Climate change impacts on the European seas & coasts: what do we observe?

Maritime Days

Gijon May 20, 2010

Trine Christiansen

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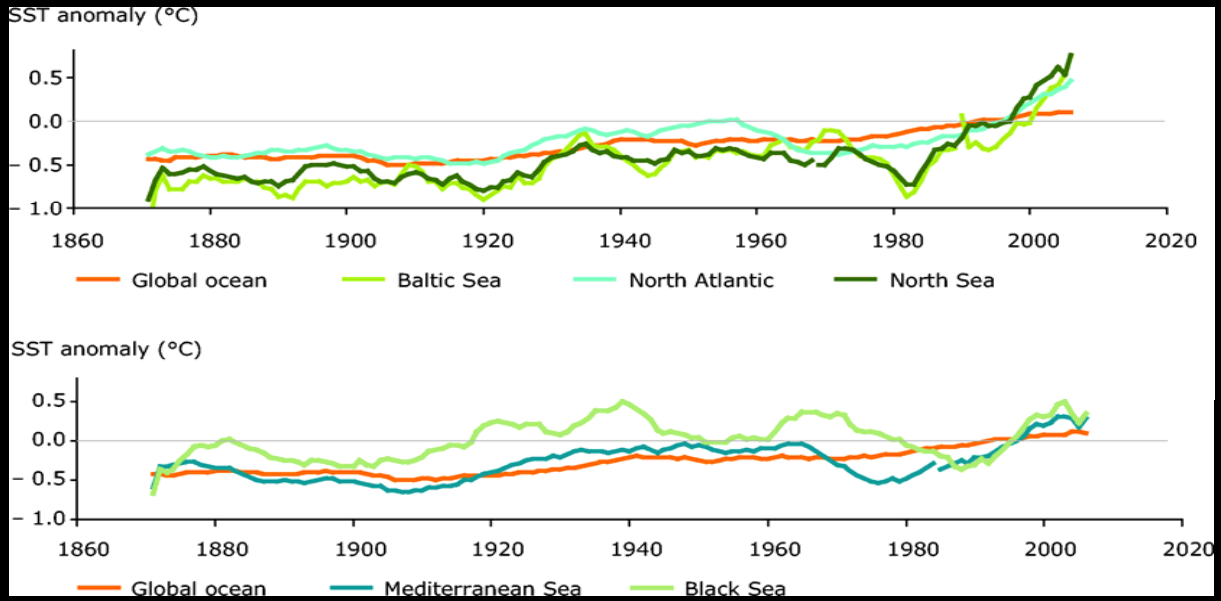
Sea surface temperature is increasing



- All European Seas are getting warmer at the surface!
- Temperatures are increasing more rapidly in Europe's seas than globally.

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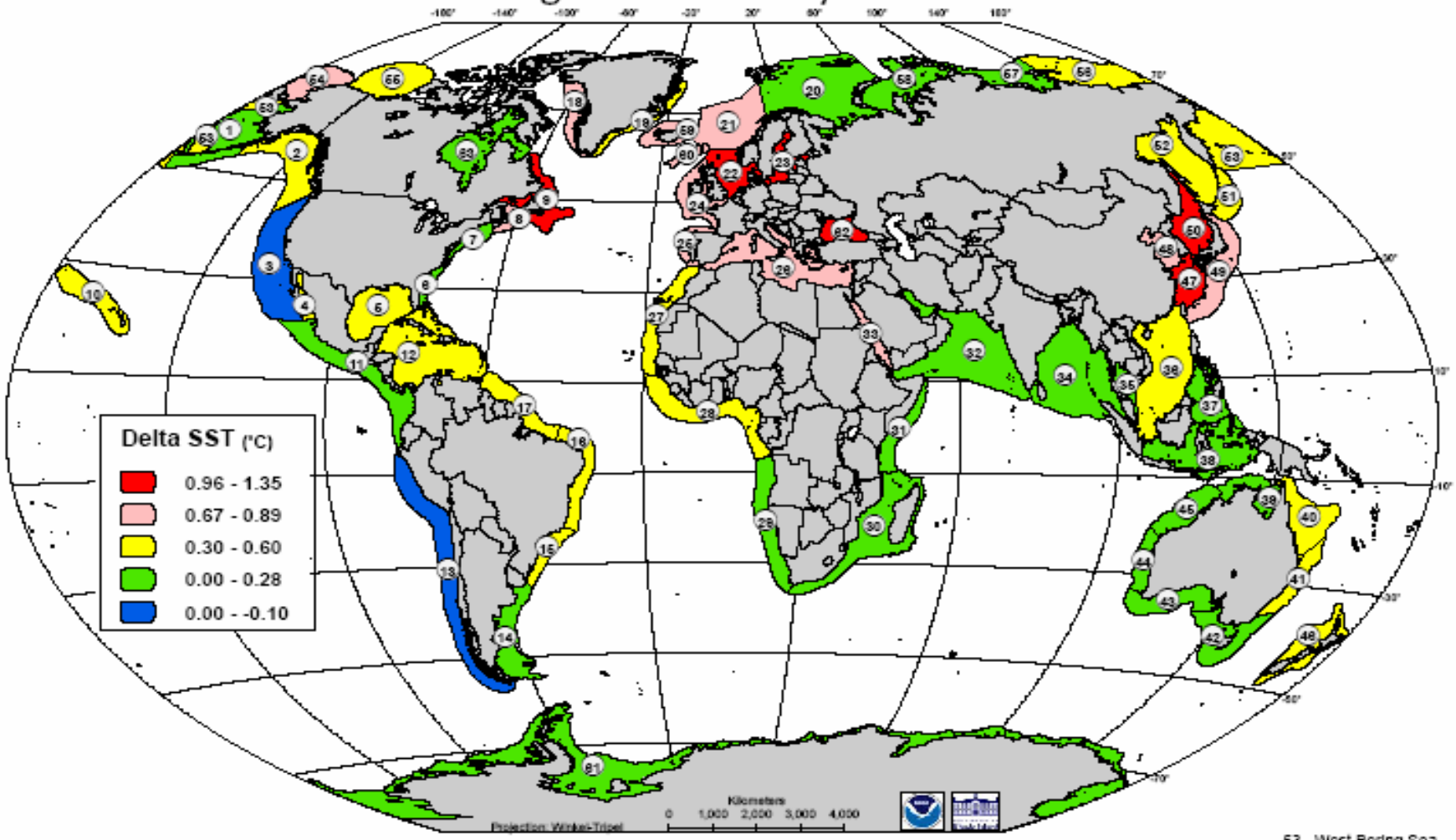
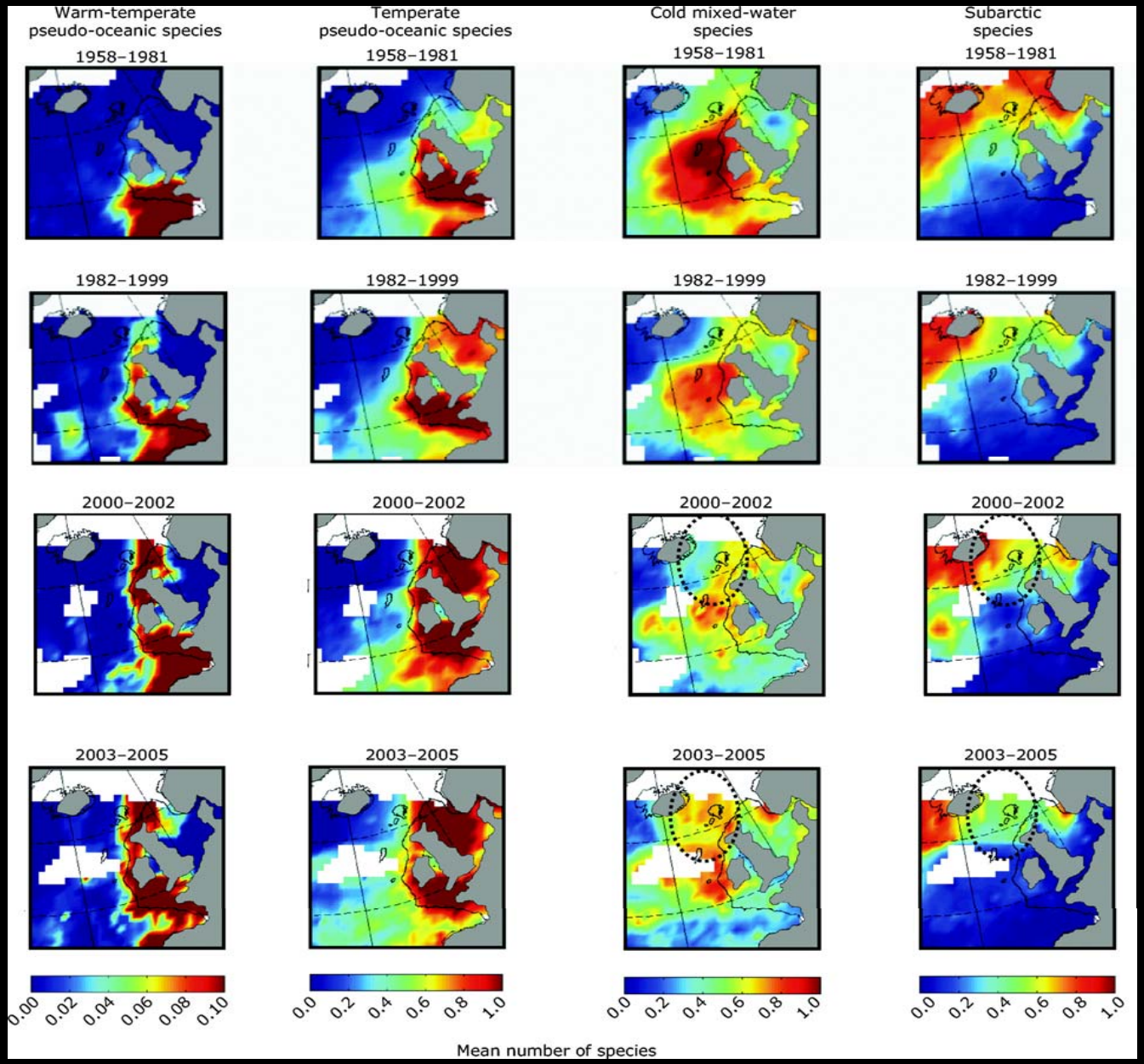
SST Trends in Large Marine Ecosystems: 1982 - 2006



1. East Bering Sea
2. Gulf of Alaska
3. California Current
4. Gulf of California
5. Gulf of Mexico
6. Southeast U.S. Continental Shelf
7. Northeast U.S. Continental Shelf
8. Scotian Shelf
9. Newfoundland-Labrador Shelf
10. Insular Pacific-Hawaiian
11. Pacific Central-American
12. Caribbean Sea
13. Humboldt Current
14. Patagonian Shelf
15. South Brazil Shelf
16. East Brazil Shelf
17. North Brazil Shelf
18. West Greenland Shelf
19. East Greenland Shelf
20. Barents Sea
21. Norwegian Sea
22. North Sea
23. Baltic Sea
24. Celtic-Biscay Shelf
25. Iberian Coastal
26. Mediterranean
27. Canary Current
28. Guinea Current
29. Benguela Current
30. Agulhas Current
31. Somali Coastal Current
32. Arabian Sea
33. Red Sea
34. Bay of Bengal
35. Gulf of Thailand
36. South China Sea
37. Sulu-Celebes Sea
38. Indonesian Sea
39. North Australia
40. Northeast Australia
41. East-Central Australia
42. Southeast Australia
43. Southwest Australia
44. West-Central Australia
45. Northwest Australia
46. New Zealand Shelf
47. East China Sea
48. Yellow Sea
49. Kuroshio Current
50. Sea of Japan/East Sea
51. Oyashio Current
52. Sea of Okhotsk
53. West Bering Sea
54. Chukchi Sea
55. Beaufort Sea
56. East Siberian Sea
57. Laptev Sea
58. Kara Sea
59. Iceland Shelf
60. Faroe Plateau
61. Antarctic
62. Black Sea
63. Hudson Bay

- Plankton are shifting their distributions northward due to warmer temperatures

- Warm water species are increasingly found in Northerly waters



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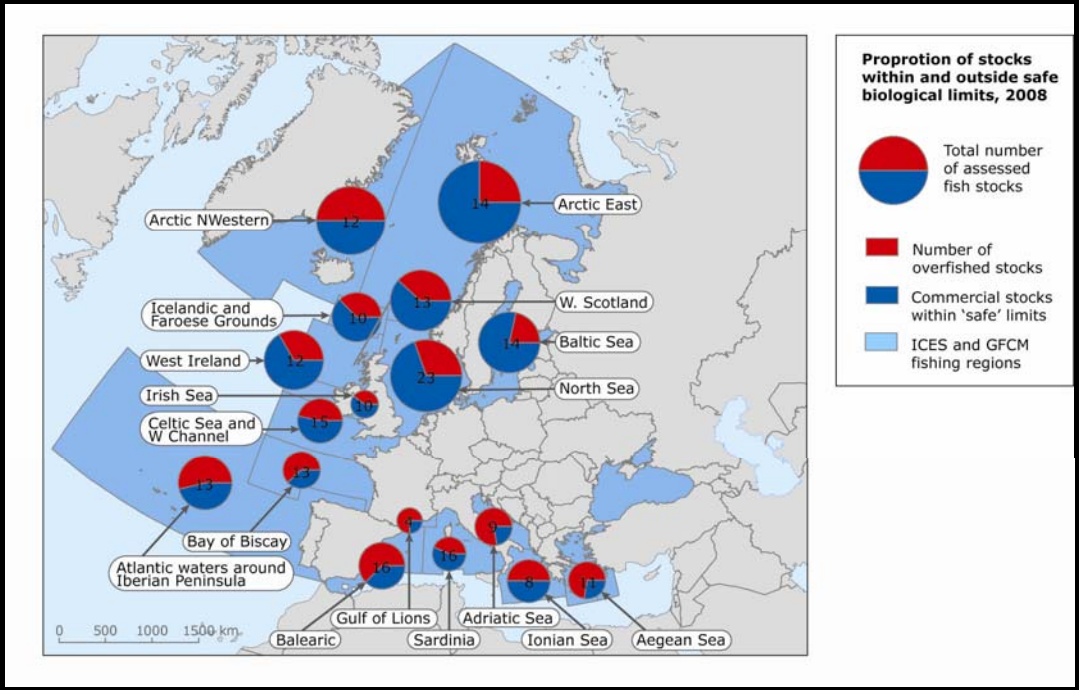
Adding pressures on fish stocks

- Climate change induced pressure also on commercially relevant fish stocks can be expected to increase in the future
- In this same area the economy of many communities depend on fisheries and related industries.



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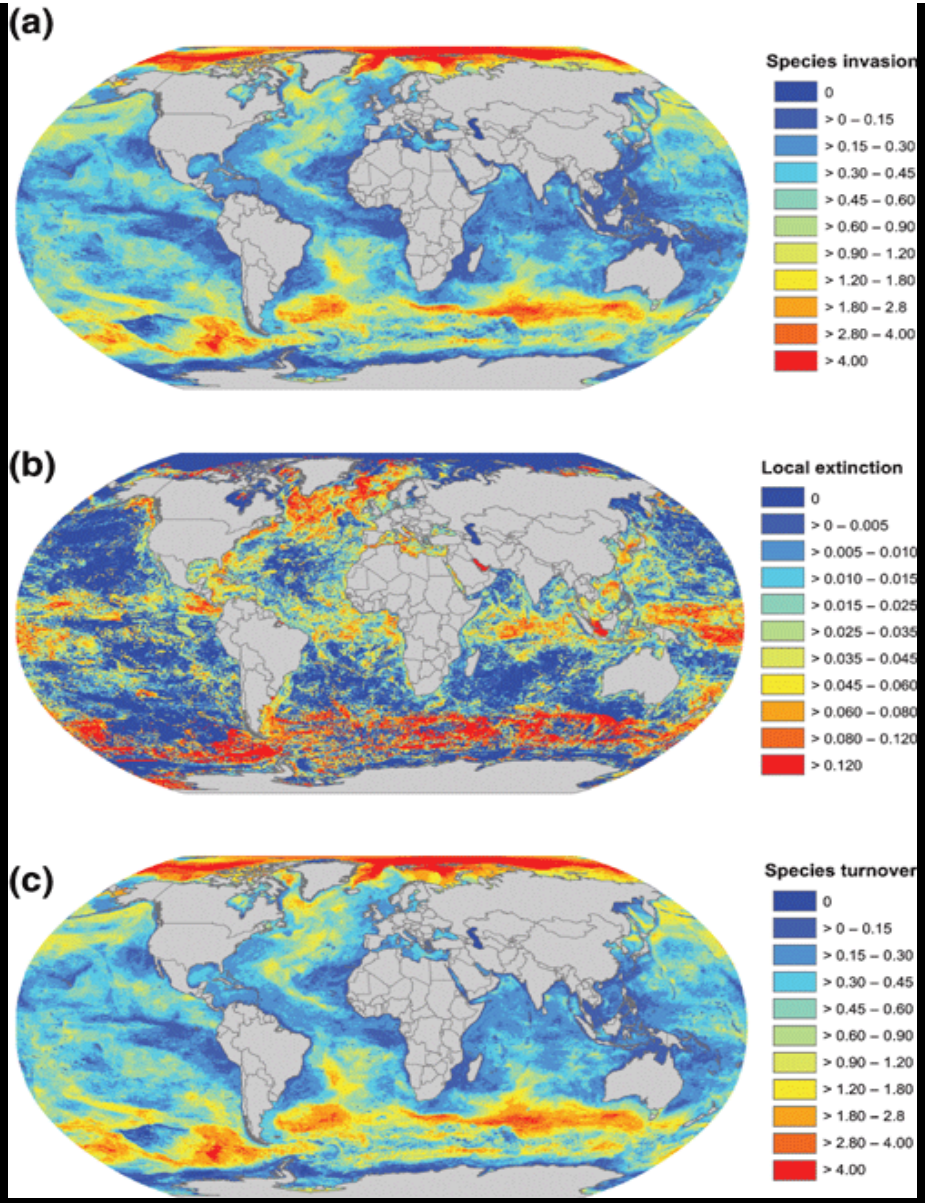
- **New findings**
- Large changes can be expected all over the globe in marine species diverstiy
- The largest species invasions and turnover is expected in the Arctic
- The largest areas of local extinction in Europe will be found in the North East Atlantic



Predicted biodiversity impact due to ocean warming.
From Cheung et al, Fish and Fisheries, September 2009

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Further threat from ocean acidification

Demonstration in Alaska

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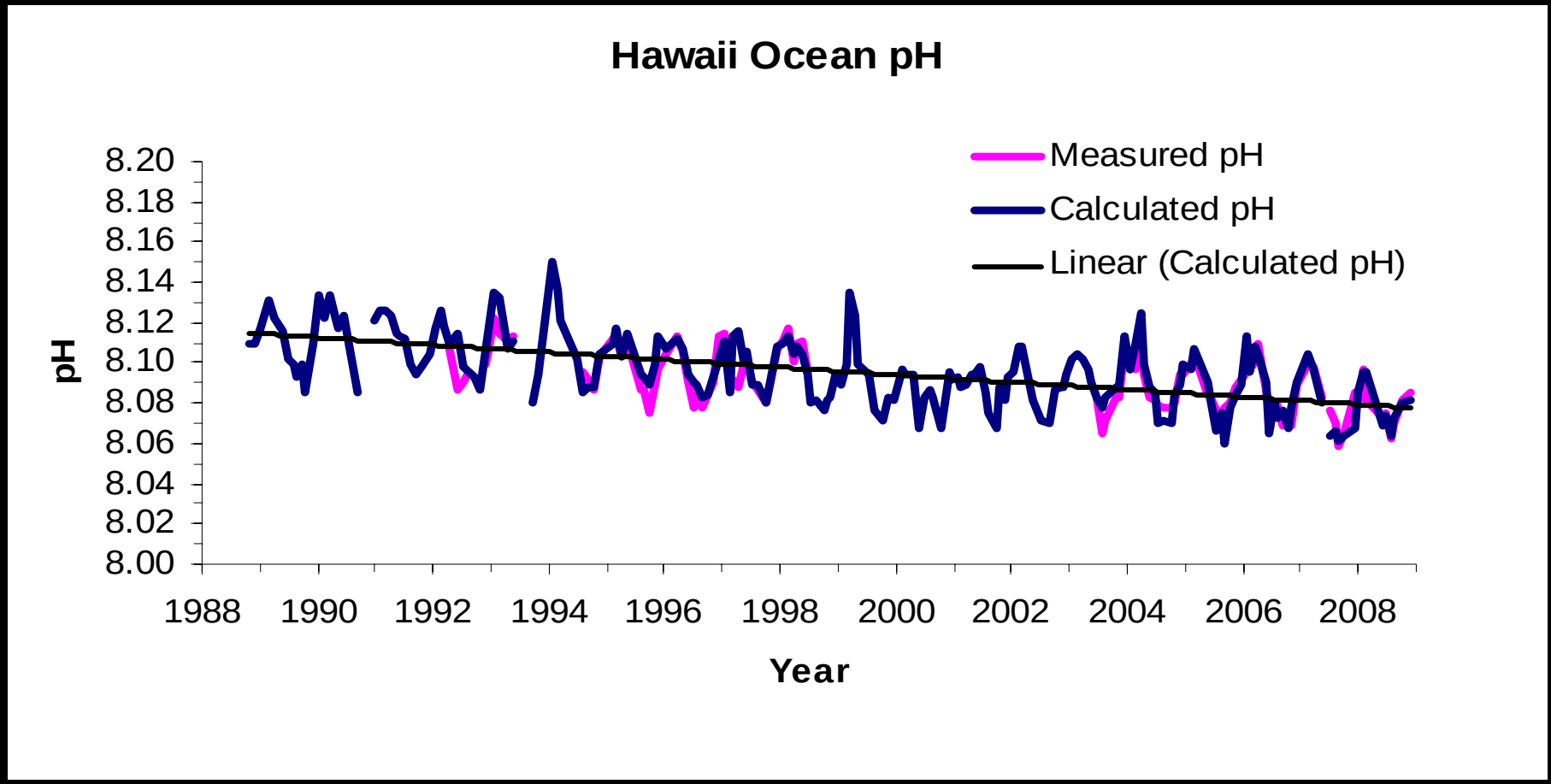

On a geological time scale pH has been stable, but recently ocean pH has started to decrease. This is happening in response to increased CO_2 in the atmosphere. Many scientists believe this can have catastrophic impacts when atmospheric CO_2 Concetrations approach 450 ppm. Projections show this can happen around 2030.

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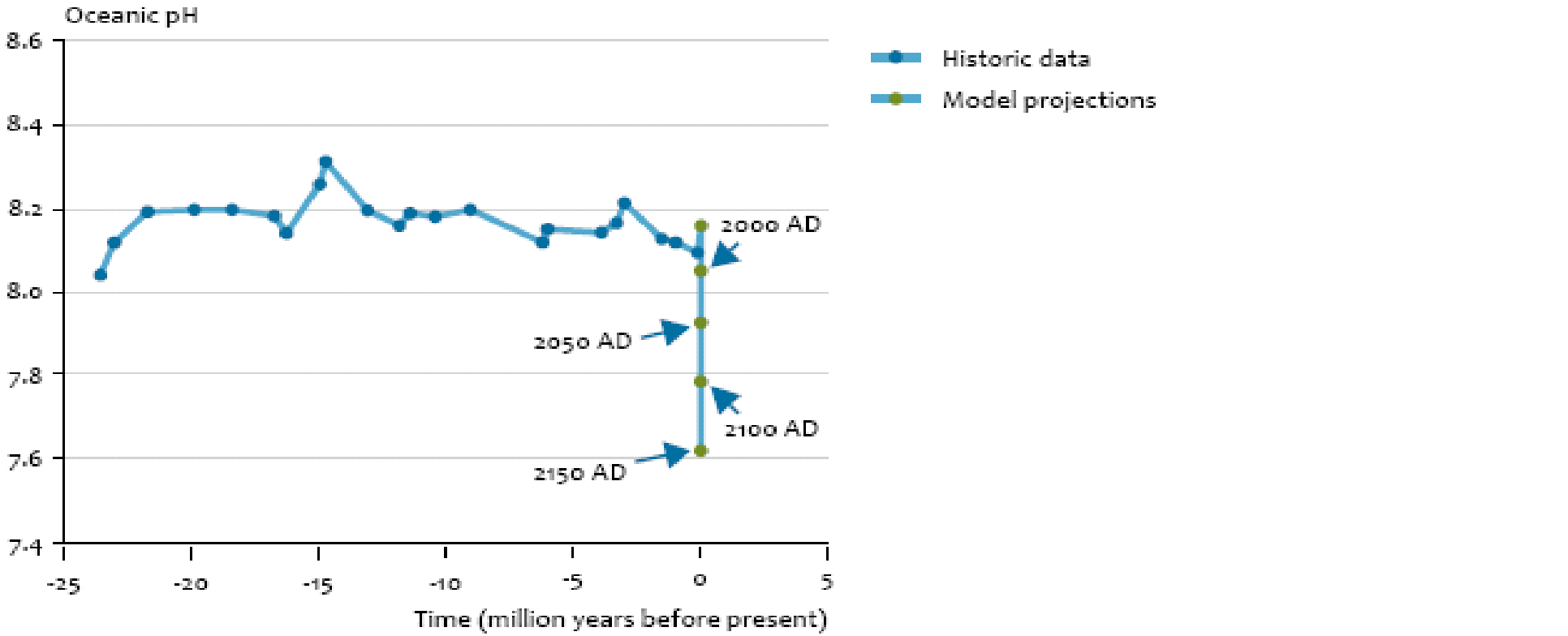
Future projection for ocean pH



Source: Earth System Science Partnership, 2009.

On a geological timescale, ocean pH has been relatively stable. Recently, oceans have been acidifying fast. and are projected to be unprecedented since millions of years. The 'pH' is a measure of acidity – the lower the number the more acidification.

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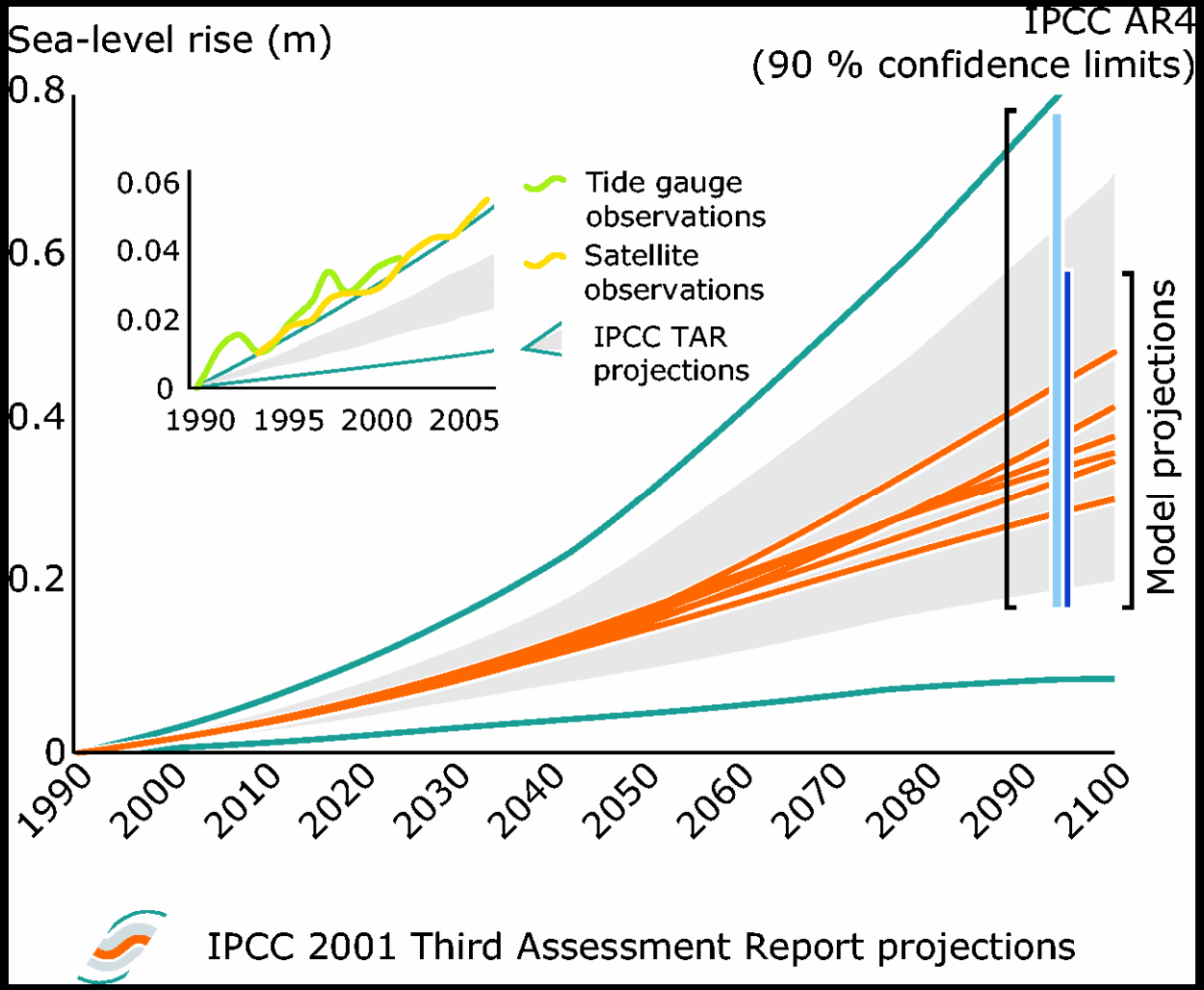
Global sea level rise projections



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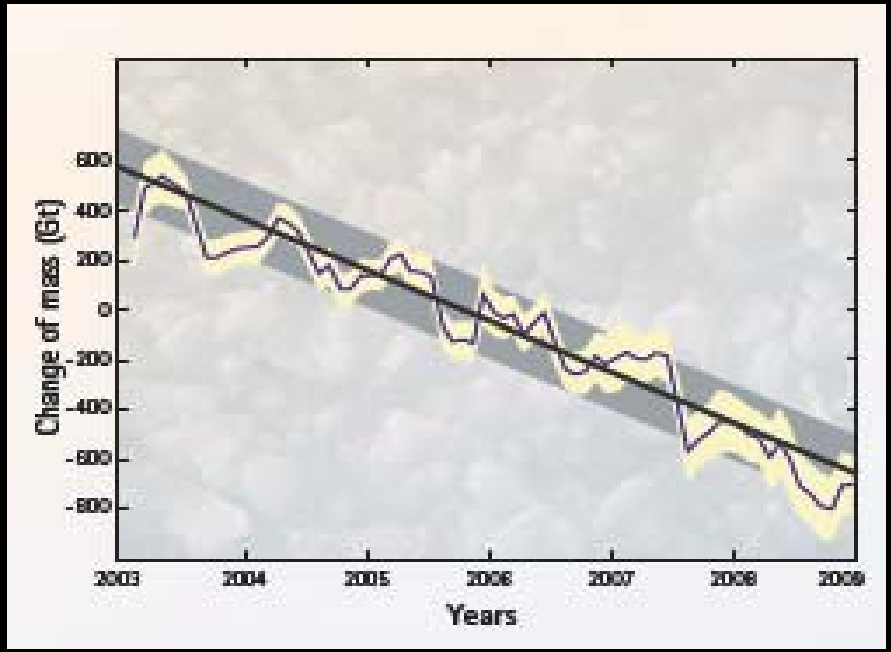
Sea level rise is linked to the melting of the Greenland Ice Sheet



- **The surface ice melt extent of the Greenland Ice Sheet (GIS) increased and the flow of outlet glaciers towards the sea accelerated the past years**
- **The GIS is losing volume at an increasing rate of about 50 Gt/year (1995 and 2000) to about 160 Gt/year (2003 to 2006)**
- **Loss of mass is estimated to increase, but reliable predictions of the future of the GIS are difficult because the processes causing the faster movement of the glaciers need to be better understood and more observations are needed**

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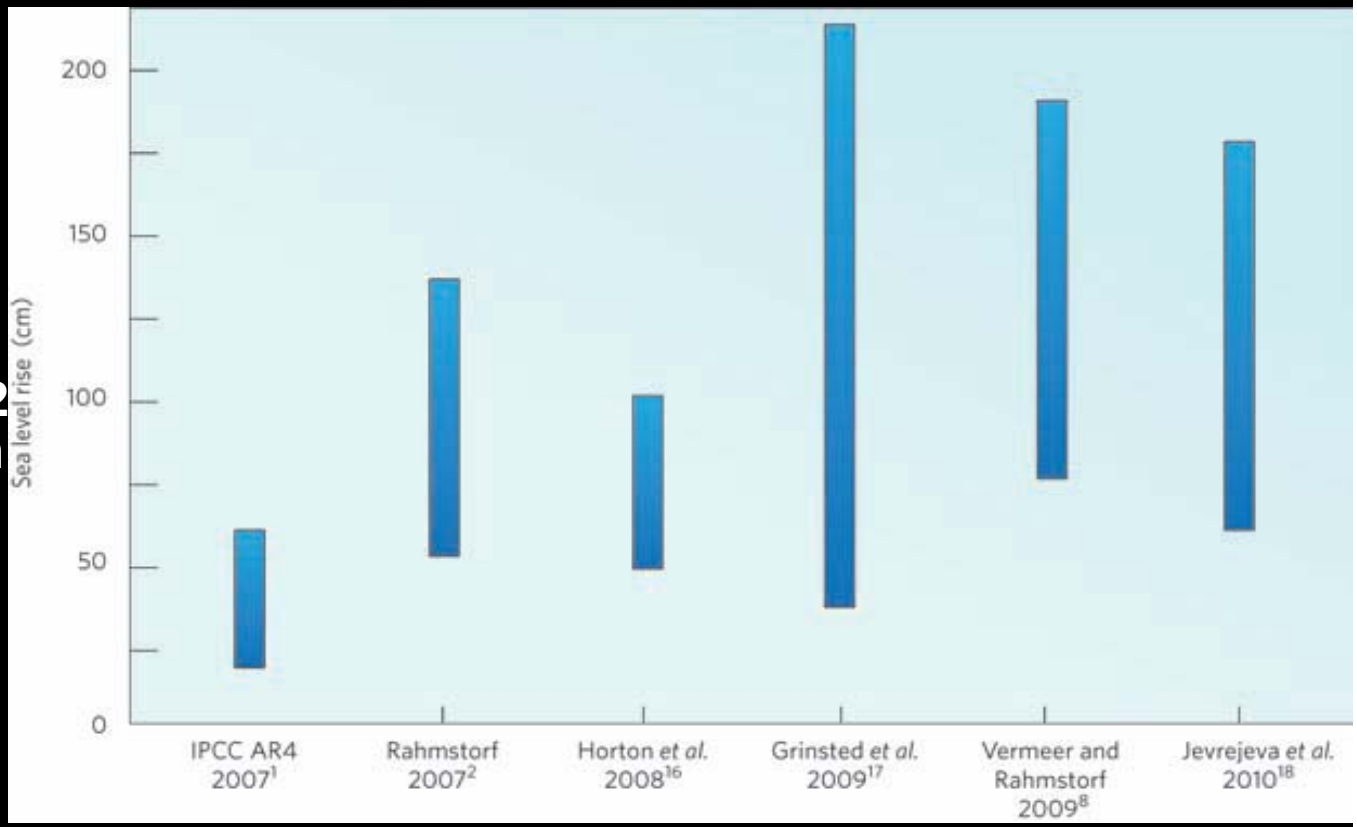
Global sea level rise

- Recent sea level rise (SLR) projections show a much higher rise than the IPCC 2007 report (estimated by up to one meter or by some experts by up to two meter, by 2100)
- Often SLR around 1 – 1.2 meters is used as a design parameter for construction projects
- SLR and changes in frequency / intensity of storms and associated surges can lead to increased flooding
- To protect population and ecosystems 'soft' and 'hard' adaptation actions will be needed



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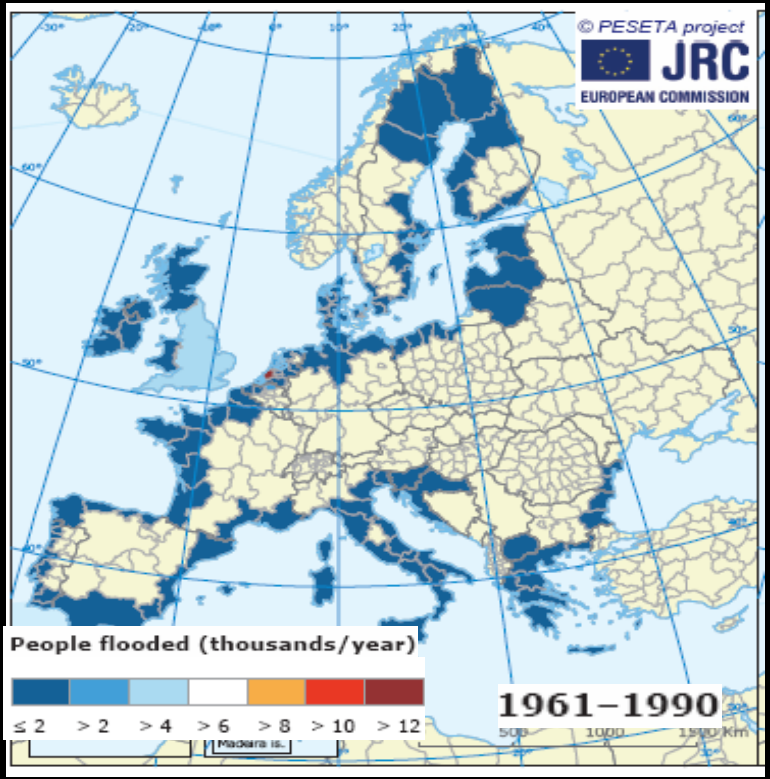
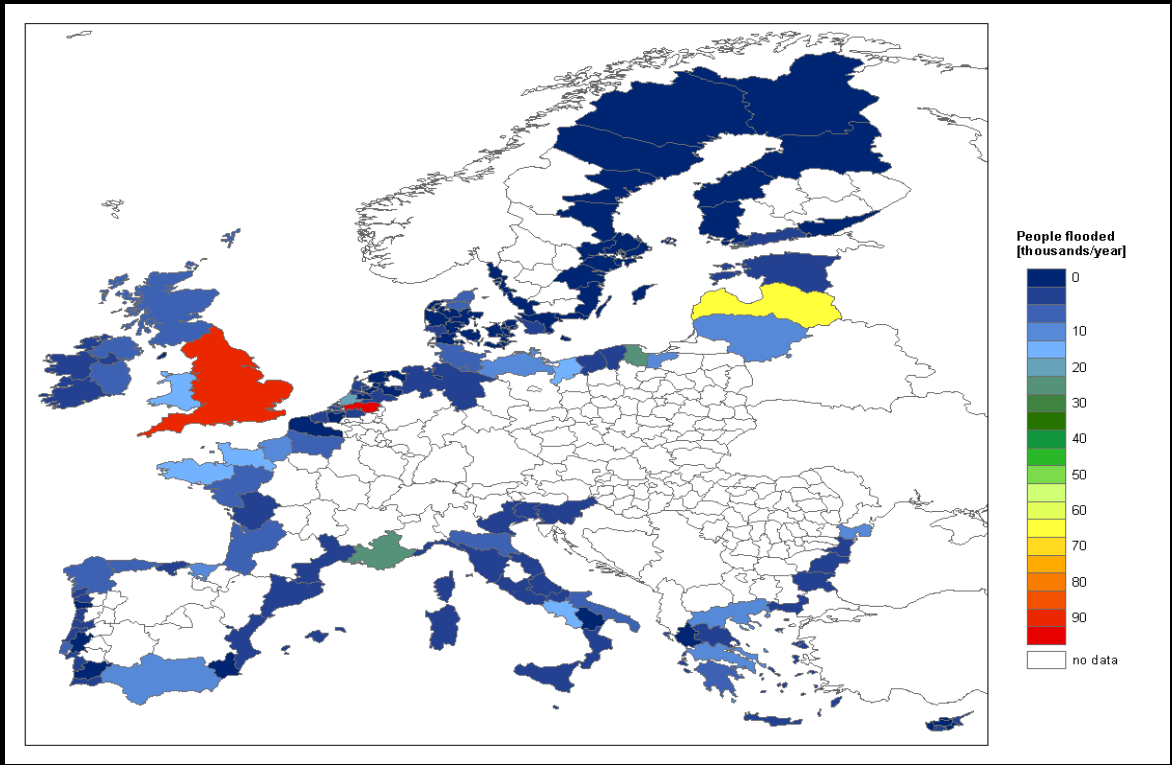
Coastal areas

- **One third of the EU population is estimated to live within 50km of the coast and some 140,000 km² of land is currently within 1m of sea level.**





People expected to be flooded in thousands per year without adaptation under the A2 scenario in the 2080s

- **200-700 thousand people/year flooded and 17-18 billion Euro/year economic damages in European coastal areas by 2080.**
- **Adaptation could significantly reduce residual damage to around EUR 2.5 billion Euro/year. Adaptation at the coasts pays off many times compared to inaction.**

future

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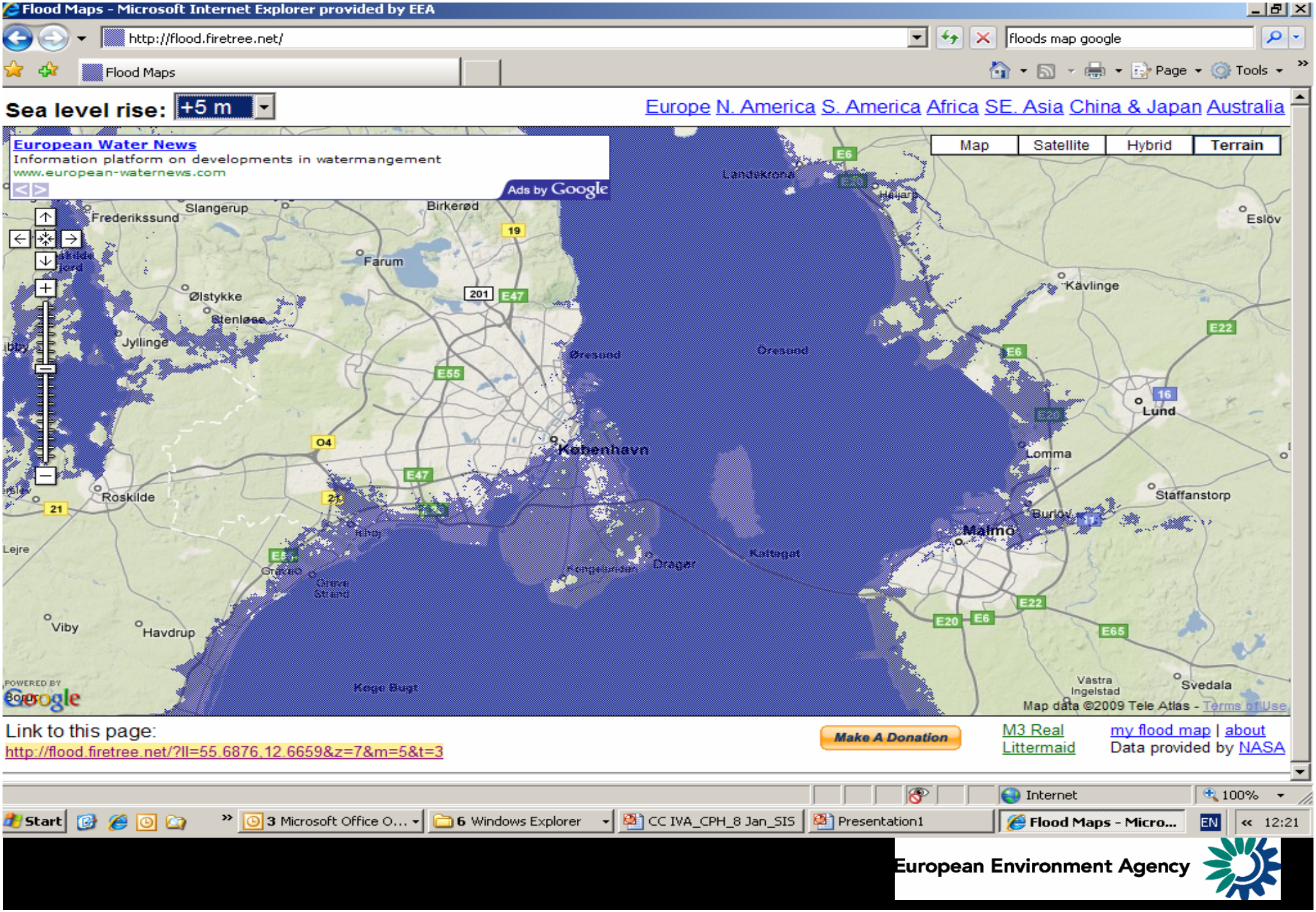

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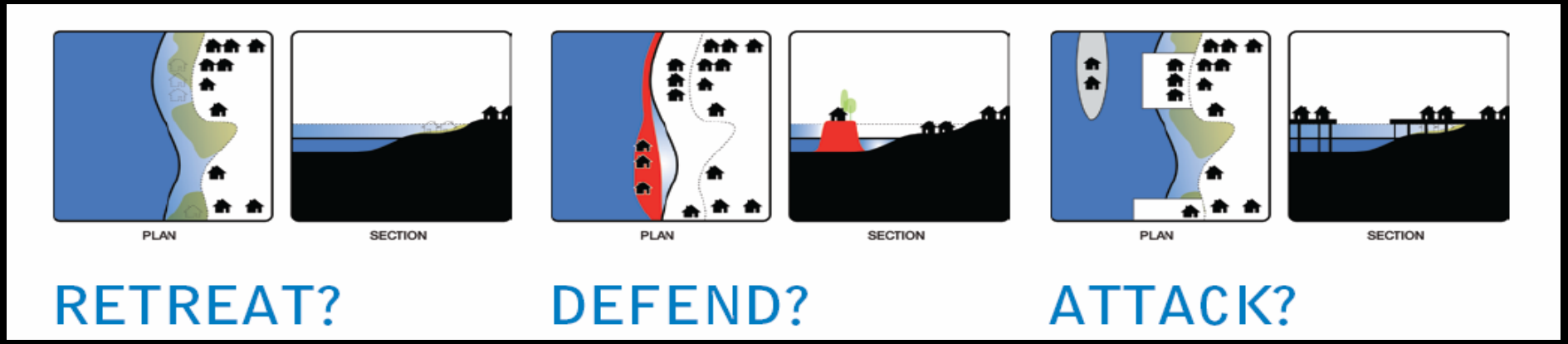
Strategy for the future?



- What if we look at the long term future of our coastal cities and imagine what strategies might need to be adopted?

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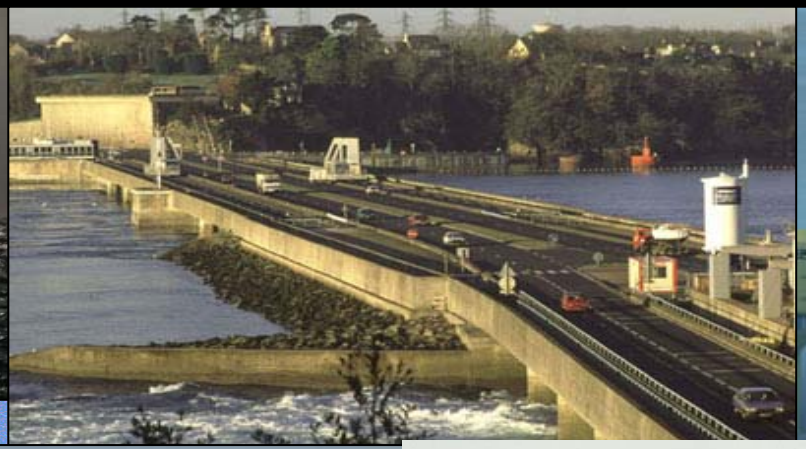
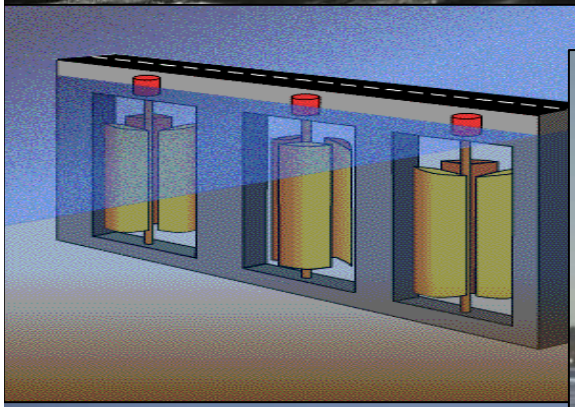
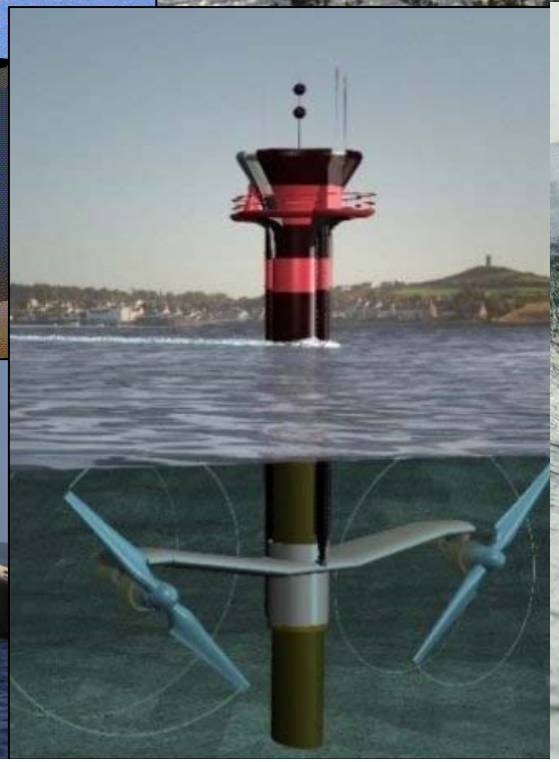
The oceans - a vast untapped energy source







The future ?

Alarming observations and trends - a huge challenge for management of marine resources!

Temperature changes above 2^{o}C will only make the challenge even greater!

International cooperation moving on from COP 15 is key to any solution!

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