



atlas

UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS



Ecosystem-relevant ocean flux (variability)

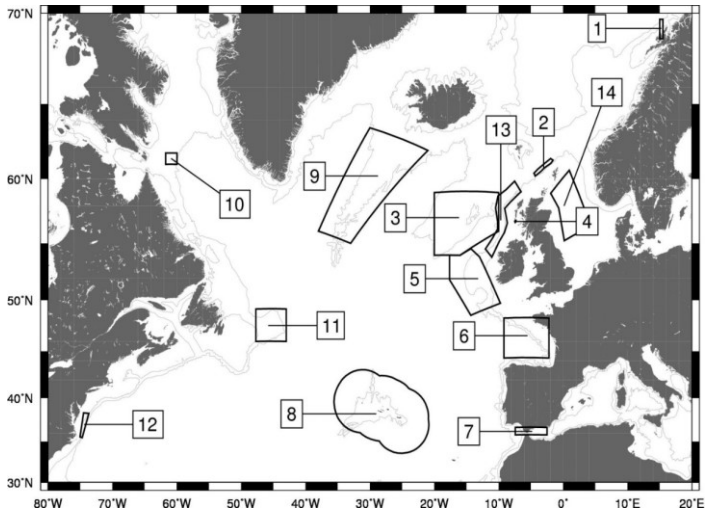
atlas General Assembly, April 2018

Clare Johnson (SAMS), Mark Inall (SAMS), Stefan Gary (SAMS), Stuart
Cunningham (SAMS)

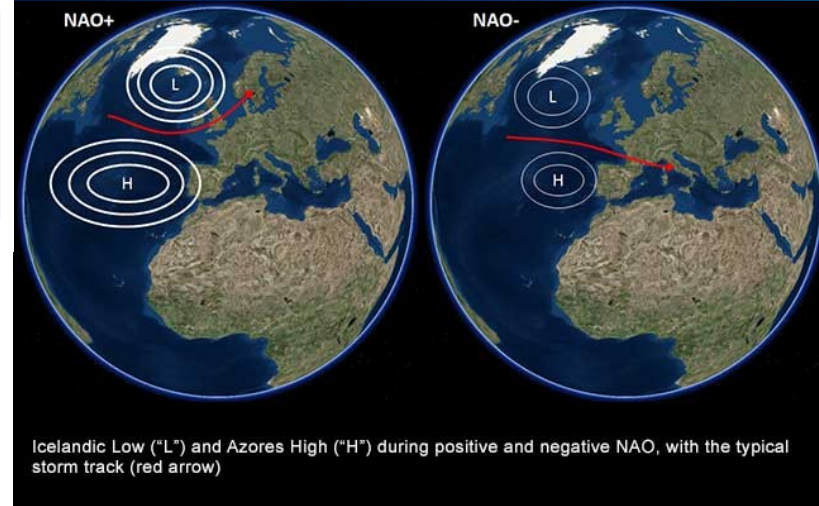
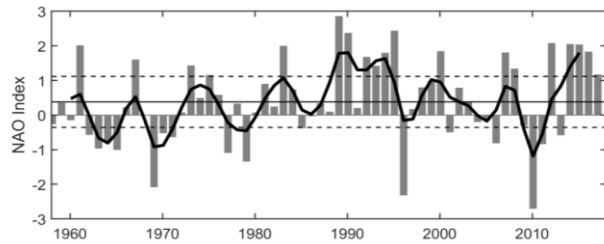




Study Areas

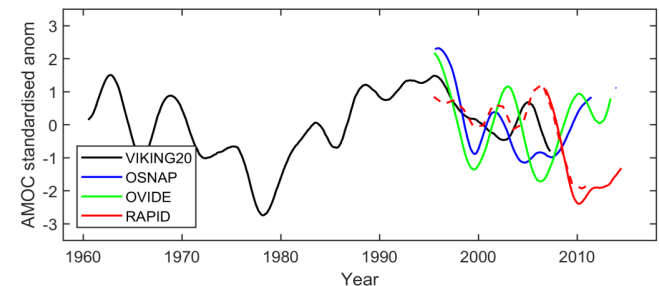
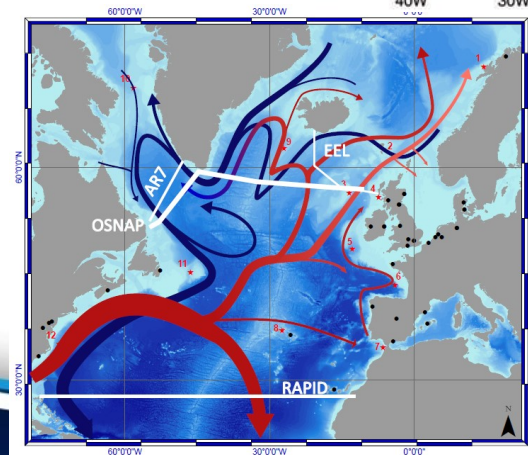
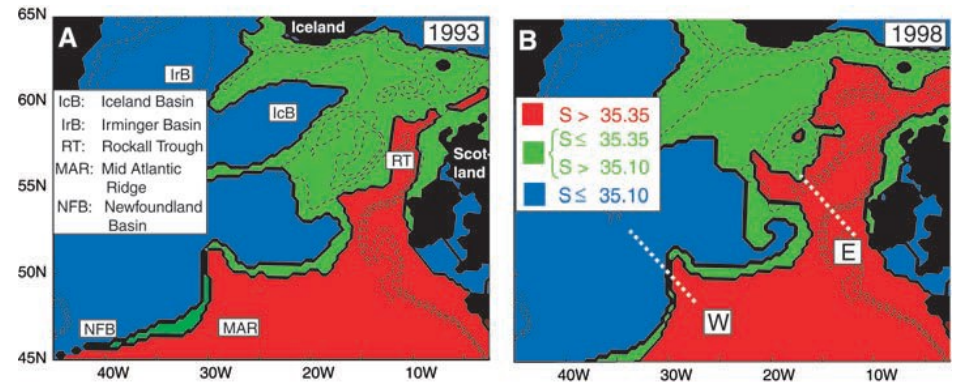


ATLAS case studies		Area (10 ³ km ²)	Mean depth (m)	Min. depth (m)	Max. depth (m)
1	LoVe Observatory	2.2	746	1	2298
2	Western Scottish Slope	5.3	596	234	952
3	Rockall Bank	301.4	1470	21	3026
4	Mingulay Reef	0.1	196	148	230
5	Porcupine Sea Bight	218.2	2187	39	4844
6	Bay of Biscay	238.5	2744	1	5026
7	Gulf of Cadiz / Alboran Sea	43.4	697	1	1872
8	Azores	954.2	3064	1	5627
9	Reykjanes Ridge	388.1	1927	499	3209
10	Davis Strait	8.2	962	518	2319
11	Flemish Cap	124.4	1471	128	4664
12	US Mid-Atlantic Canyons	16.5	750	32	2205
Alterecco					
13	Scottish Slope	61.2	1243	57	3009
14	North Sea	112.0	99	40	179



Climate 'states' or 'indices'

- NAO SeaLevelPressure →
- SPG SeaSurfaceHeight →
- AMO: SST based
- AMOC: meridional circulation.
- AMOC OV →
- AMOC OS →

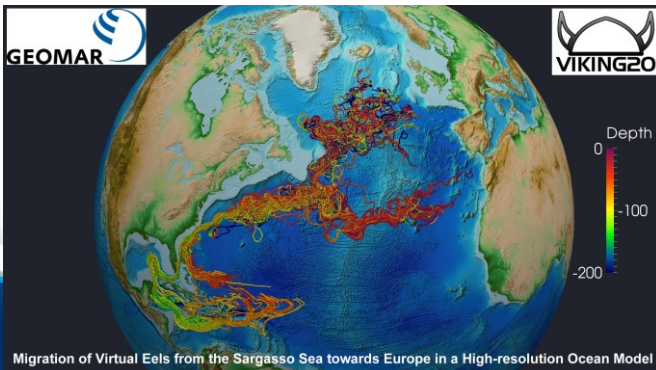




Data sources, and variables

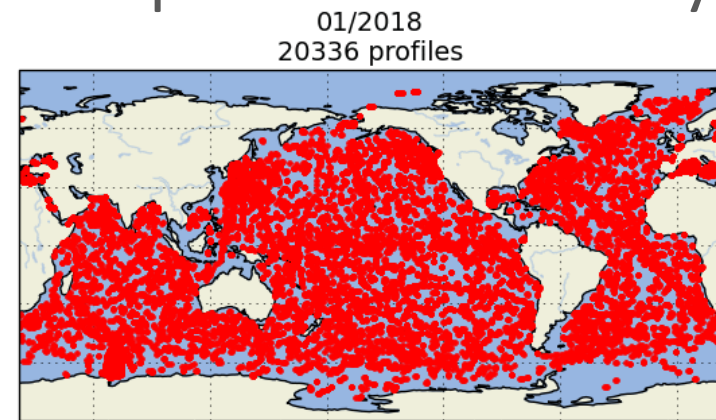
Viking20 Model

- NEMO N. Atlantic 1/20
- Fivedays: 1958 – 2009
- T, S, U, V



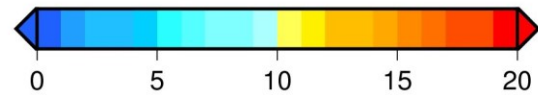
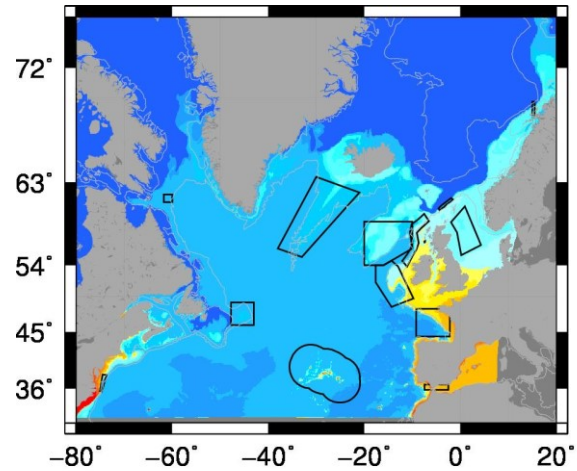
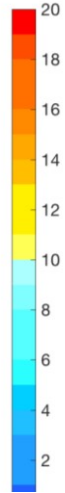
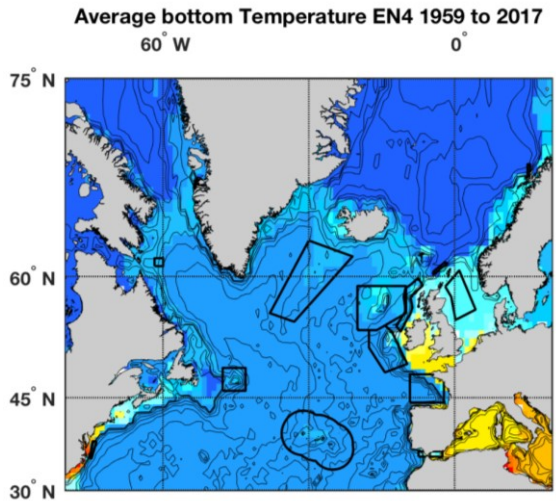
EN4 optimally interpolated observations

- Global, 1x1degree
- Monthly: 1900 – present (poor coverage <1970s)
- Temperature & Salinity (z)

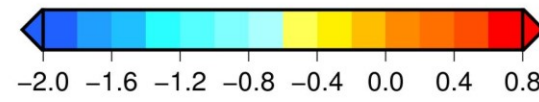
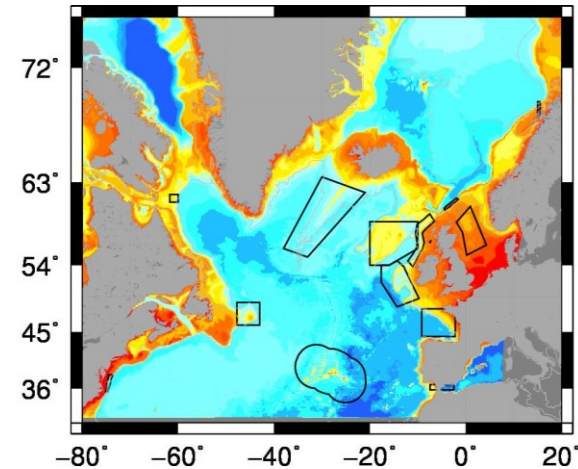
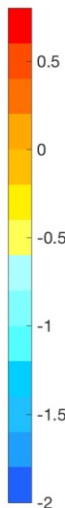
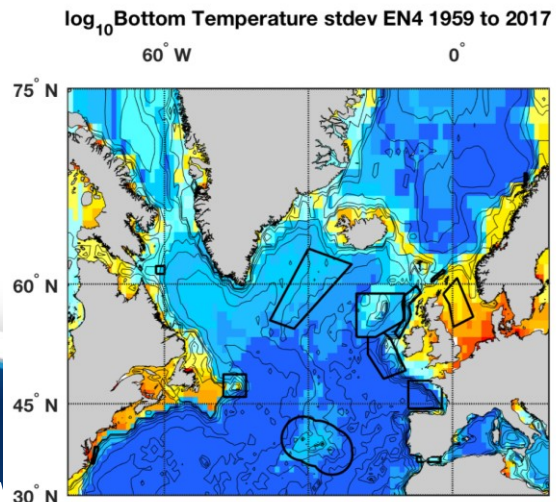
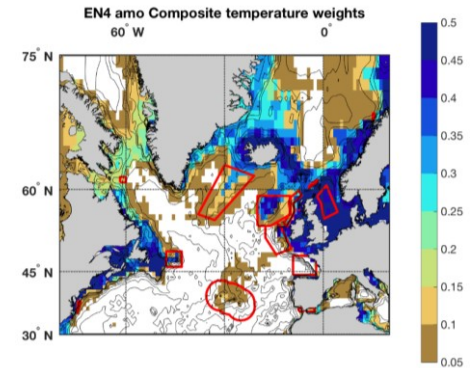




mean conditions: 1959 to 2005(V20)/2017(EN4)



Mean temperature, T_{bot} ($^{\circ}C$)



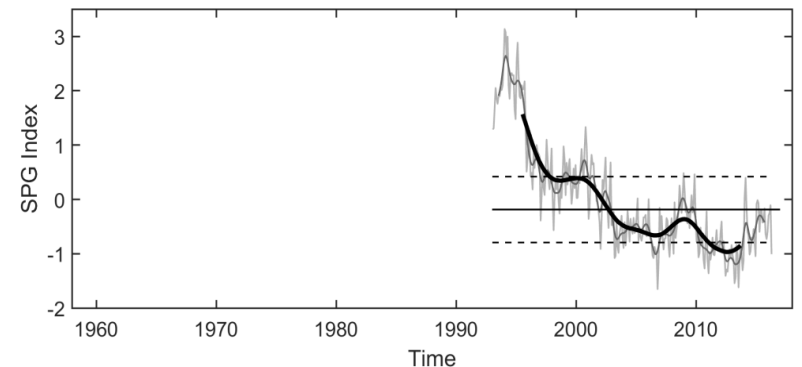
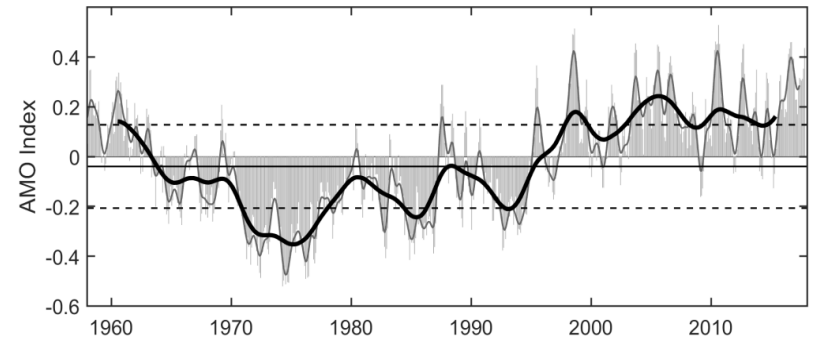
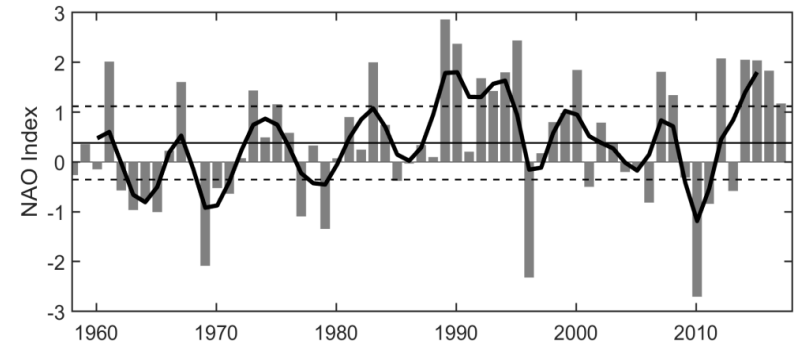
$\log_{10}(\text{std}(T_{bot}))$



Methods: composite states

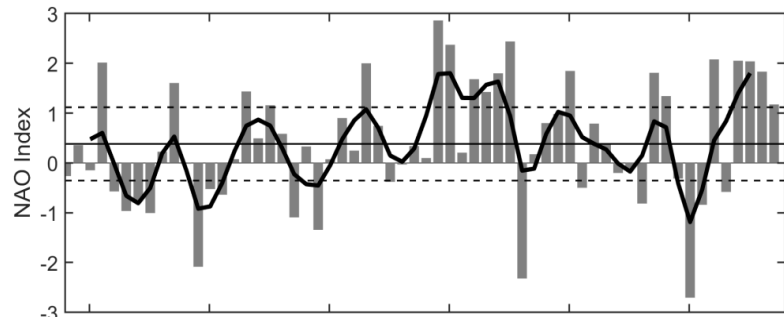
Average conditions during ± 1 *st dev* from mean

- High (low) state: +1 (-1) average minus 1959 to 2009 mean conditions
- EN4: Bottom T and S, N^2
- V20: Bottom T, S, KE; SST, SSH, MLD
- Indices: NAO, SPG, AMO, AMOC (three 'flavours')





atlas Example #1 NAO

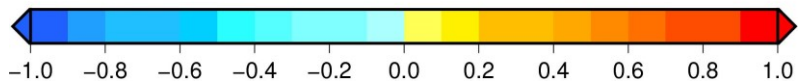
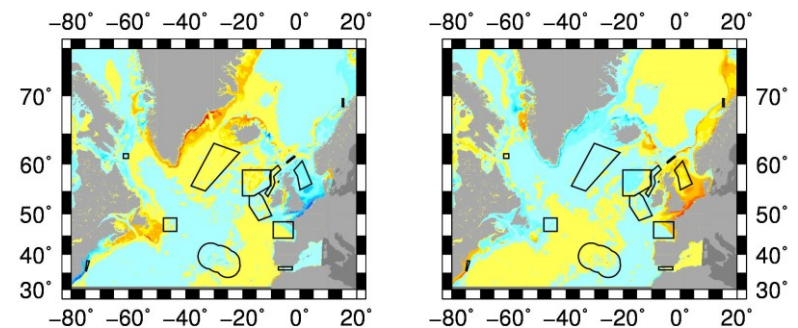


EN4

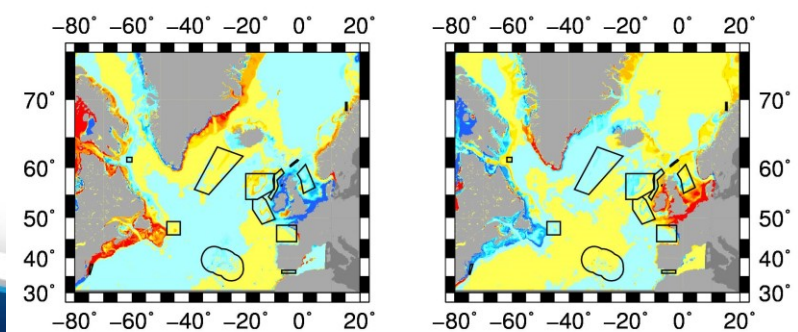
V20

Lows

Highs

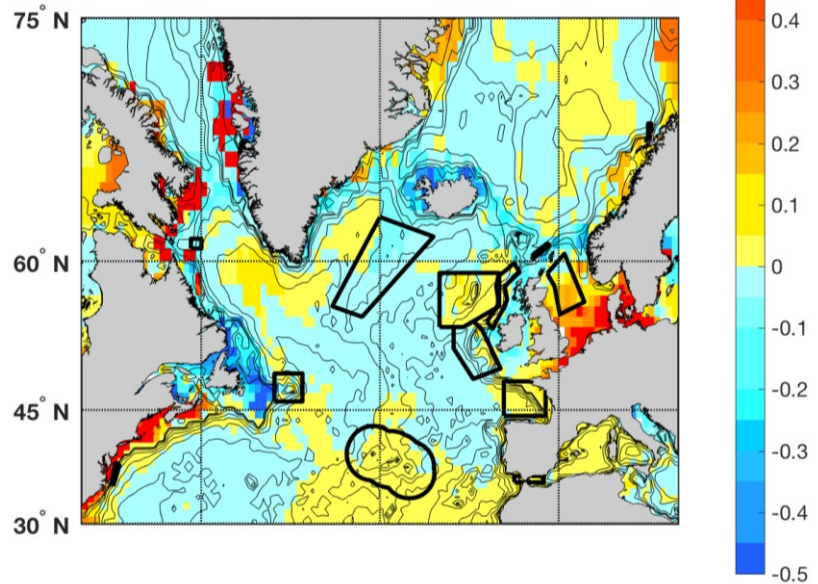


Anomalous temperature, T_{bot} (°C)



Anomalous salinity, S_{bot} (PSU)

EN4 nao Composite temperature anomaly: H - L



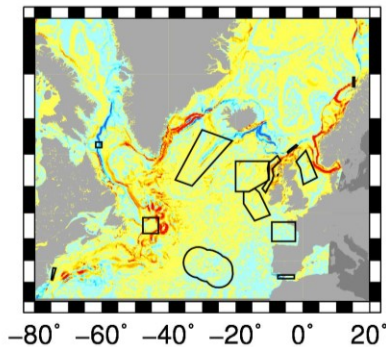
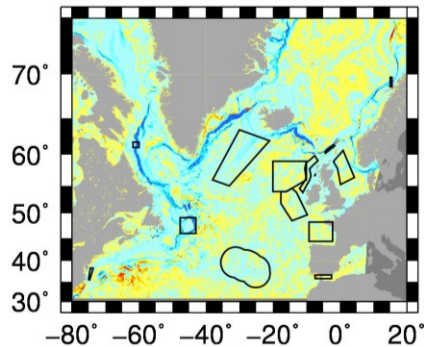
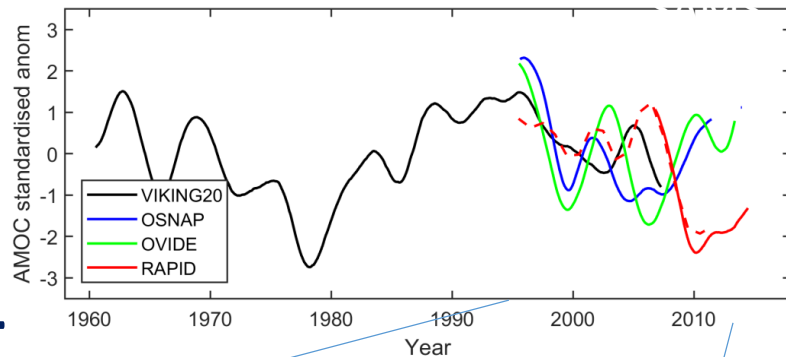


Example #2 AMOC Ov

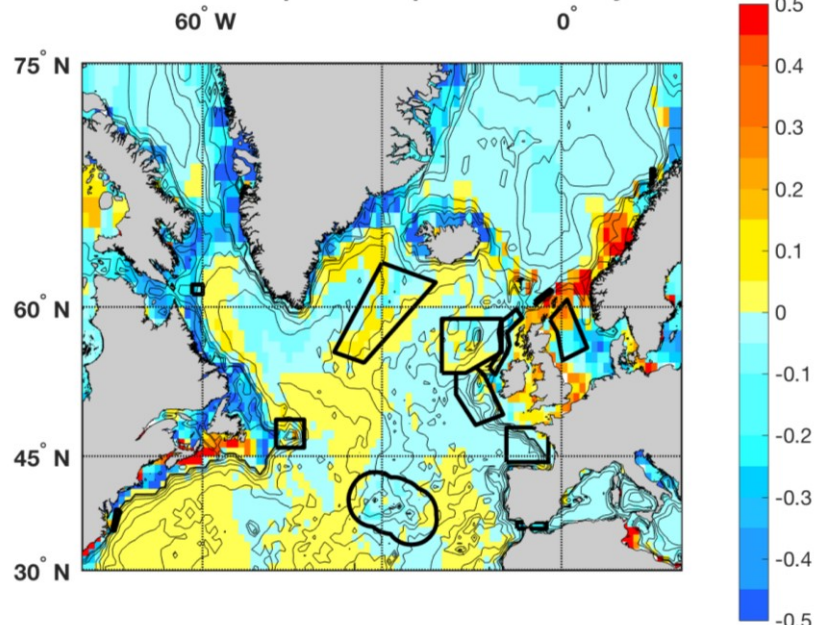
V20 Lows

Highs

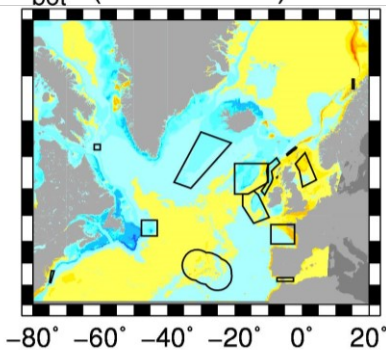
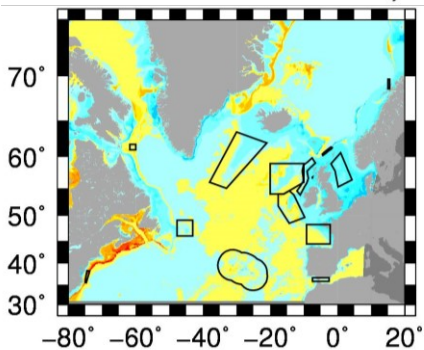
EN4



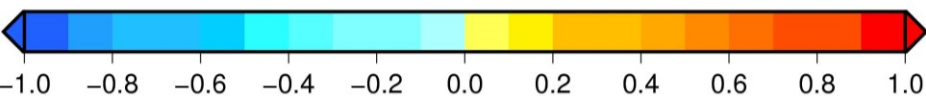
EN4 amocov Composite temperature anomaly: H - L



Anomalous KE, $u_{bot}^2 + v_{bot}^2$ ($\times 10^{-3} m^2 s^{-2}$)



Anomalous temperature, T_{bot} ($^{\circ}C$)

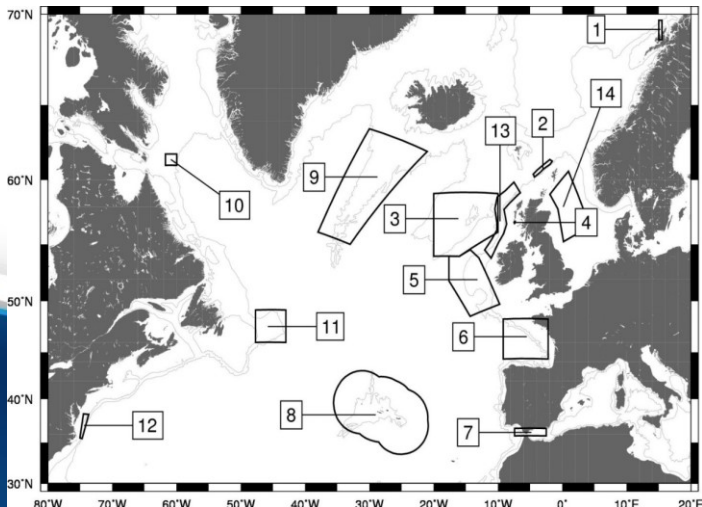
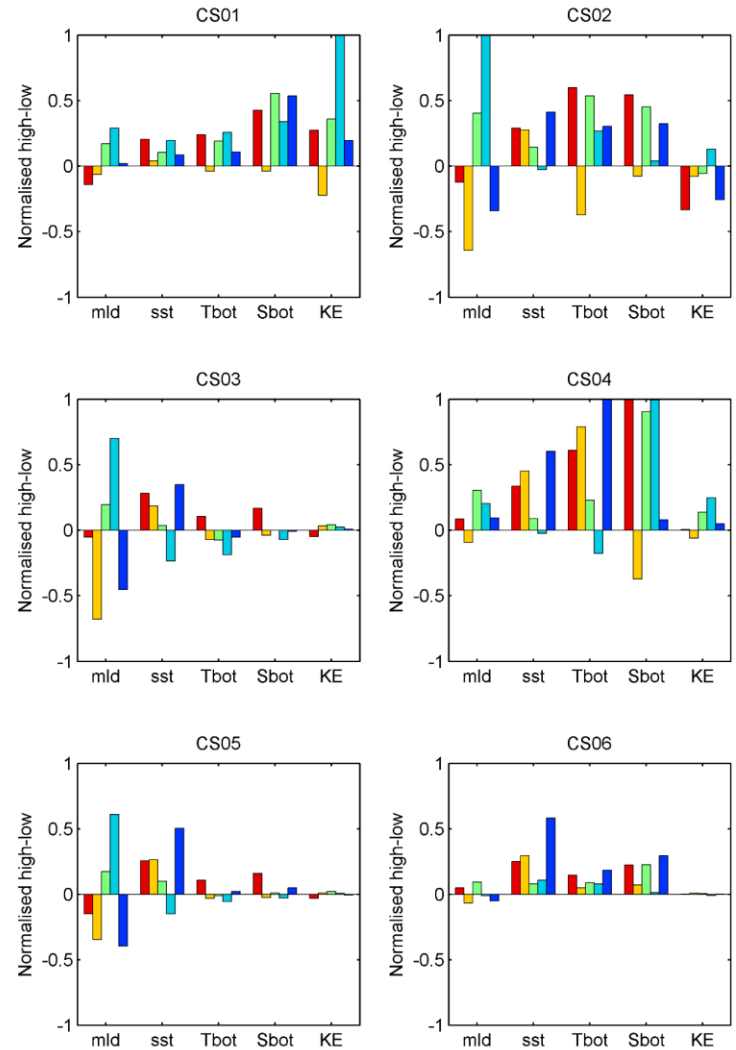




Case Study sites: 1 to 6

Of note:

- Strong indexation CS4, 12
- Bottom indexation weaker at deeper sites
- CS6 weak (except spg/sst)



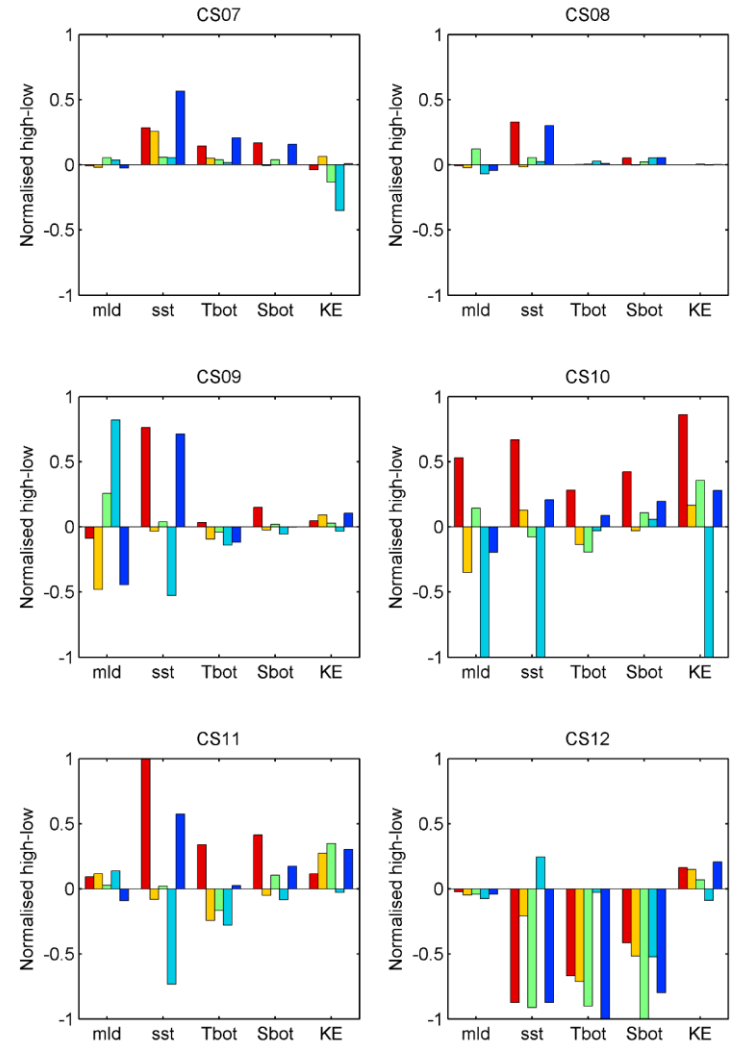
red = amo
 yellow = amocov
 green = amocv
 light blue = nao
 dark blue = spg



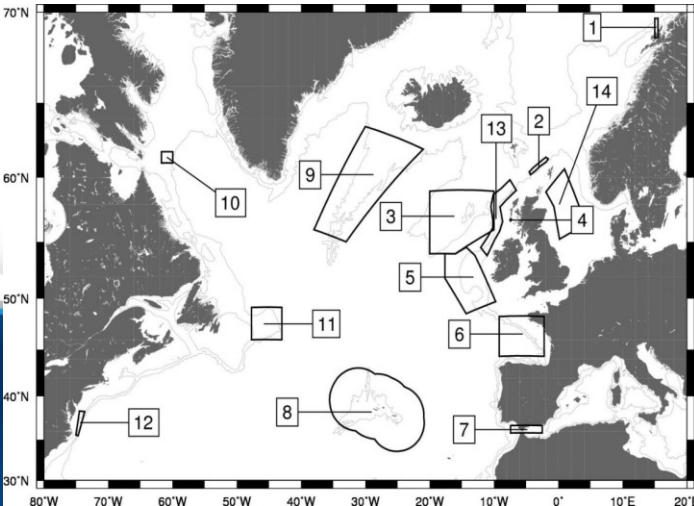
Case Study sites: 6 to 12

Of notes:

- CS4&12 anti-phased
- CS8 weak indexation
- CS9,10,11 scattered



red = amo
 yellow = amocov
 green = amocv
 light blue = nao
 dark blue = spg





Conclusions & further work

Conclusions

- E/W anti-phase AMOC
- Shelves/basin edges more highly indexed than interior in bottom properties
- SSH indexed in basin interior
- Relationships for particular CS areas can be analysed in greater detail ... just ask!

Further work

- Directions and rates of change of bottom conditions ('velocity')
- D1.2 available 30th April 2018
- Physical tele-connections, time lag correlations, underlying causal dynamics

Thank You!



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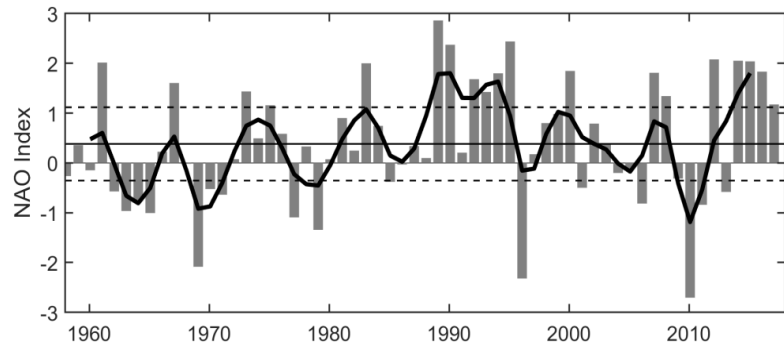
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atlas Example #1 NAO

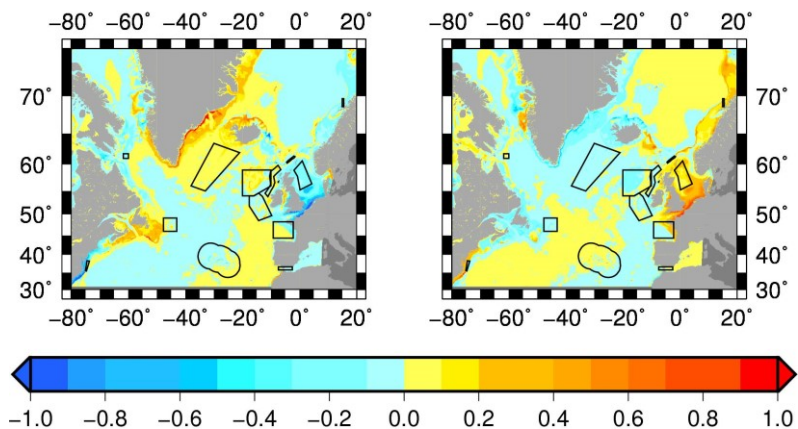


V20

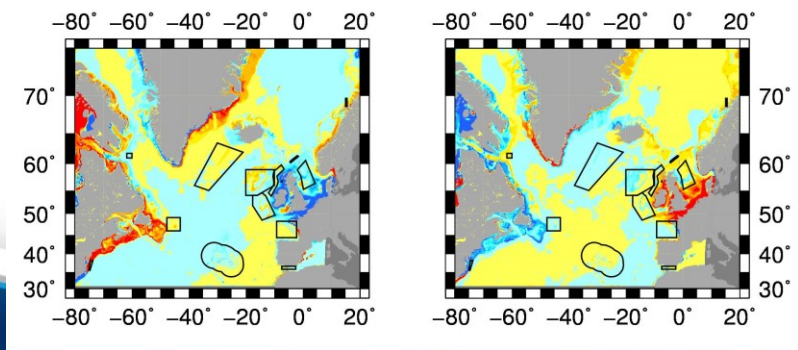
EN4

Lows

Highs

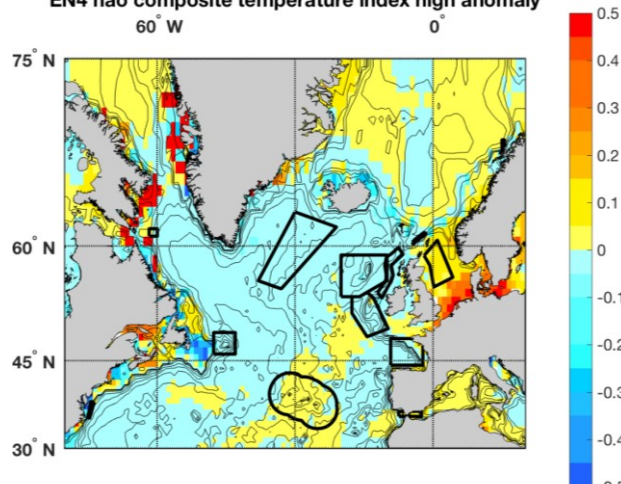


Anomalous temperature, T_{bot} (°C)

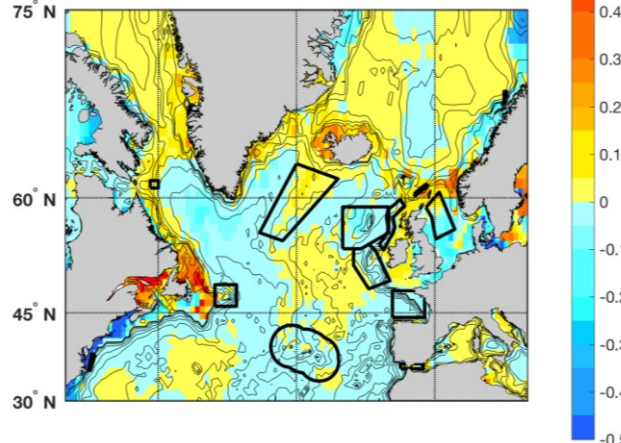


Anomalous salinity, S_{bot} (PSU)

EN4 nao composite temperature index high anomaly
60° W 0°



EN4 nao composite temperature index low anomaly
60° W 0°



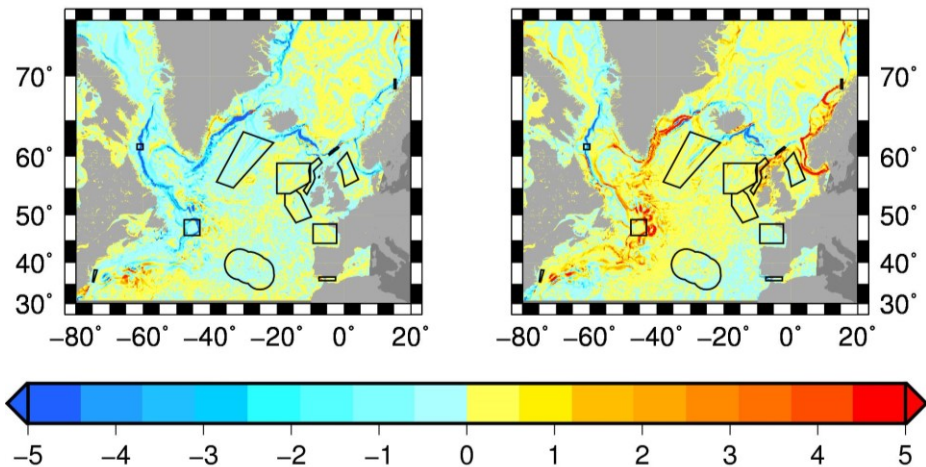
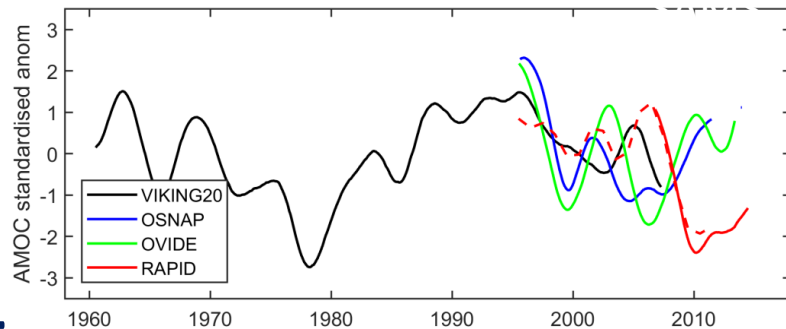


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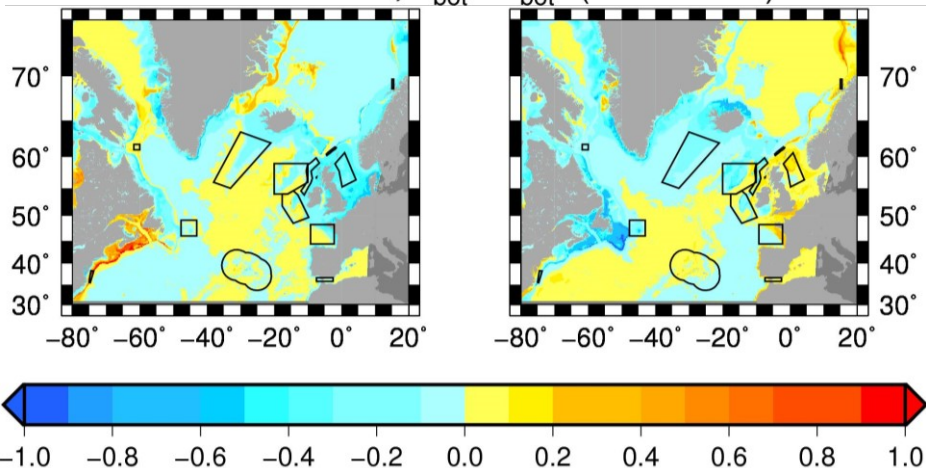
V20 Lows

Highs

EN4

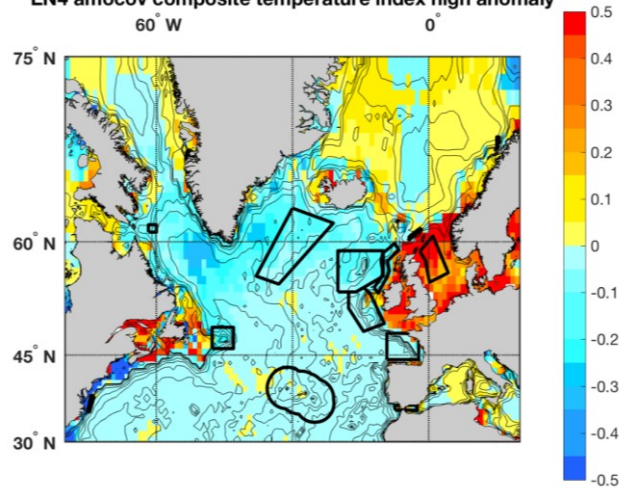


Anomalous KE, $u_{bot}^2 + v_{bot}^2$ ($\times 10^{-3} m^2 s^{-2}$)



Anomalous temperature, T_{bot} ($^{\circ}C$)

EN4 amocov composite temperature index high anomaly



EN4 amocov composite temperature index low anomaly

