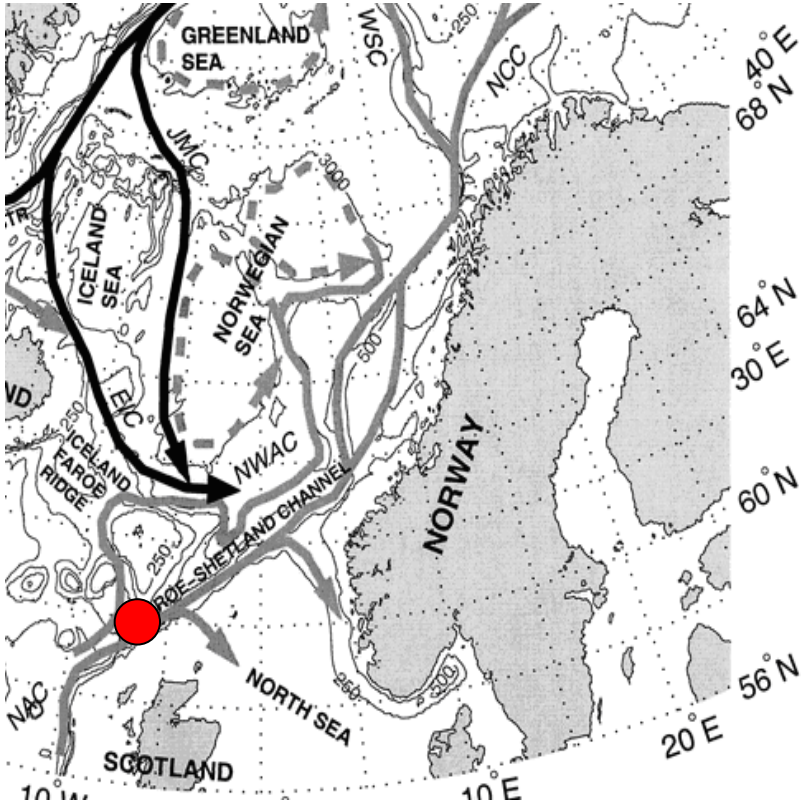
H. Yndestad et al. / Deep-Sea Research I 55 (2008) 1201–1217

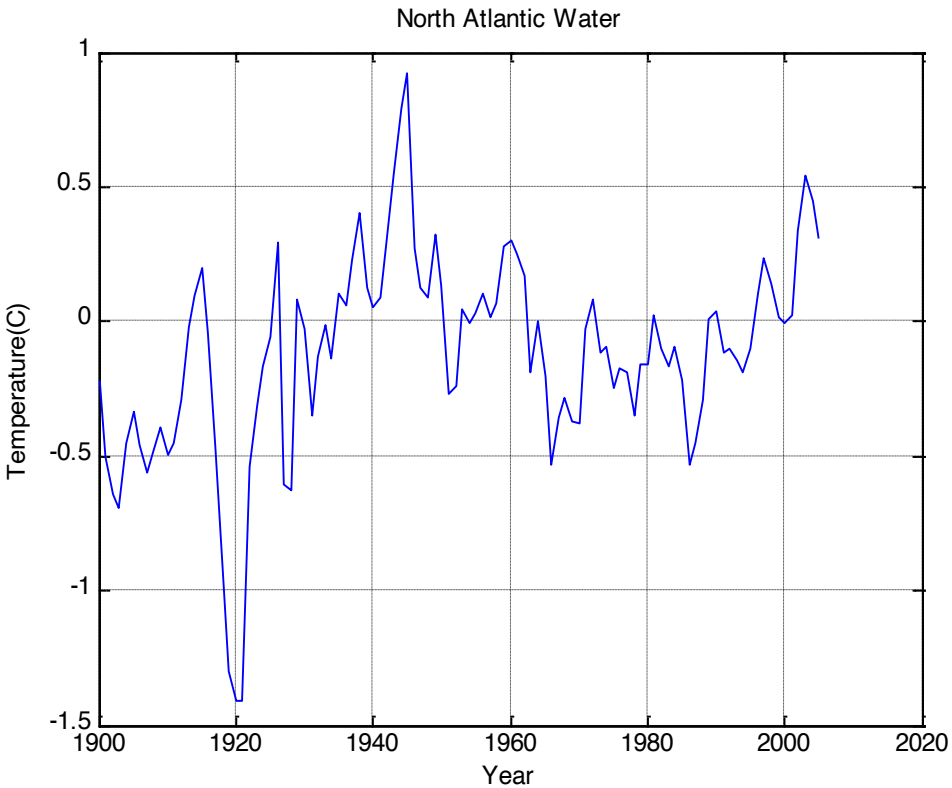


ig. 2. The annual mean Aberdeen sea level (mm): the identified 18-year-dominant wavelet and the 18.6-year lunar nodal cycle.

North Atlantic Water temperature

Inflow to the Norwegian Sea



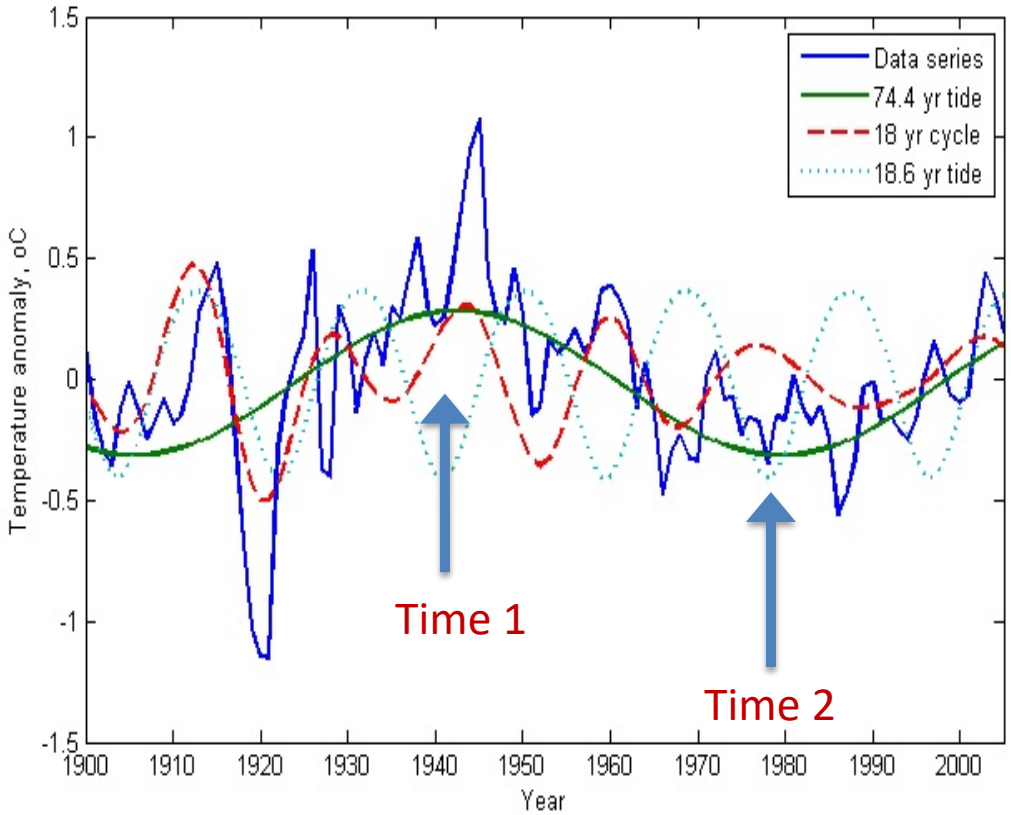


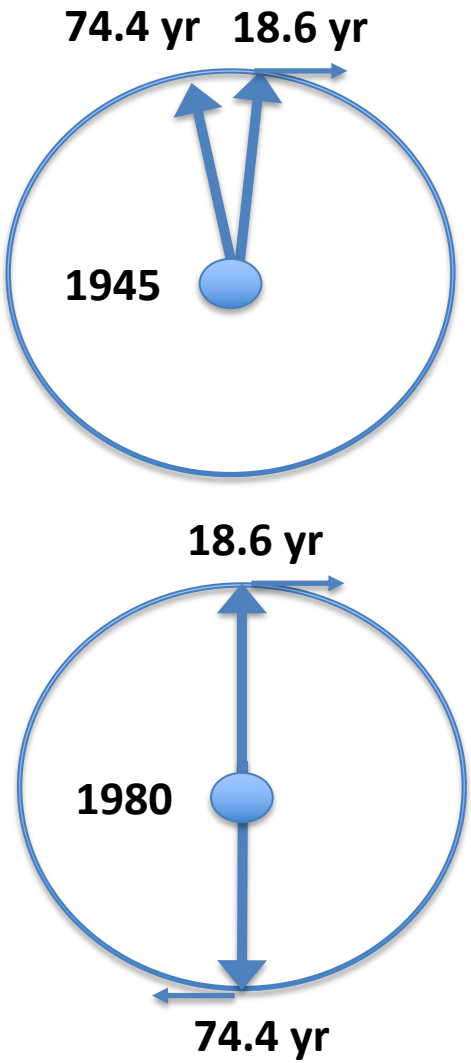
(Yndestad et al. 2008)

Lunar-driven Sea Temperature variability

Lunar-driven period spectrum: 9.3, 18.6, 74.4 yr

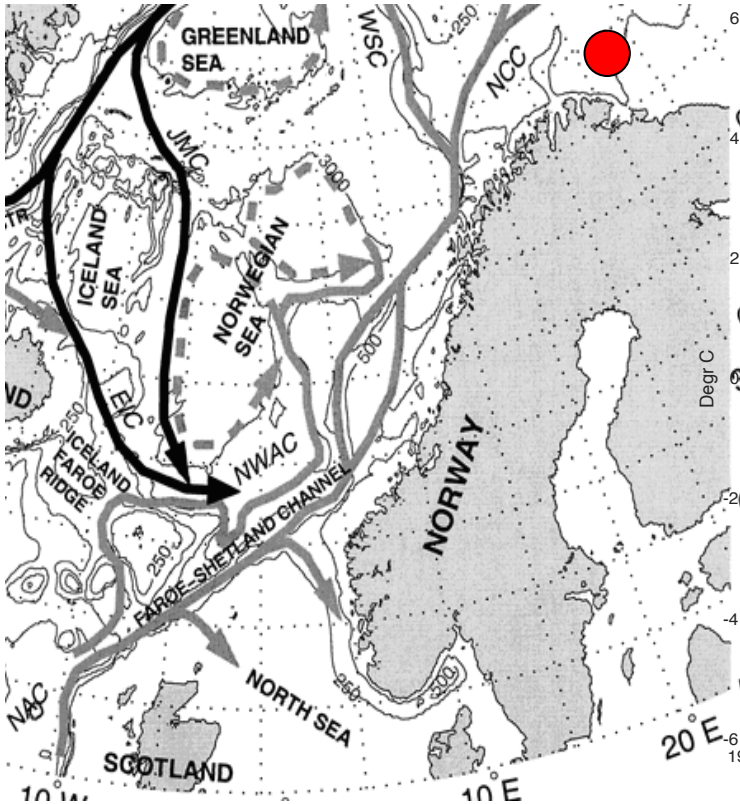
North Atlantic water temperature



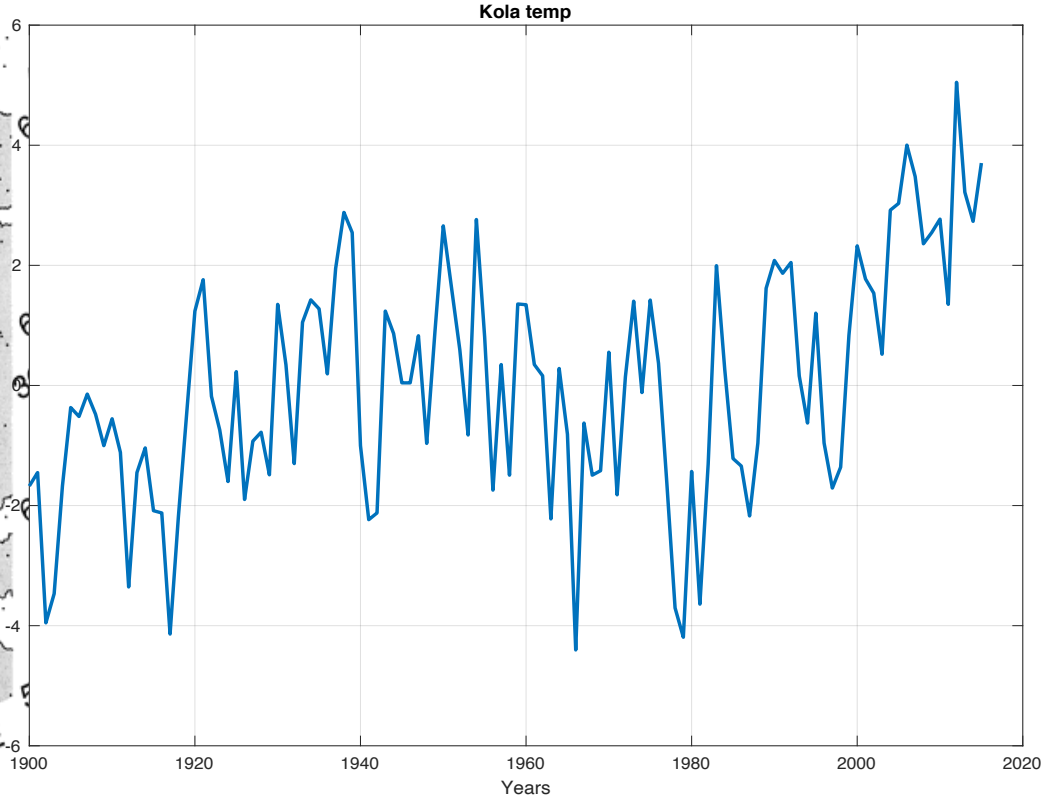


(Yndestad et al. 2008)

The Barents Sea temperature



Kola-section 1900-2017

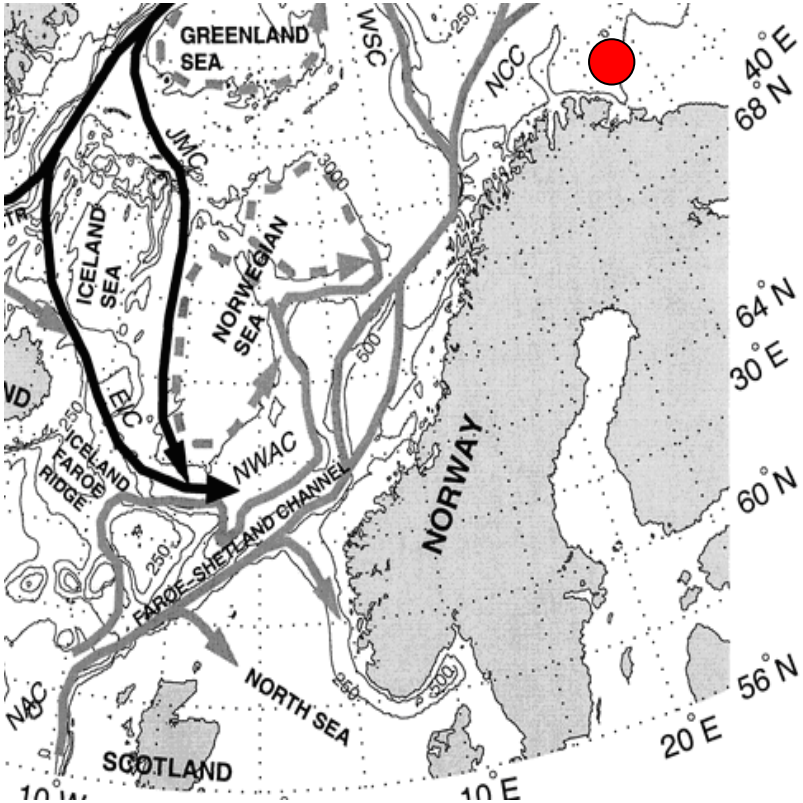


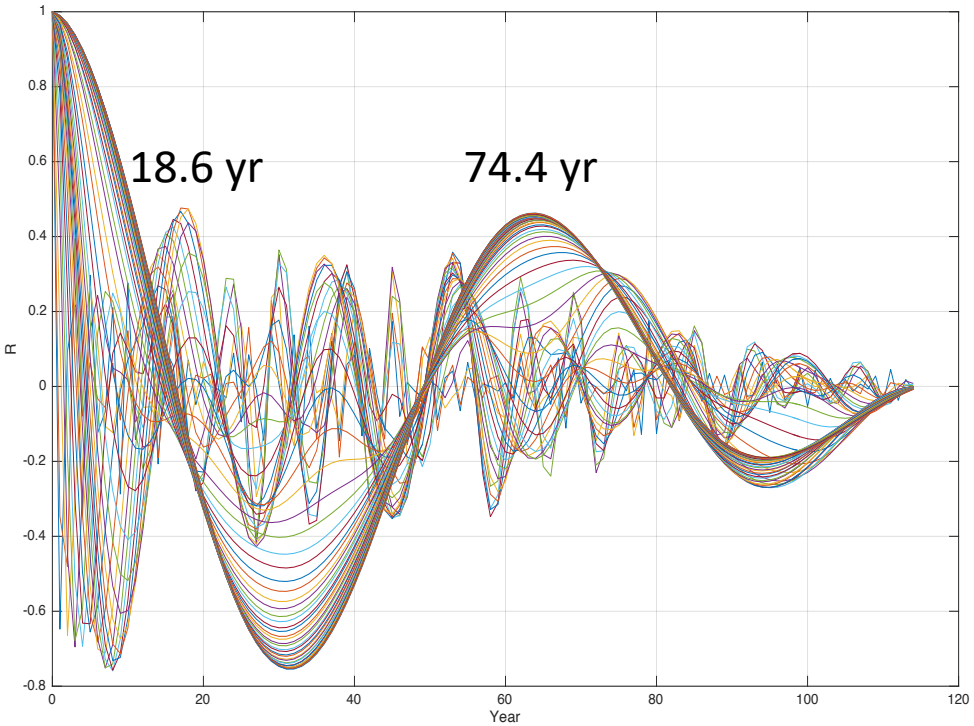
(PINRO, Murmansk 2016)

Barents Sea Temperature variability

Lunar-driven period spectrum: 9.3, 18.6, 74.4 yr

Autocorrelations wavelet spectrum

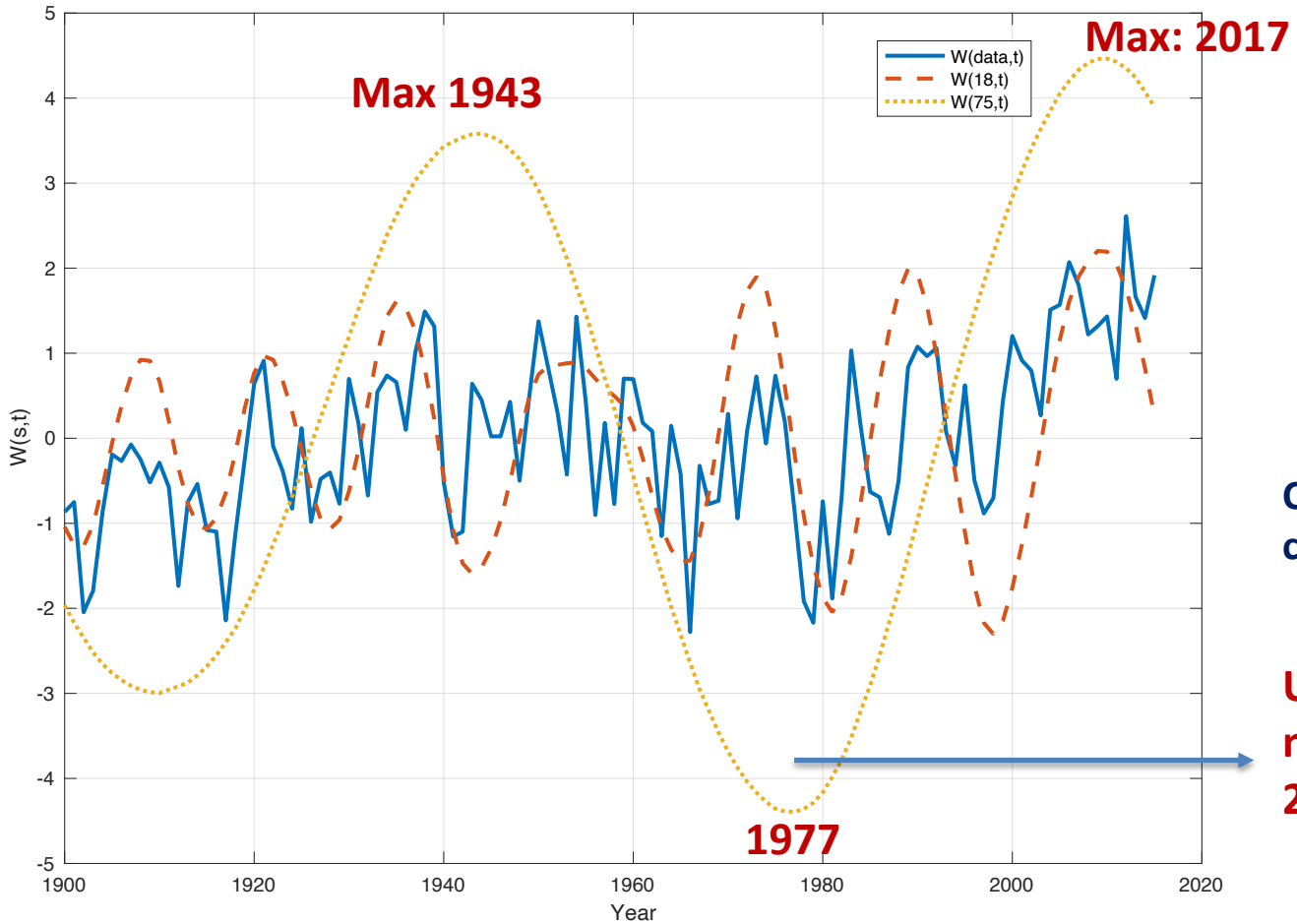




(Yndestad, 1999, 2006, 2008, 2016)

Barents Sea Temperature variability

Stationary periods: => Modern max => Next min temp.

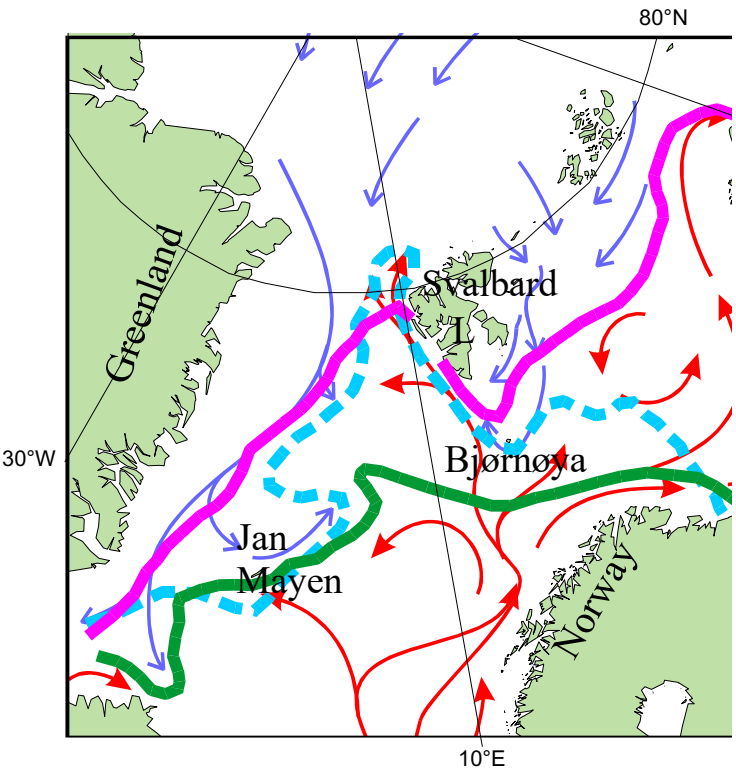


Cold period is coming

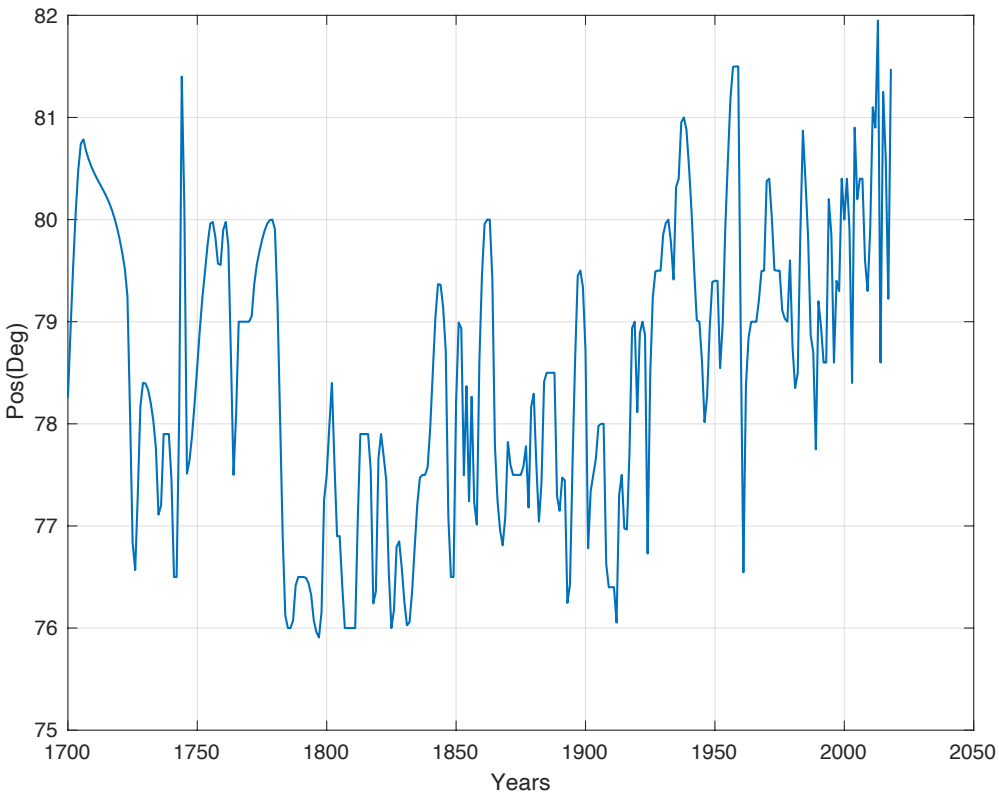
Upcoming next minimum 2051

(Yndestad, 2017)

Barents Sea Ice Edge Position



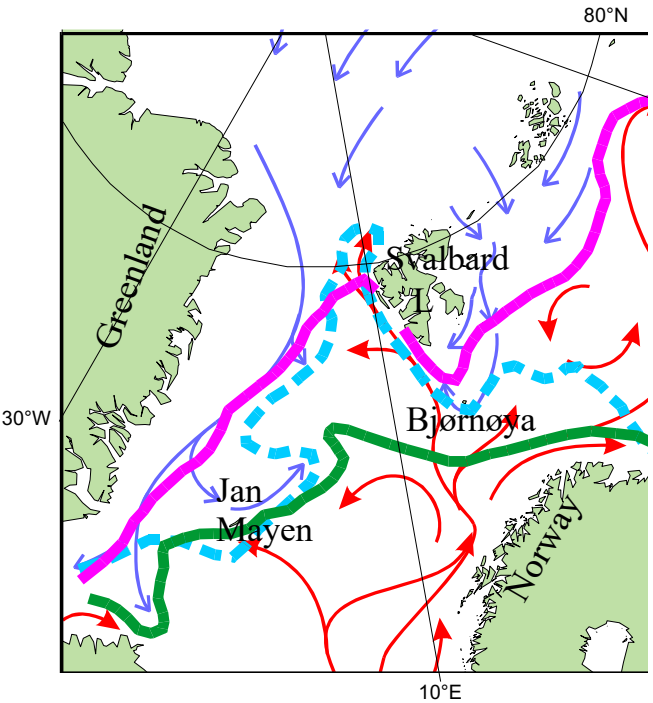
Ice Edge position from 1579-2018



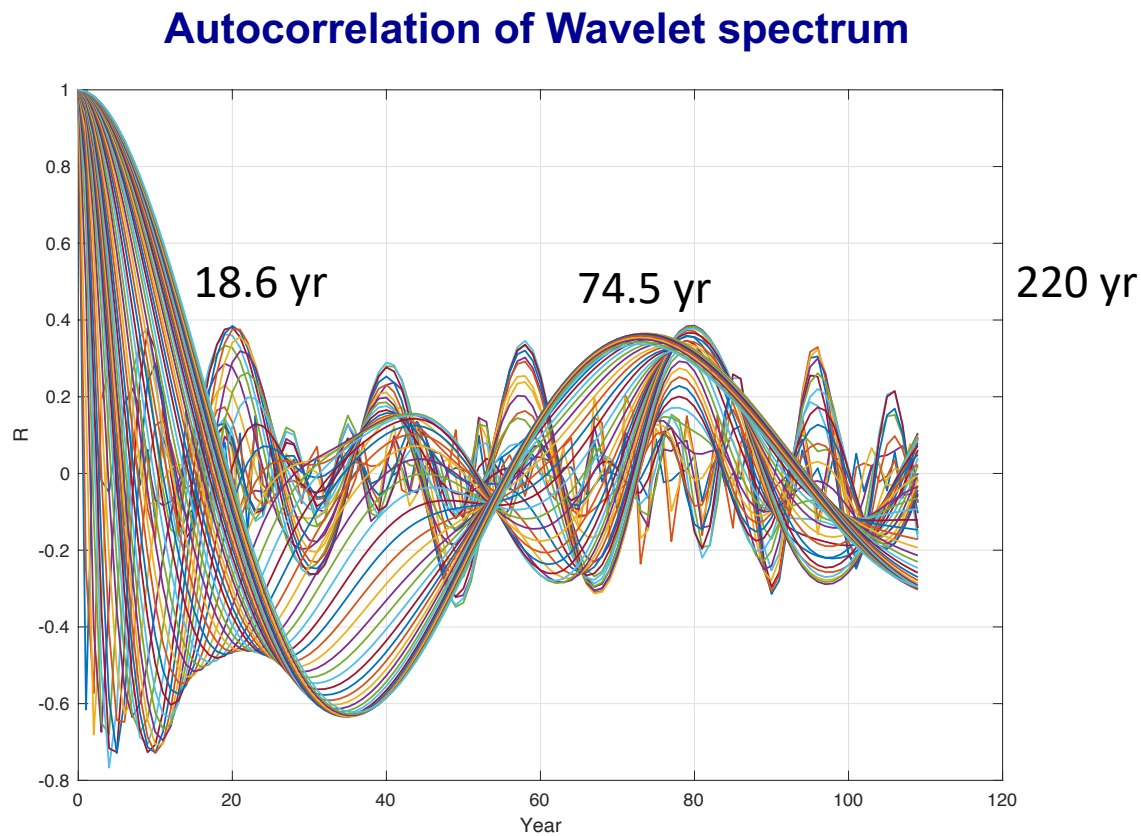
(Stig Falk-Petersen, 2019)

Barents Sea Ice Edge Position

Lunar-driven period spectrum: 9.3, 18.6, 74.4,…220 yr

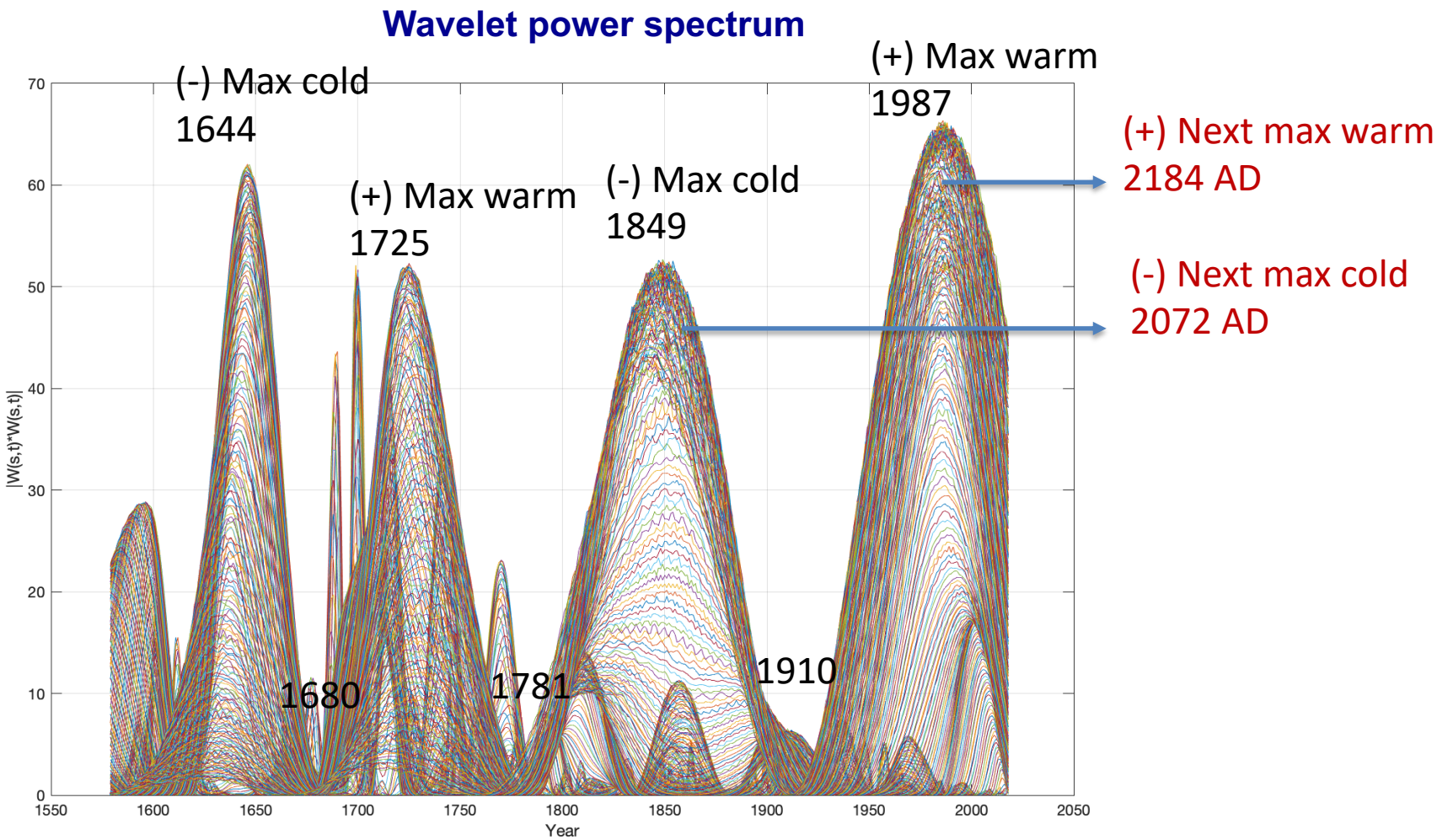


(Yndestad, 2019)



Barents Sea Ice Edge Position

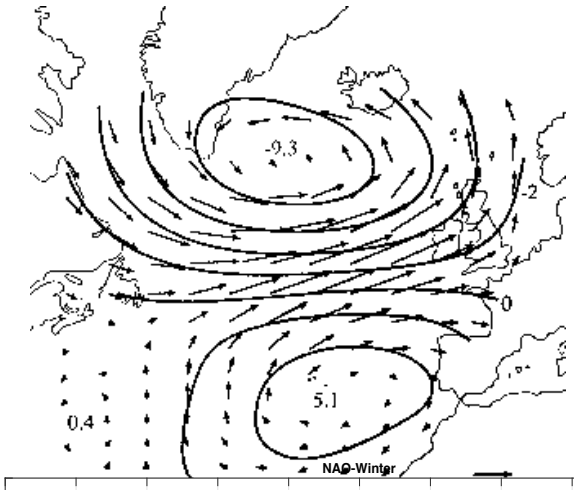
Lunar-driven 220-yr period => Next deep minimum is coming



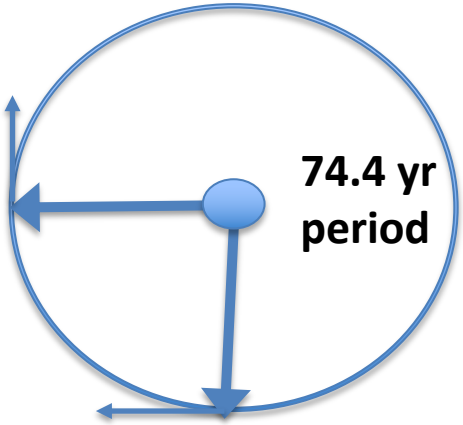
(Yndestad, 2019)

North Atlantic Oscillation

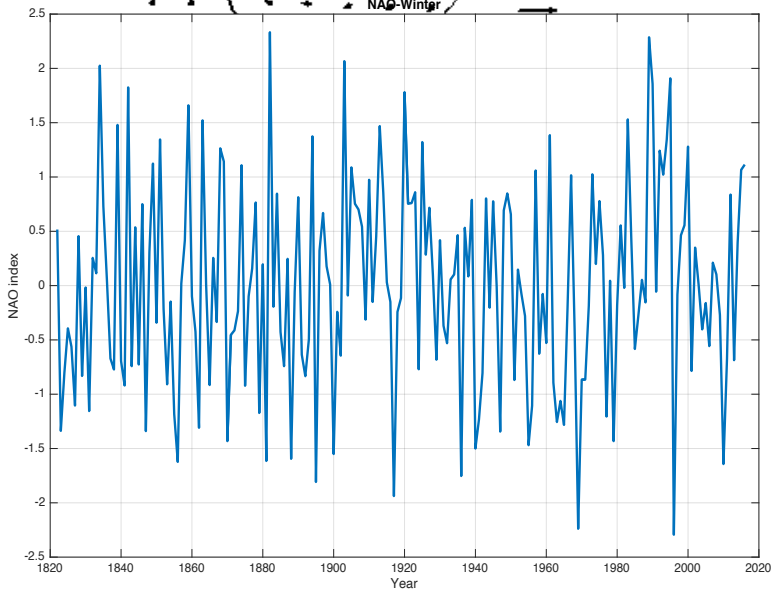
Lunar-driven: => Wind direction



NAO wind direction shifts

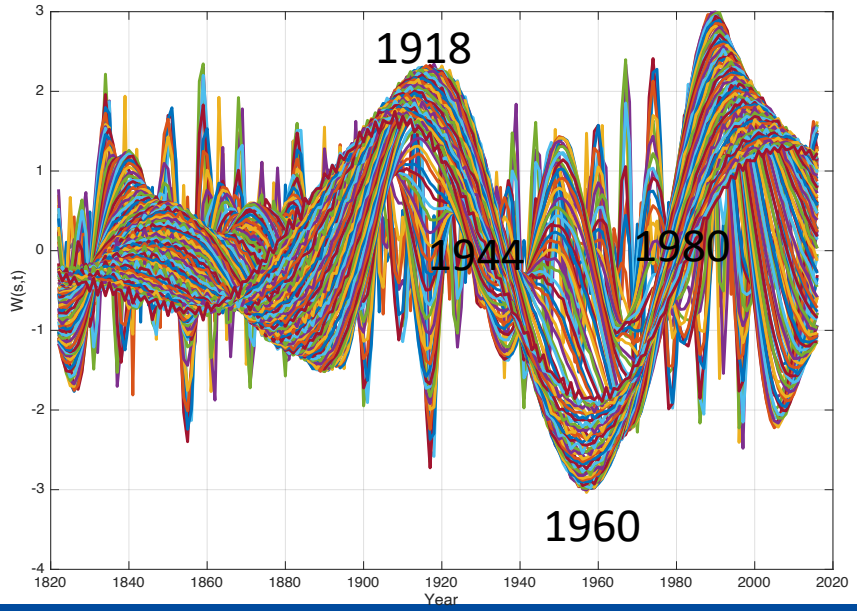


NAW temperature shift



(Yndestad, 2006)

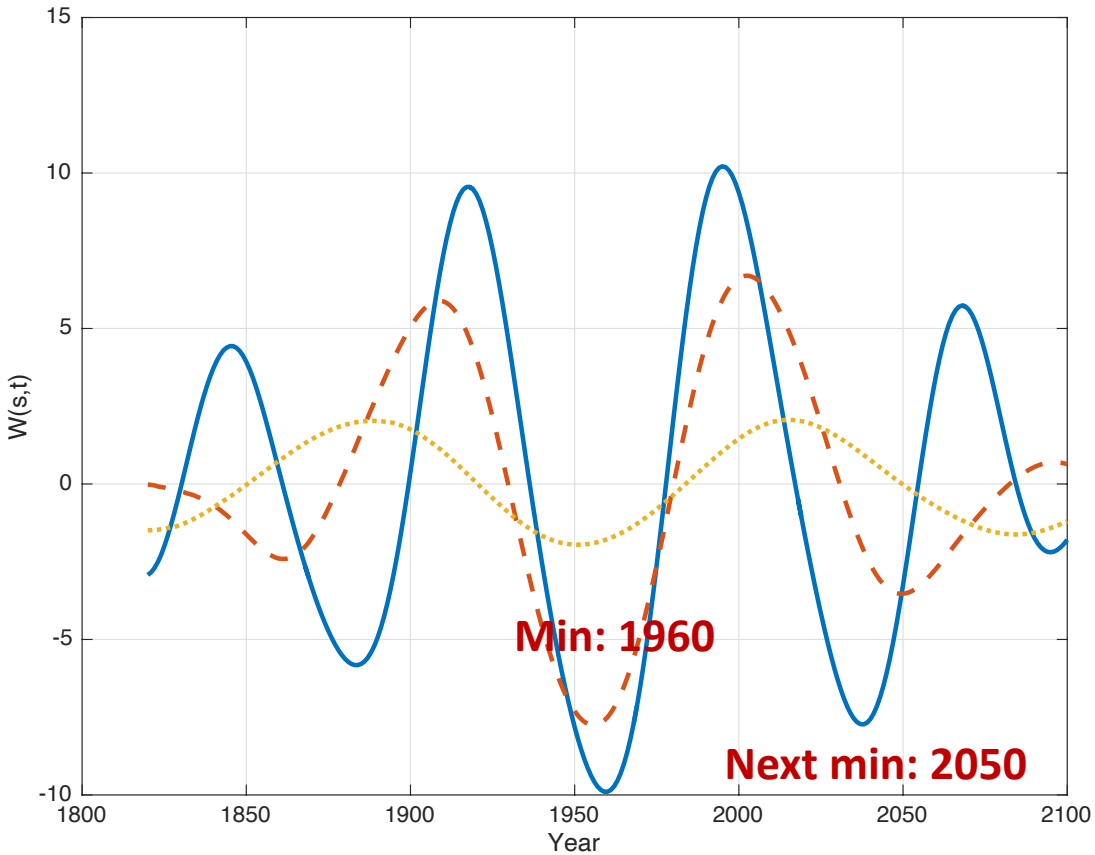
Wavelet spectrum



North Atlantic Oscillation

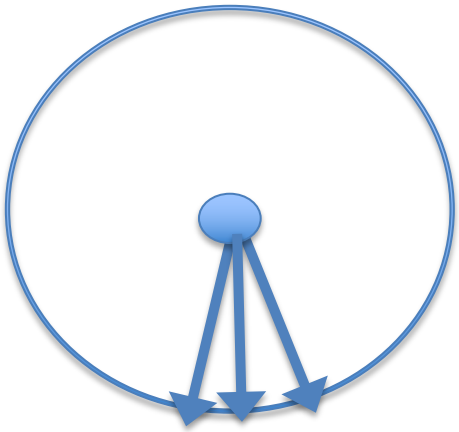
NAO periods => The cold winds are coming

Lunar-driven periods: [2, 4, 6, 12]18.6 yr



Climate clock

Year 1960

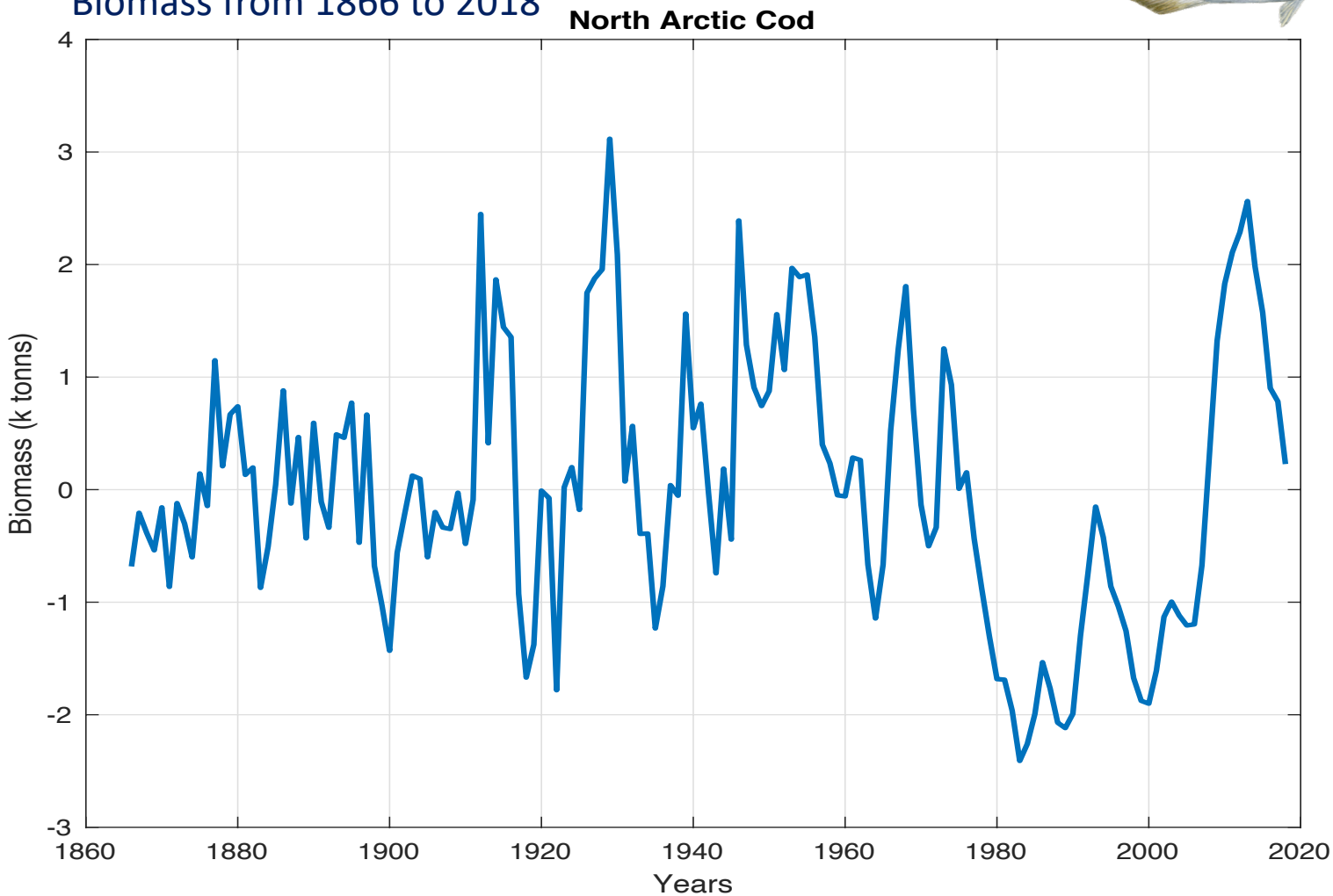


37, 74.4, 112 yr

(Yndestad, 2018)

North Arctic Cod Biomass

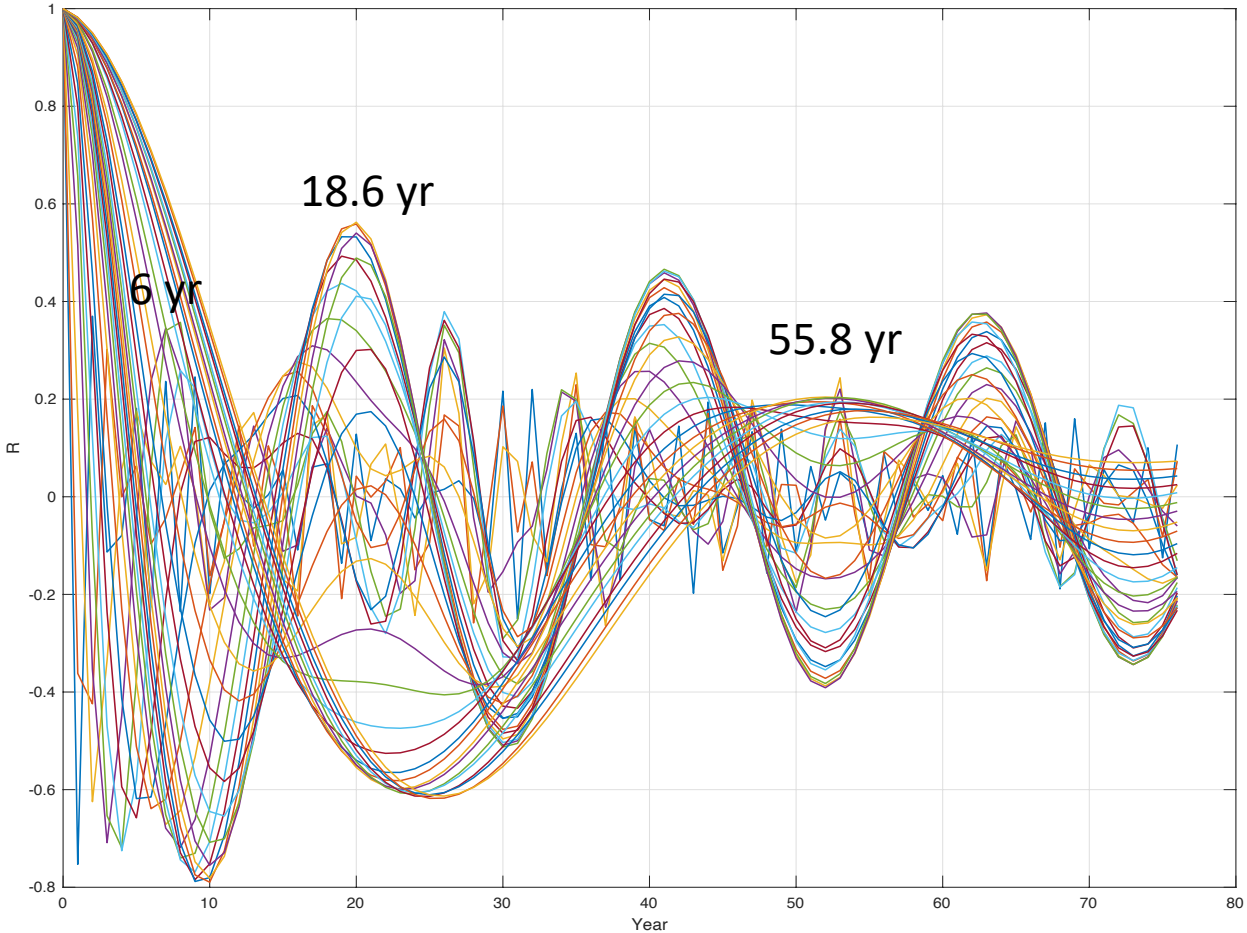
Biomass from 1866 to 2018



(Rune Godø 2004, ICES 2018)

North Arctic Cod variability

Lunar-driven period spectrum: [1/3, 1, 3]18.6 yr

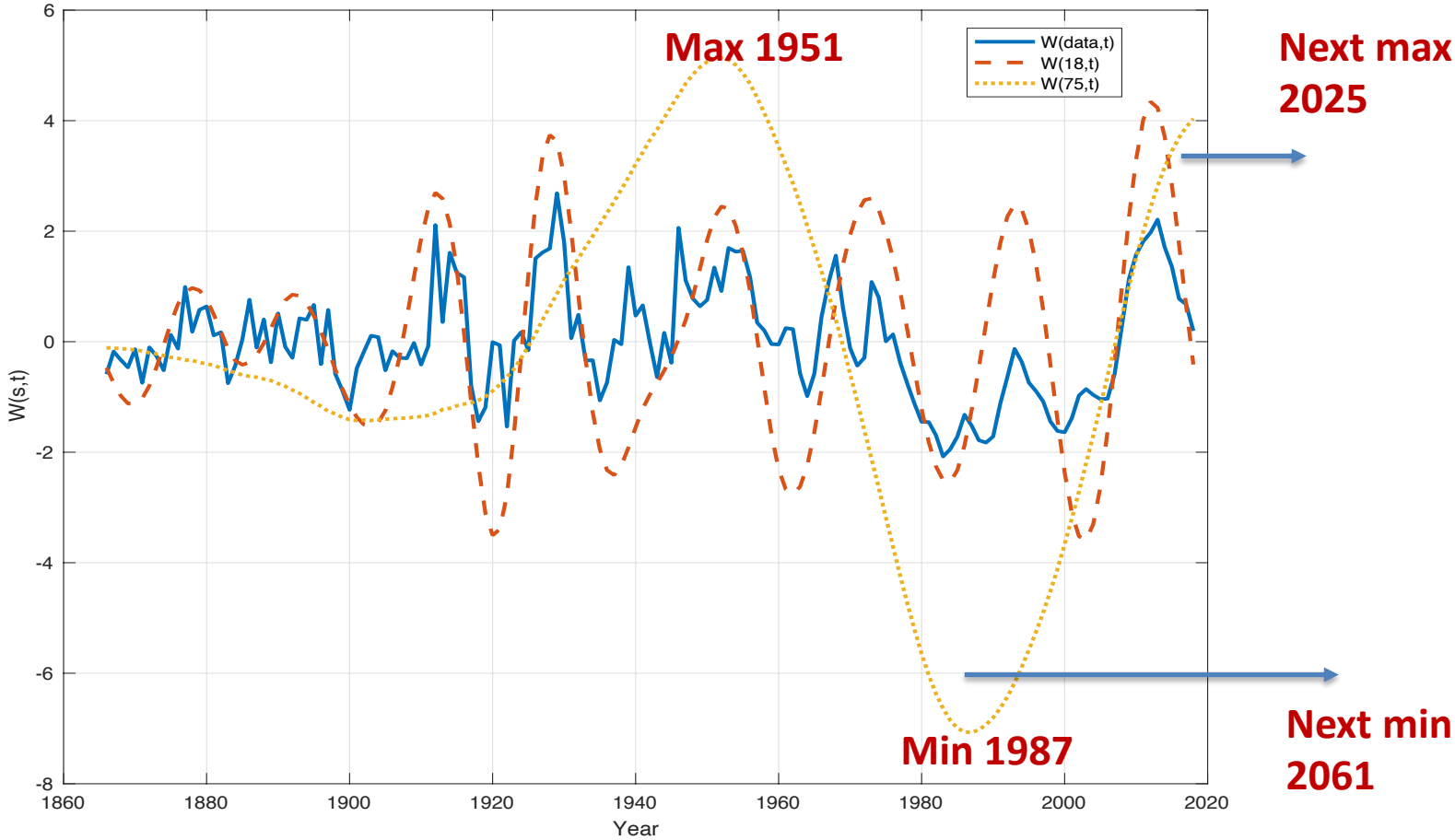


(Yndestad, 1999, 2009)

North Arctic Cod variability

Phase-locked to lunar-driven period [1, 4]18.6 yr

Deep minimum biomass is coming.

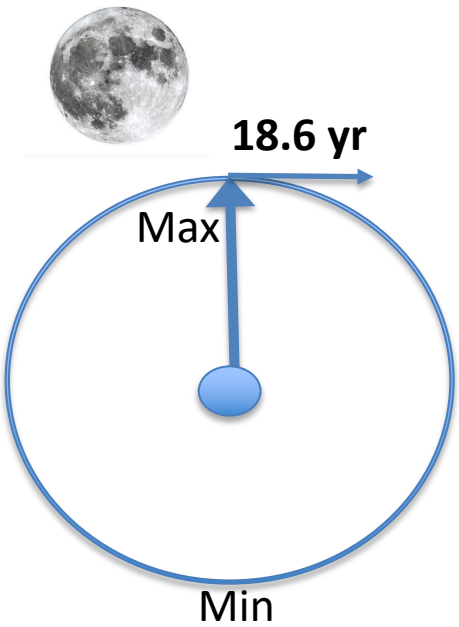


(Yndestad 1999, 2009)

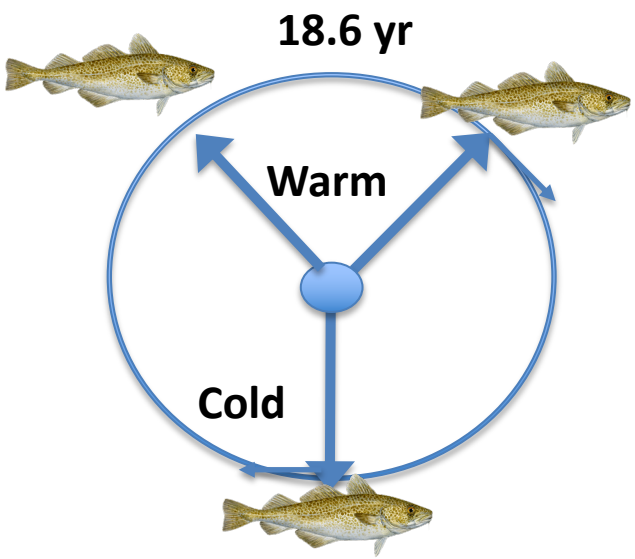
North Arctic Cod variability

Period- and phase-locked to lunar-driven NAW temperature

NAW: Temperature

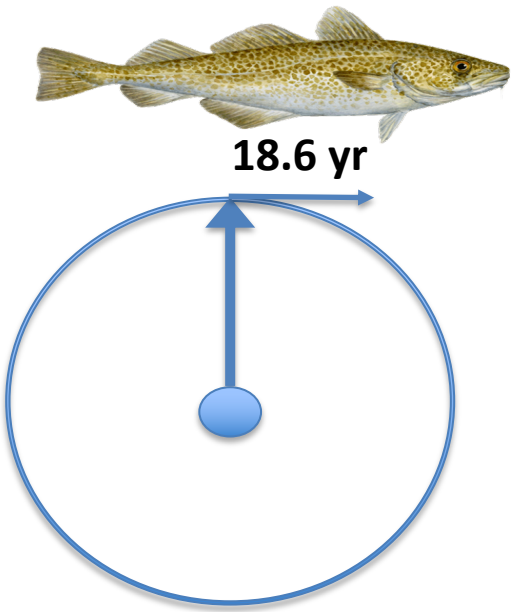


Cod spawning period
18.6/3= 6.2 yr



+0.5 degree => 20 time more cod recruitment

Cod biomass
18.6 yr

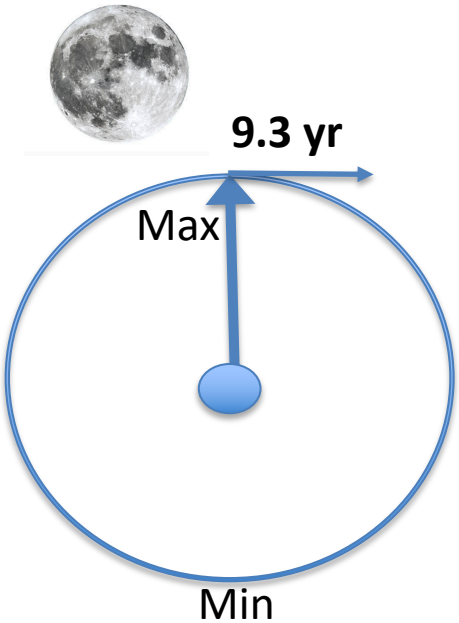


(Yndestad, 1999, 2009)

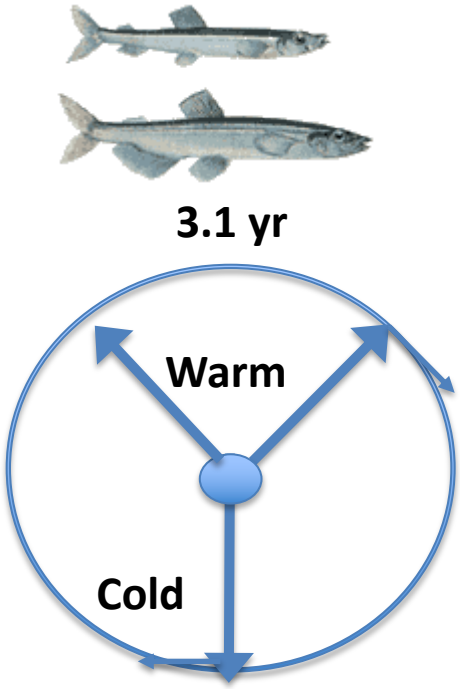
Lunar-driven Capelin variability

Phase-locked to 18.6/2=9.3 yr NAW temp period

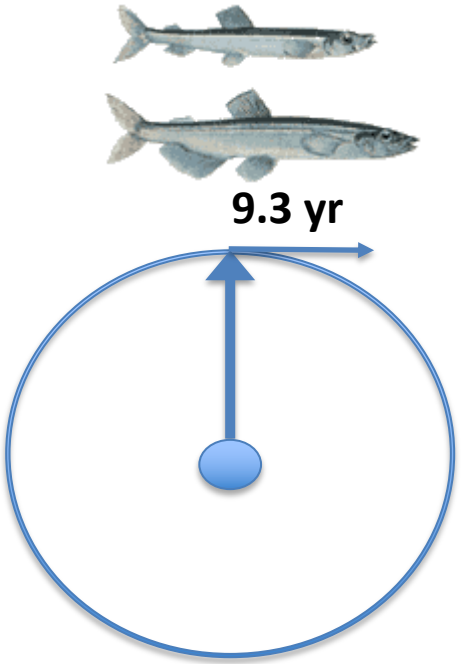
NAW: Temperature



Capelin spawning period
9.3/3= 3.1 yr



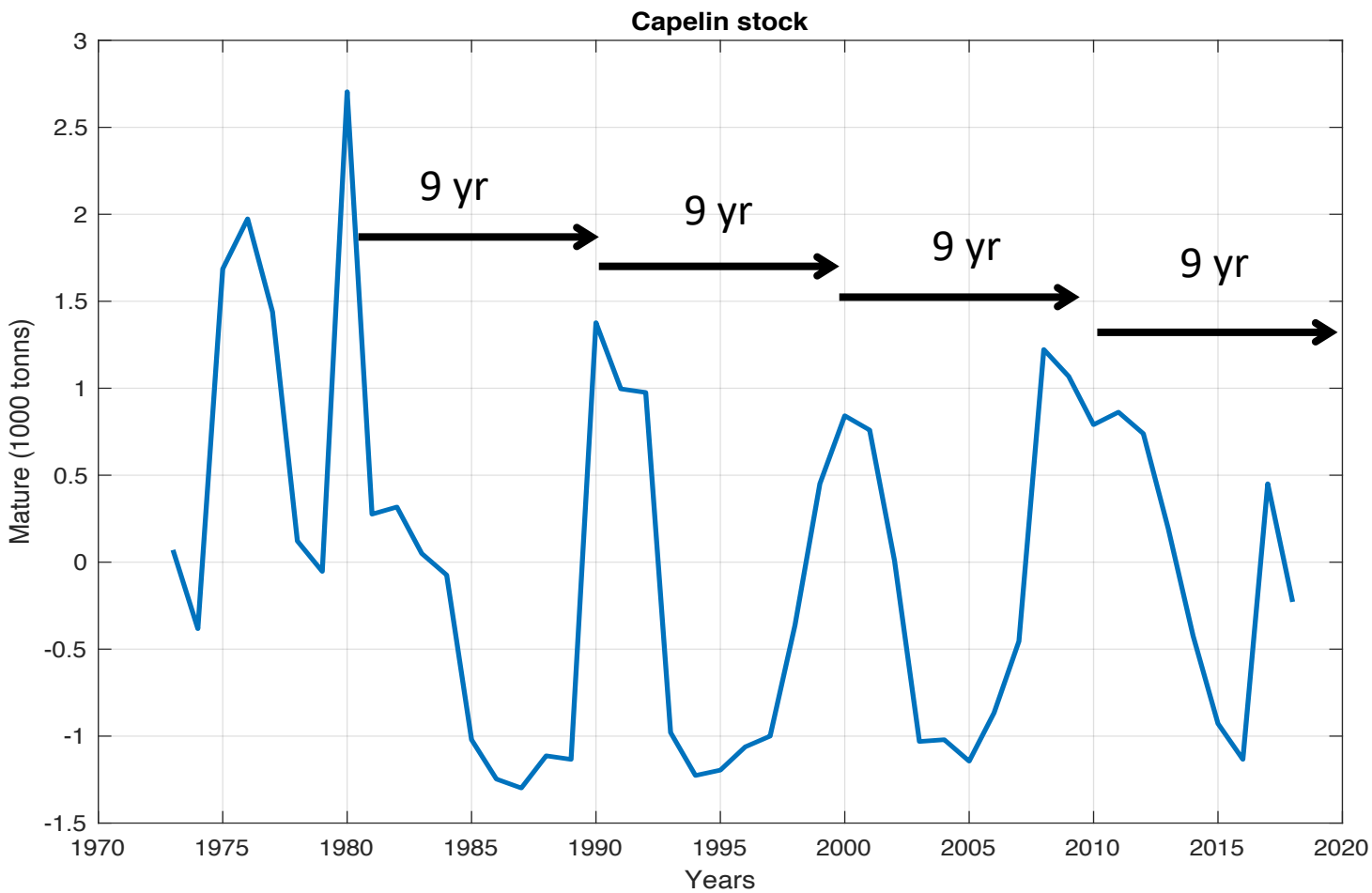
Capelin biomass
9.3 yr period



(Yndestad and Stene, 2001)

Capelin Biomass variability

Phase-locked to 18.6/2=9.3 yr NAW temp period



(Yndestad and Stene, 2001)

The Moon and the Black Swan

Lunar-driven variability:

- Global tide, Norwegian coastline
- Sea temperature & salinity, NC
- Rainfall in Scandinavia, NC
- Air temperature, NC
- NAO-INDEX wind direction
- Arctic ice extent
- Earth axis position
- Barents Sea eco system (Plankton, capelin, herring, haddock, North Arc cod)

(Yndestad, 1996-2019)

Ref.: https://www.climateclock.no

The Climate Clock

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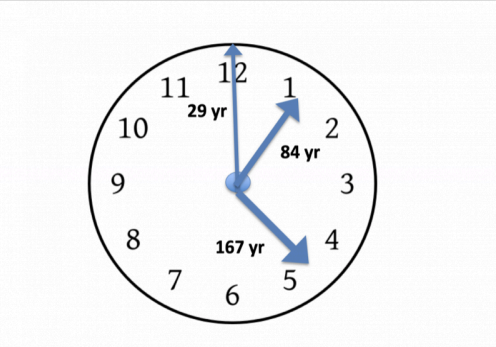

The Solar Irradiation Clock

Harald Yndestad *April 20, 2019* *Climate*

The Solar Irradiation Clock (SIC) is turning, The Winter is Coming. SIC is a Total Solar Irradiation (TSI) indicator based on identified stationary periods in...

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Lunar-driven Marin Eco systems

Harald Yndestad *March 5, 2019* *Eco*

A sustainable management of the Barents Sea ecosystem is dependent on the period- and phase-relation between lunar-driven biomass variability, and biomass management variability. Management...

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Climate and the Black Swan

Harald Yndestad *February 3, 2019* *Climate*

Is the Moon a Black Swan, in understanding climate variability? This question has divided science for more then hundred years. The shadow from the Moon,...

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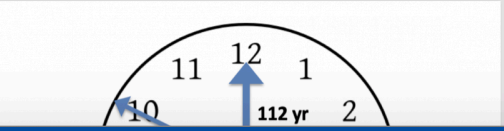

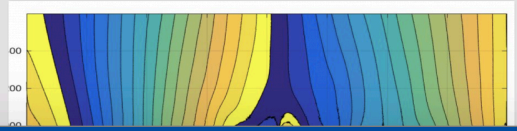

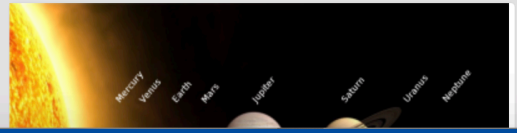

Thank you

Yndestad/2019