Sea-level change: *Why seasons matter!*

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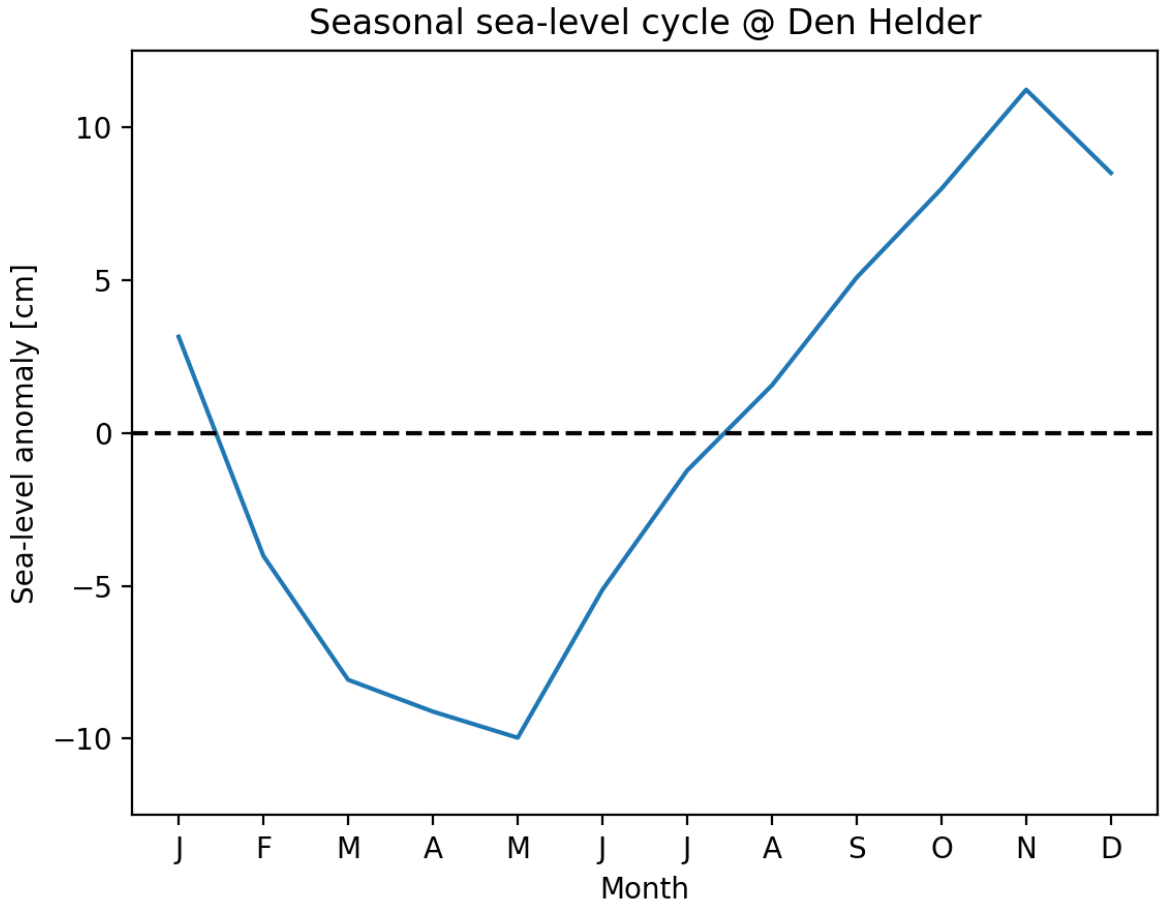
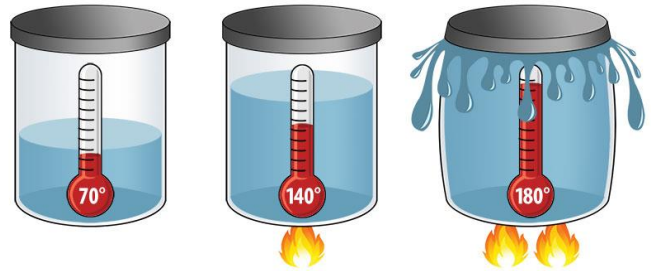
Group by month

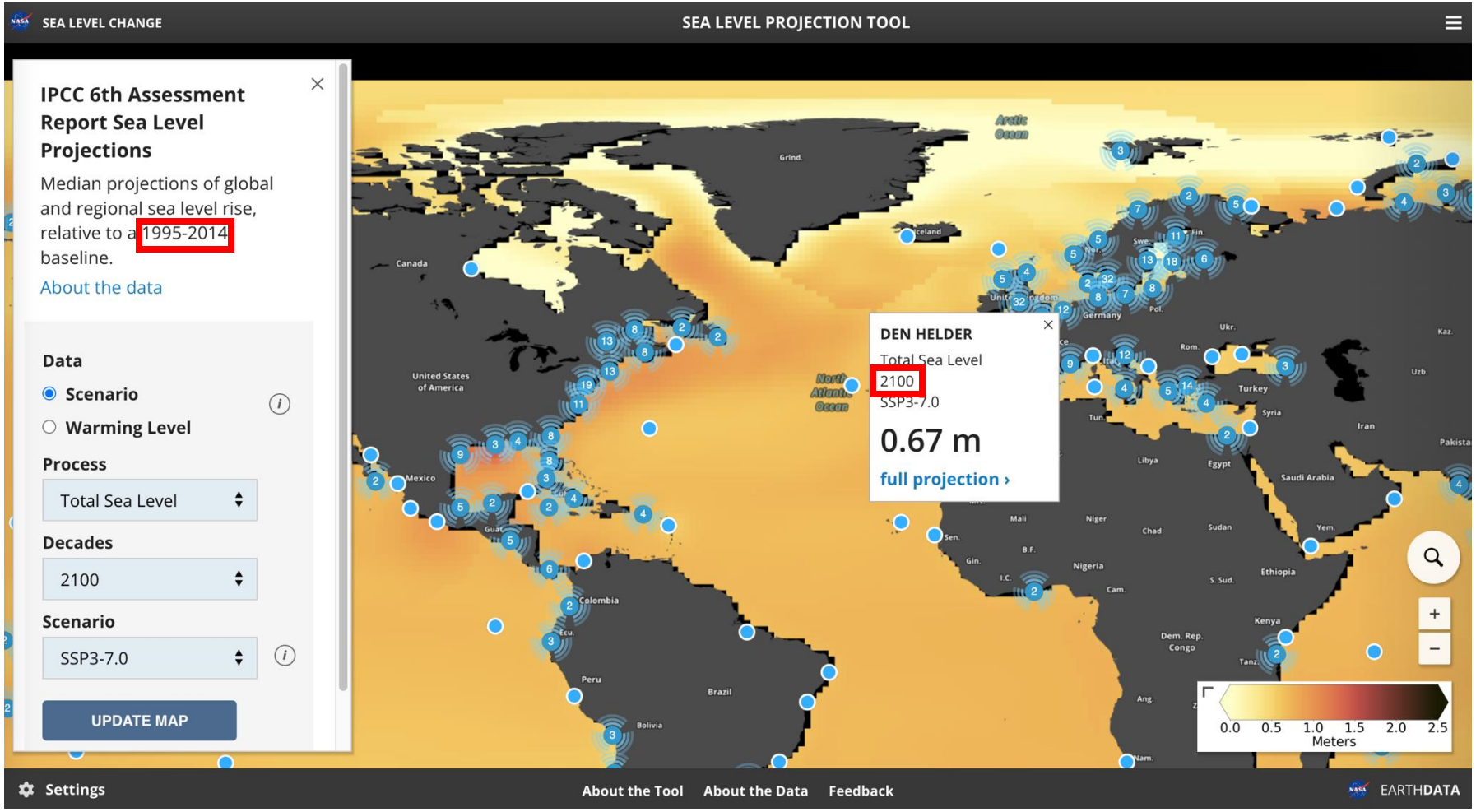


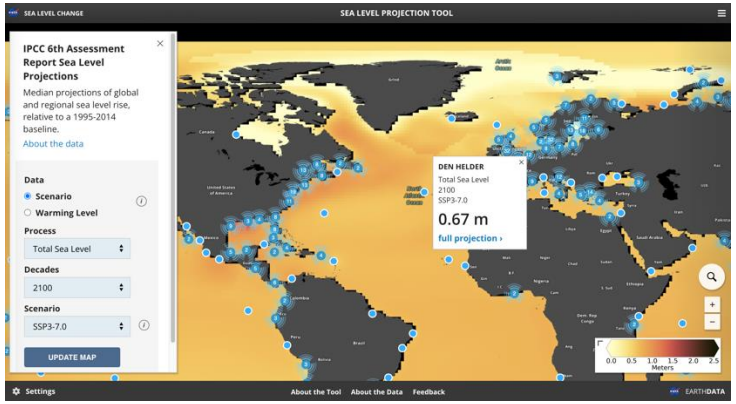
Reasons?

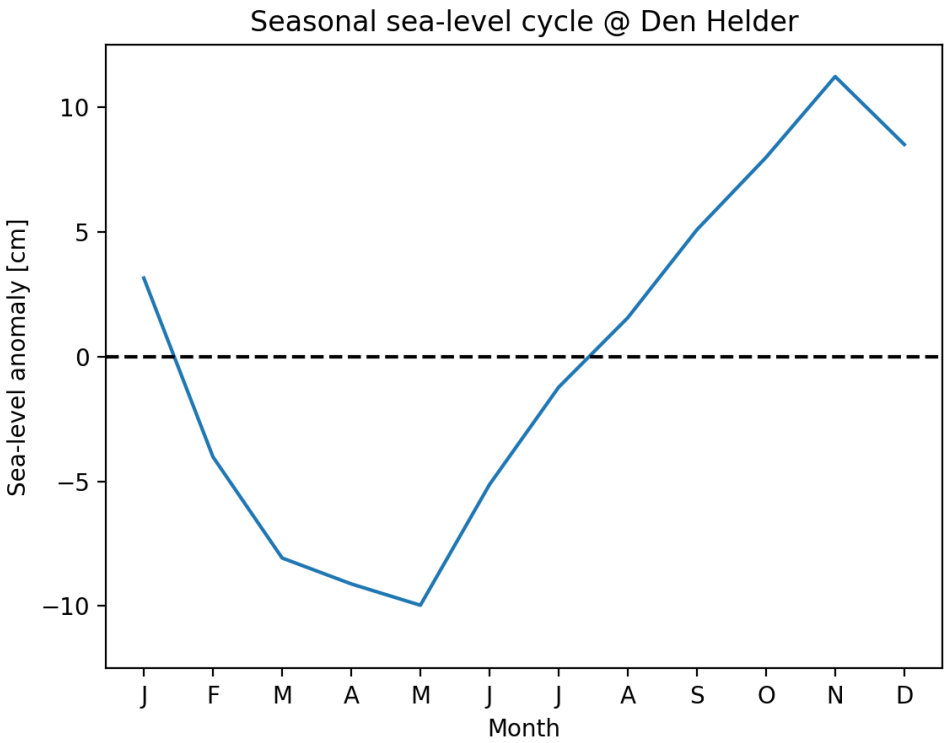


Past
Future

NASA Sea-level tool

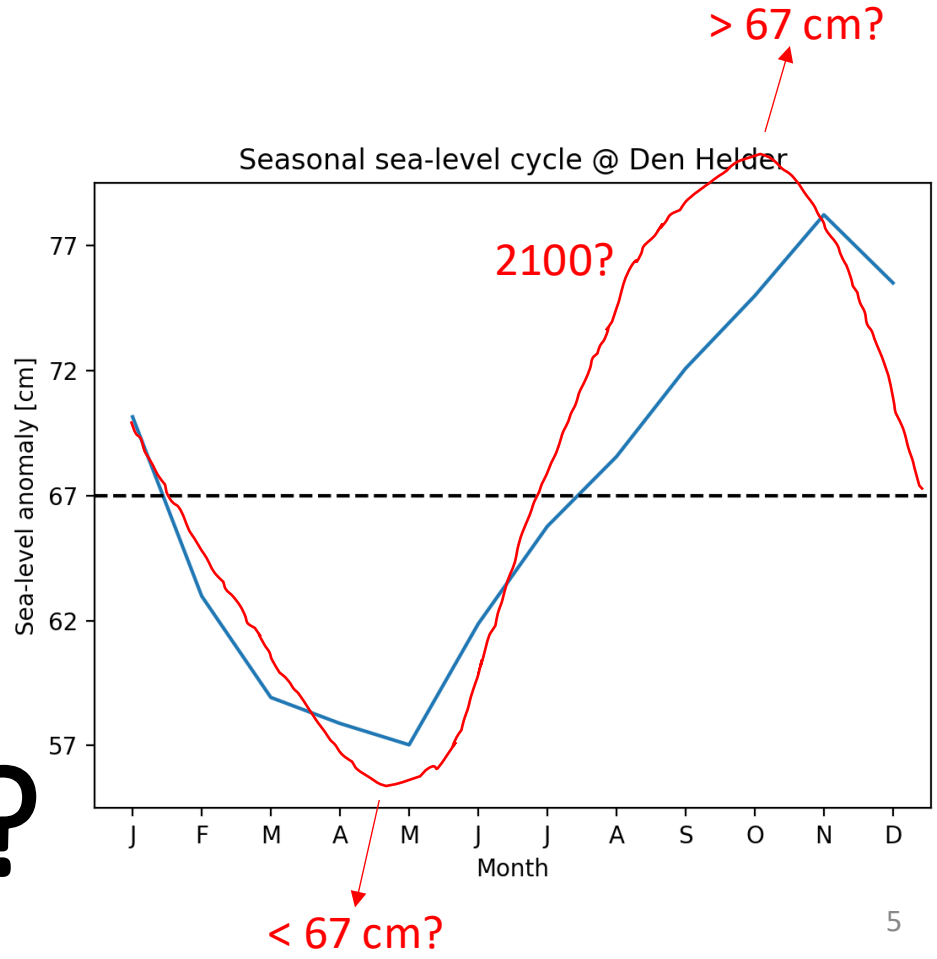



SEA LEVEL CHANGE
SEA LEVEL PROJECTION TOOL
IPCC 6th Assessment Report Sea Level Projections
Median projections of global and regional sea level rise, relative to a 1995-2014 baseline.
About the data
Data
Scenario
Warming Level
Process
Total Sea Level
Decades
2100
Scenario
SSP3-7.0
UPDATE MAP
DEN HELDER
Total Sea Level
2100
SSP3-7.0
0.67 m
full projection ›
Settings
About the Tool
About the Data
Feedback
EARTHDATA


Seasonal sea-level cycle @ Den Helder
Sea-level anomaly [cm]
10
5
0
−5
−10
J
F
M
A
M
J
J
A
S
O
N
D
Month

+ 67 cm

?

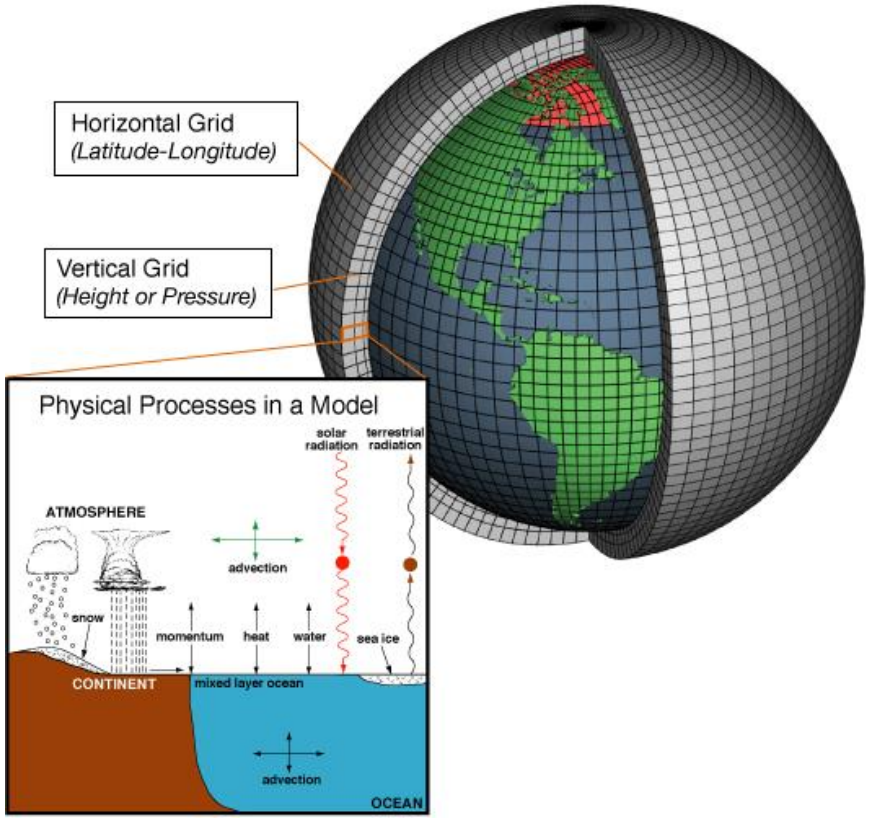

> 67 cm?
Seasonal sea-level cycle @ Den Helder
2100?
Sea-level anomaly [cm]
77
72
67
62
57
J
F
M
A
M
J
J
A
S
O
N
D
Month
< 67 cm?

Climate model simulations

Scenario

x 30!

Global climate model

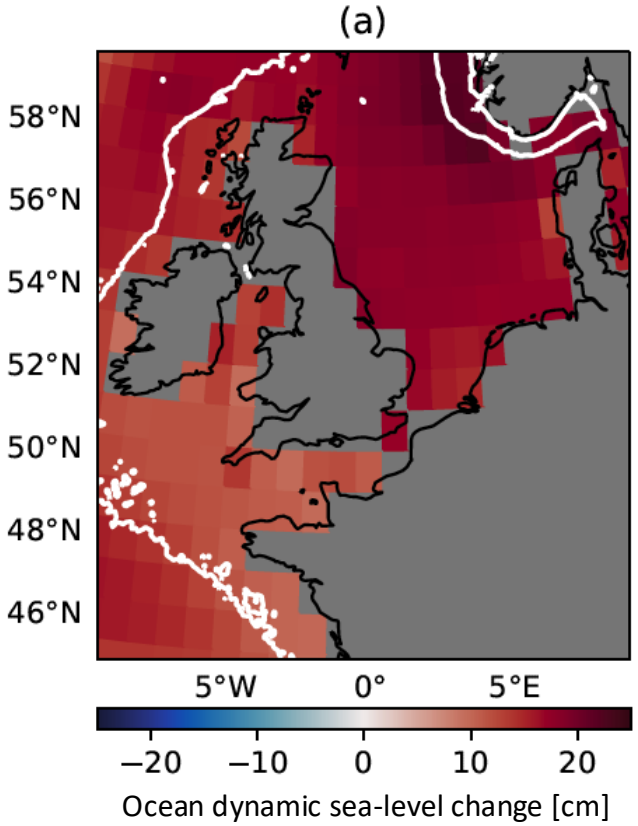


Simulations of sea level

(among others!)

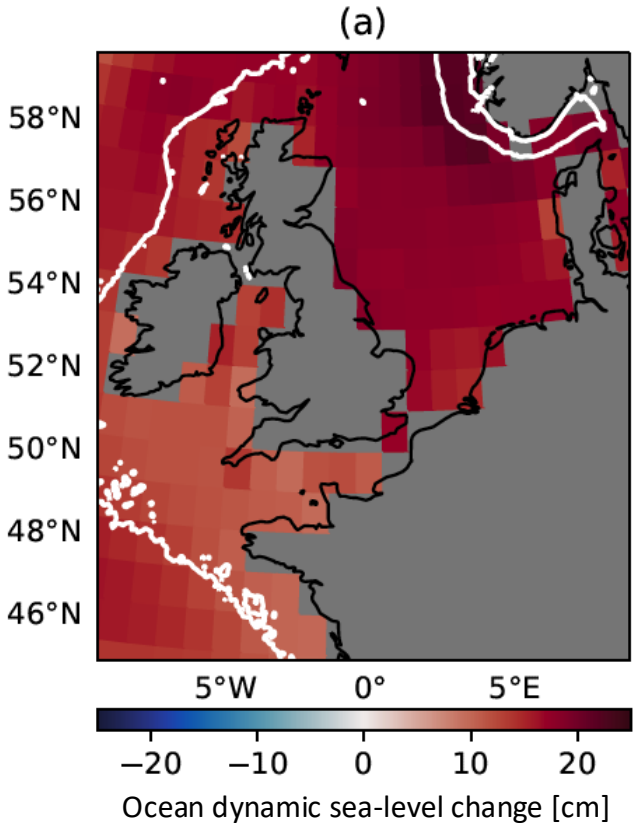
Projected ‘ocean dynamic’ sea-level change

- Mean of all models

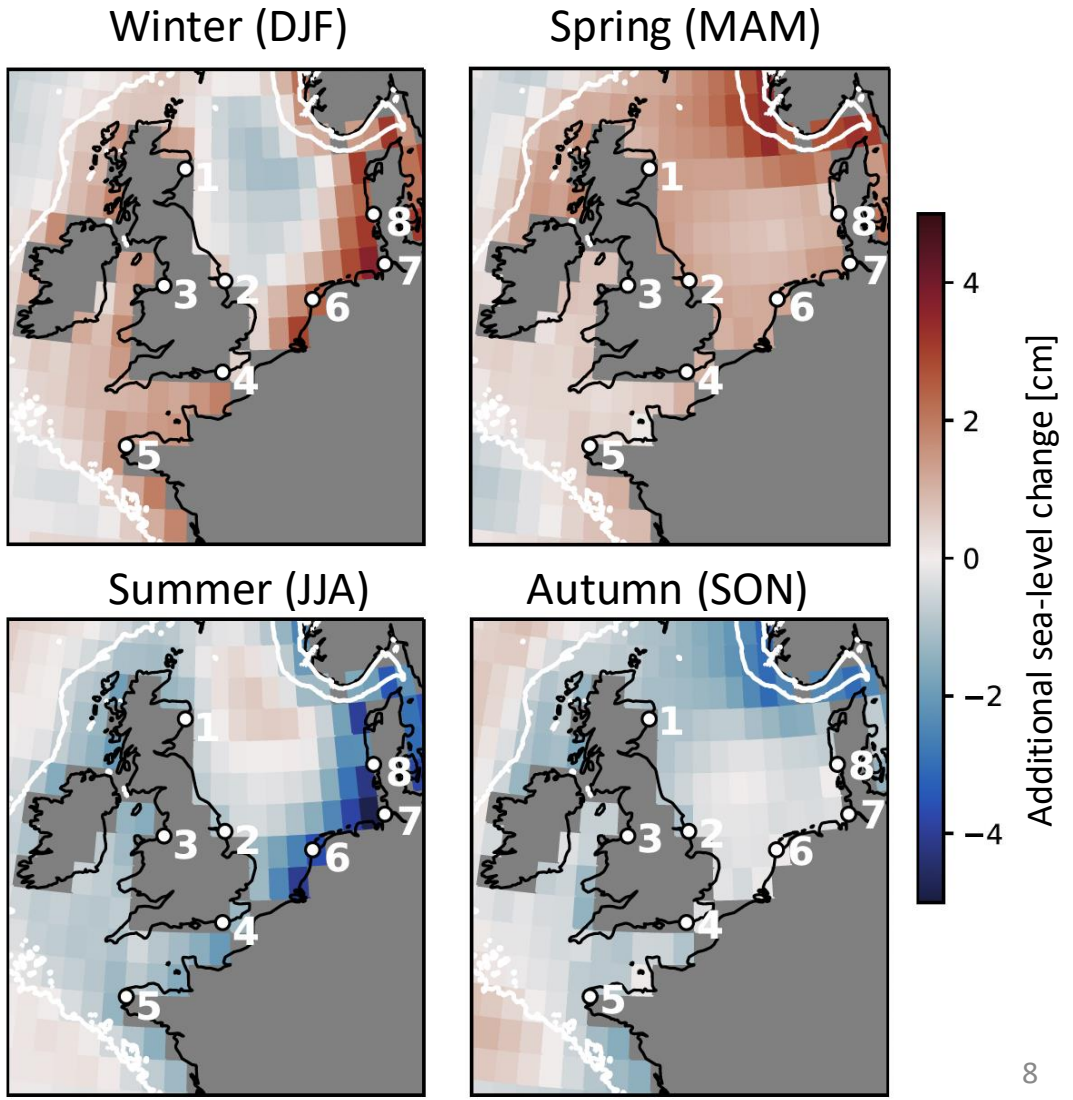


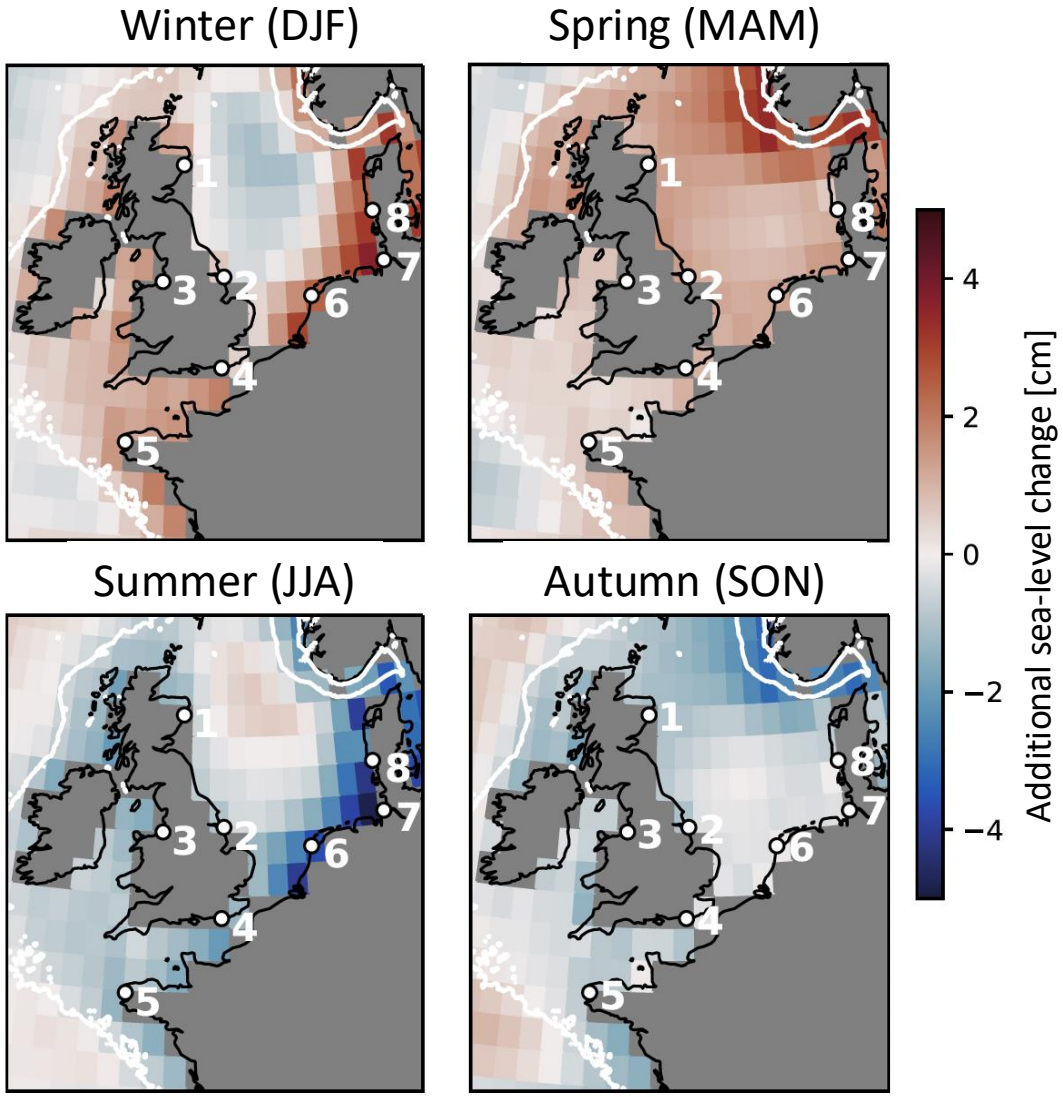
How much more/less in seasons?

- Mean of all models

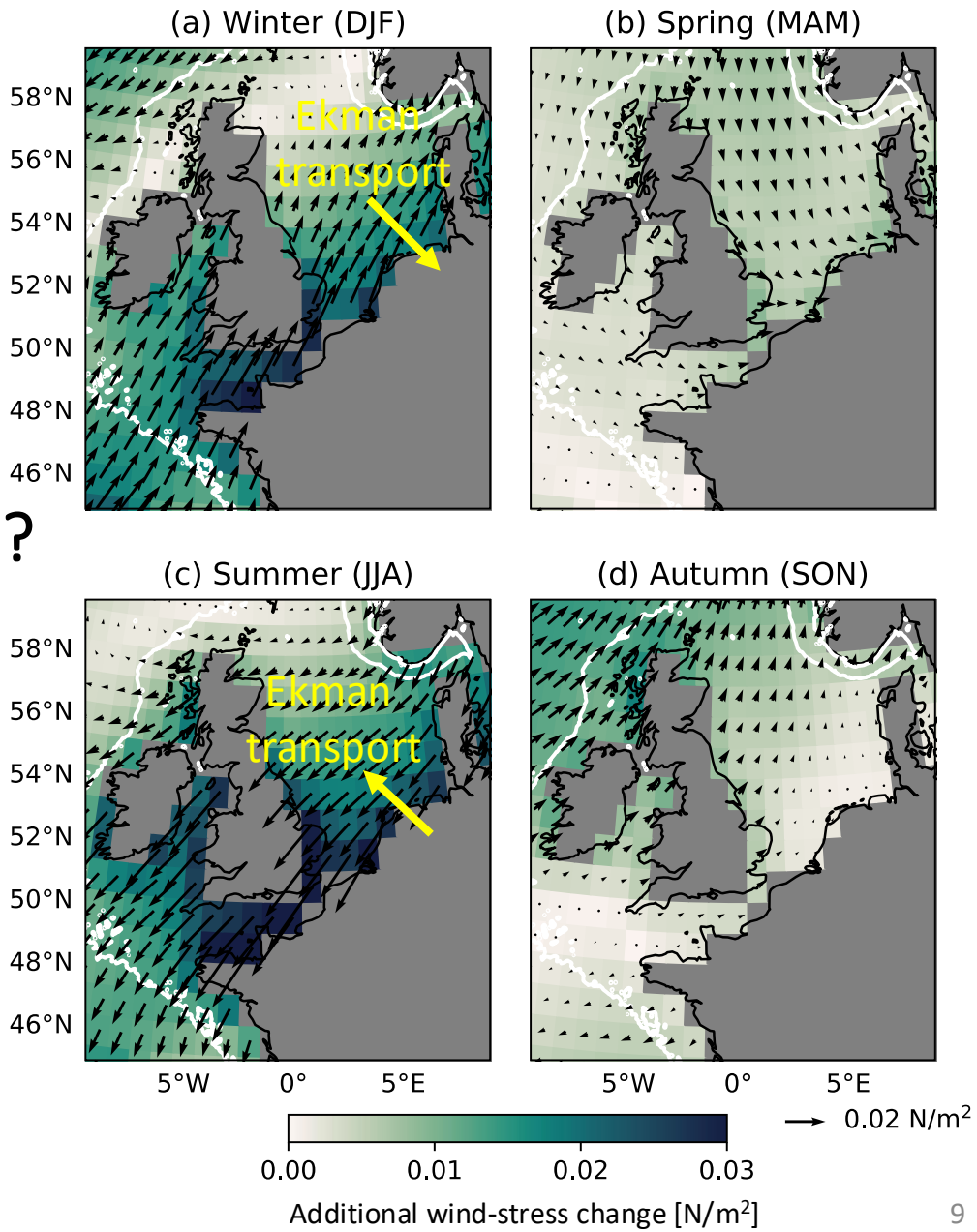


+



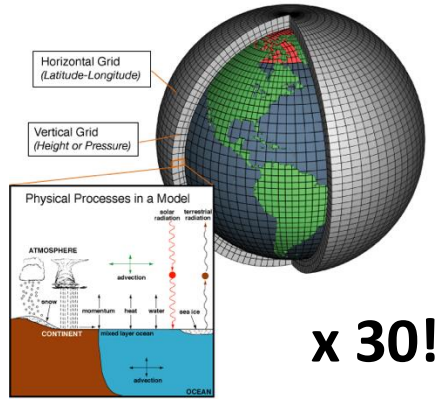

Winter (DJF)
Spring (MAM)
Summer (JJA)
Autumn (SON)
1
2
3
4
5
6
7
8
4
2
0
−2
−4
Additional sea-level change [cm]

cause?

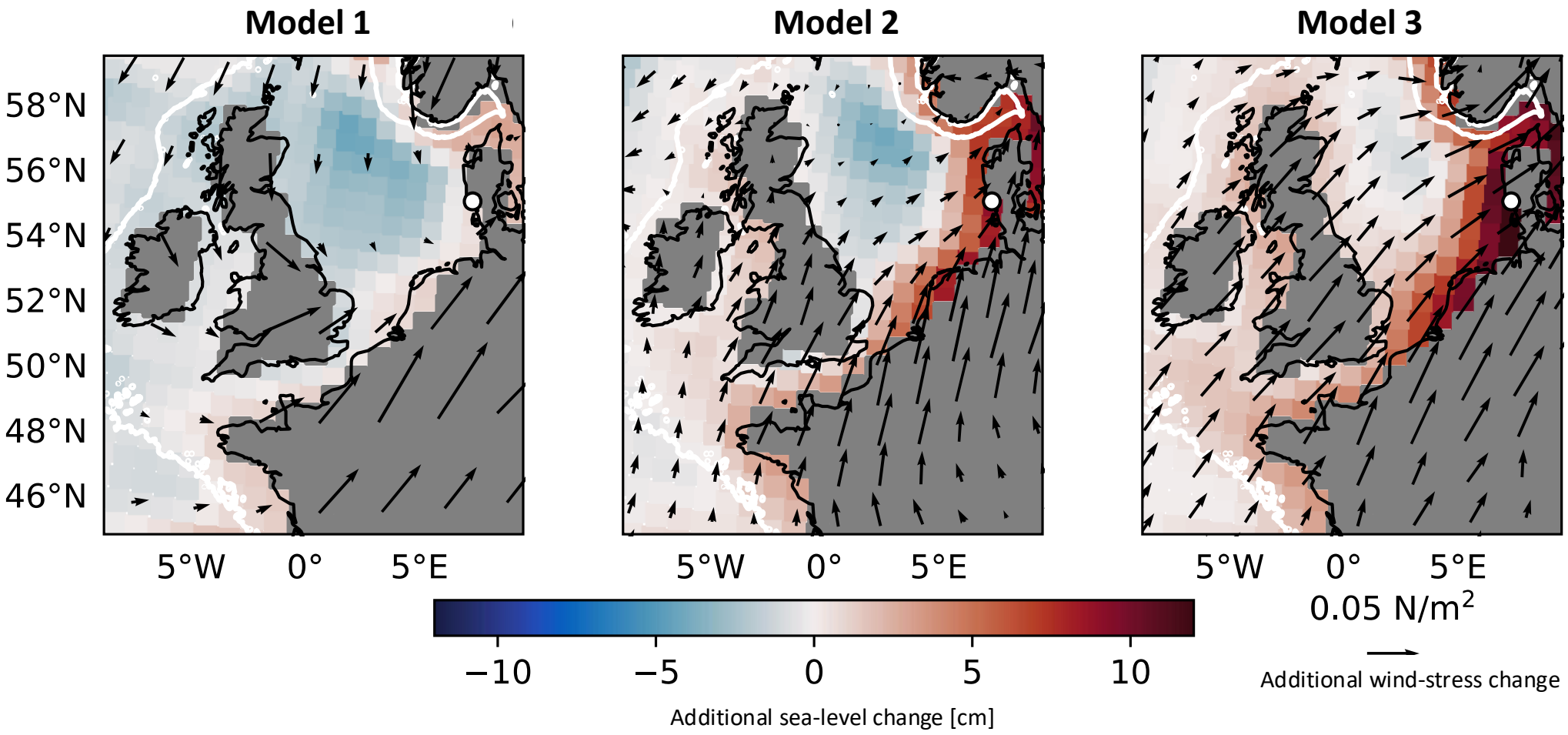

(a) Winter (DJF)
(b) Spring (MAM)
(c) Summer (JJA)
(d) Autumn (SON)
Ekman transport
Ekman transport
58°N
56°N
54°N
52°N
50°N
48°N
46°N
5°W
0°
5°E
0.02 N/m²
0.00
0.01
0.02
0.03
Additional wind-stress change [N/m²]

Additional change in winter:

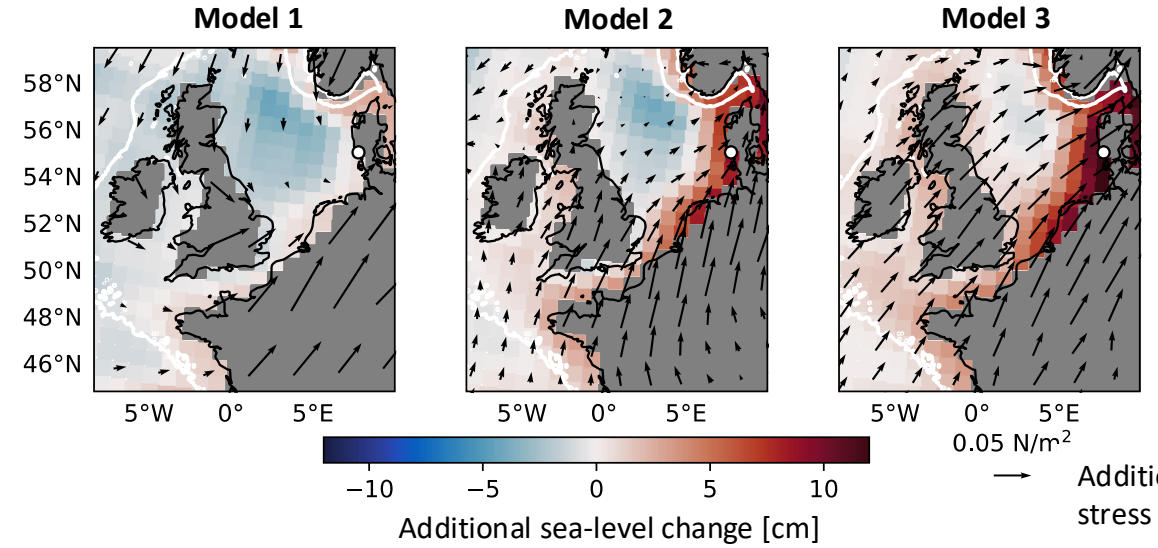
3 examples



x 30!

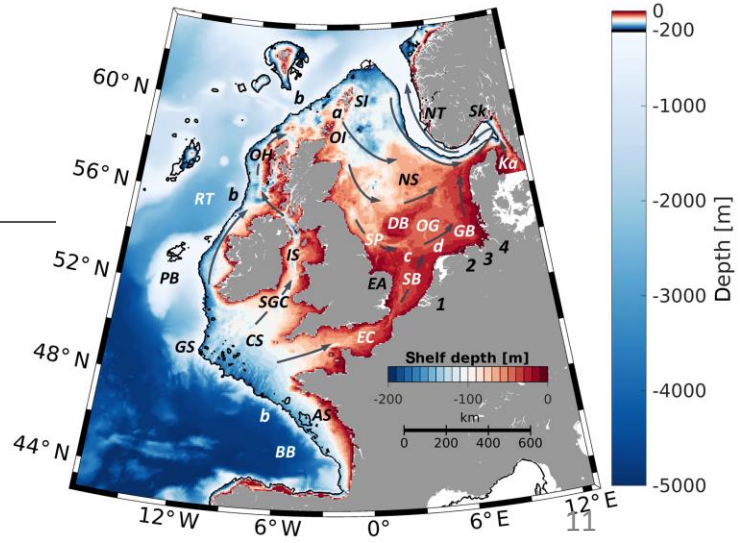


Isolating effect of the wind

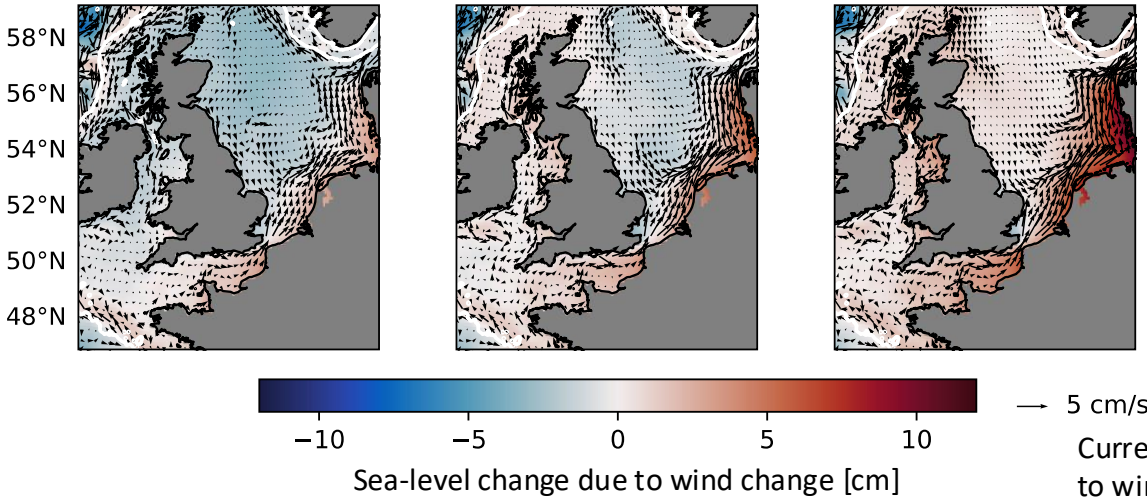


Take the wind change

Apply to regional ocean model



Simulate effect of wind change

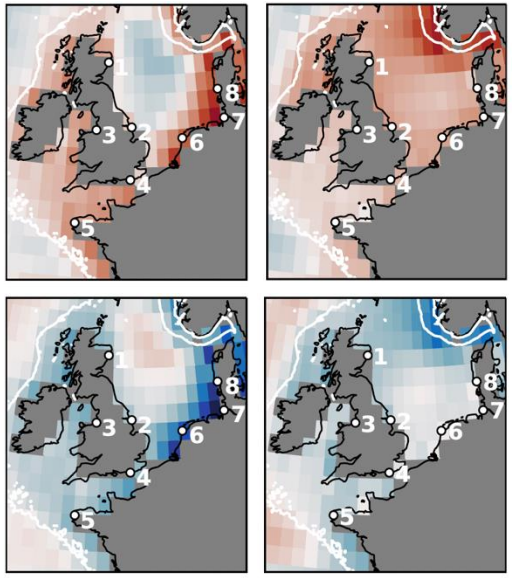


5 cm/s

Currents change due to wind change

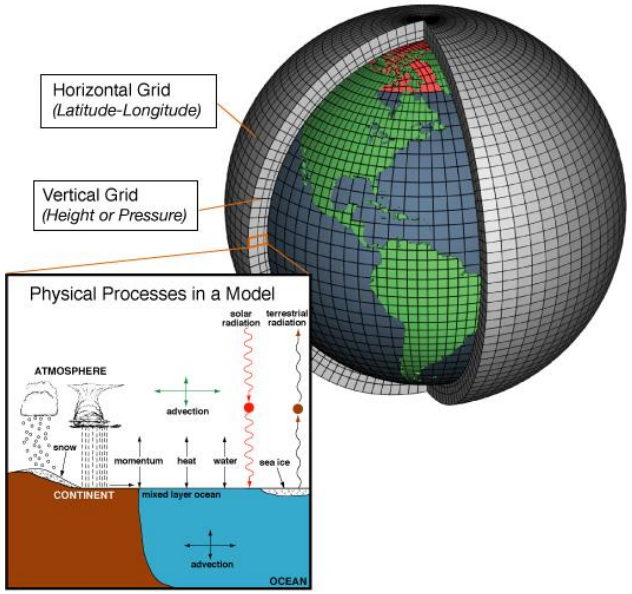
Conclusions

- Sea-level rise in Europe differs between seasons
  - Higher in winter & spring
  - Lower in summer & autumn
- Causes:
  - Winter & summer: wind-stress change
  - Spring & autumn: density changes?
- Relevant for instance for intertidal ecosystems



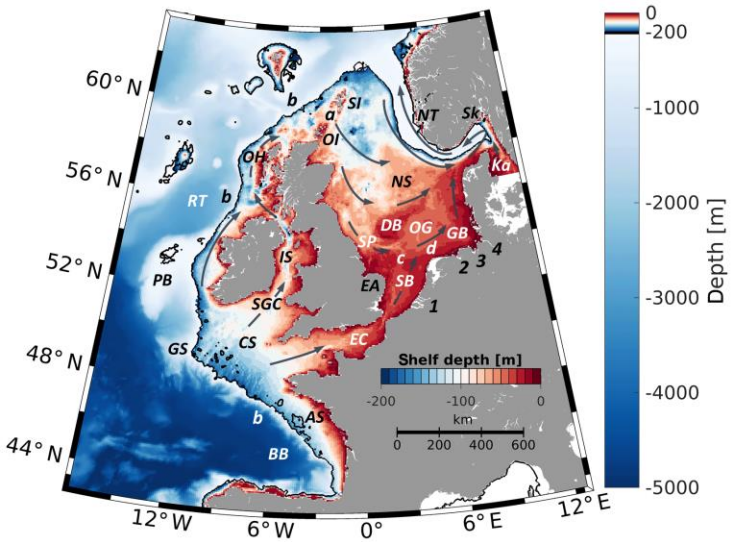
Topics for MSc thesis

Global climate models



- Seasonal changes in sea level
- Performance

Regional ocean modeling



- Downscaling global models
- Changes in storm surges & tides

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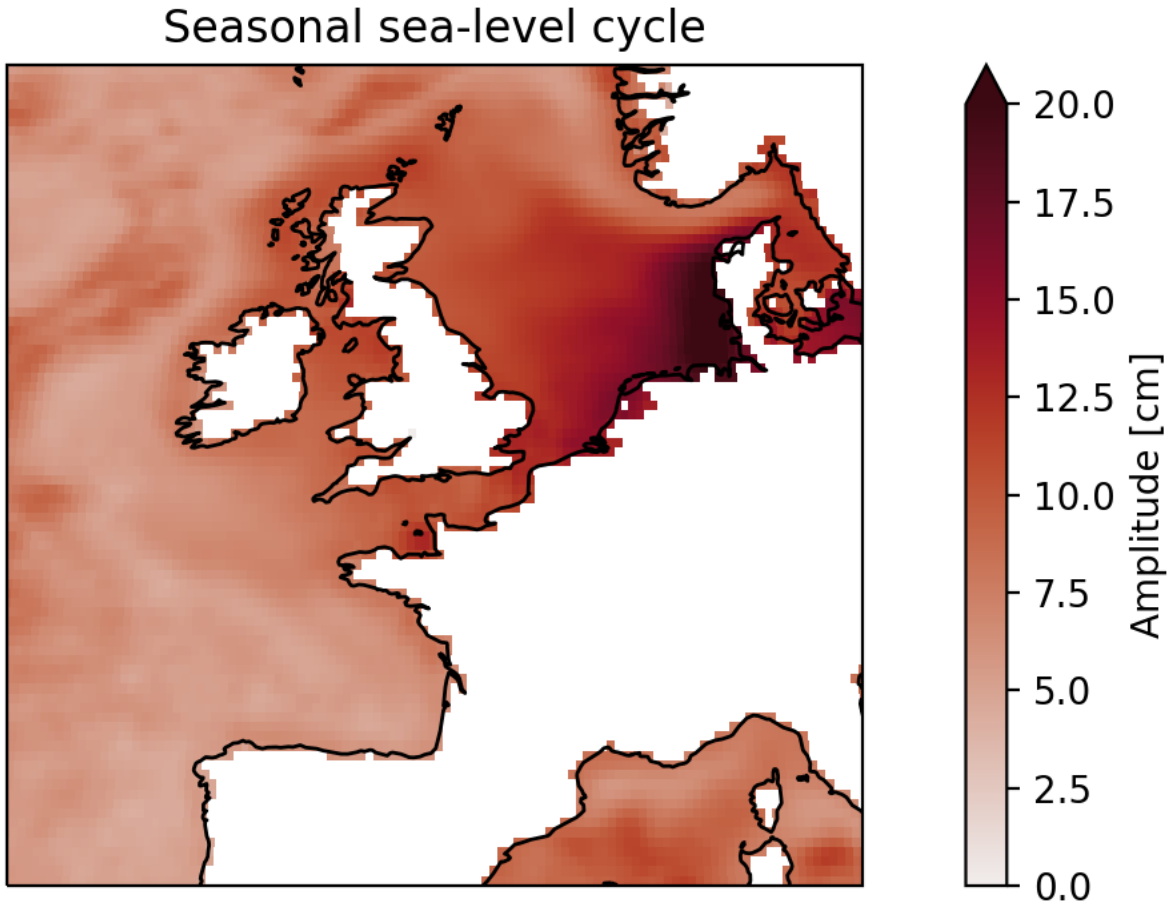
Extra

What satellites see:



(PS: same data as in python assignment 7.2! 1995-2015)