

Extreme hitte en stormvloeden: Het modelleren van extreme gebeurtenissen

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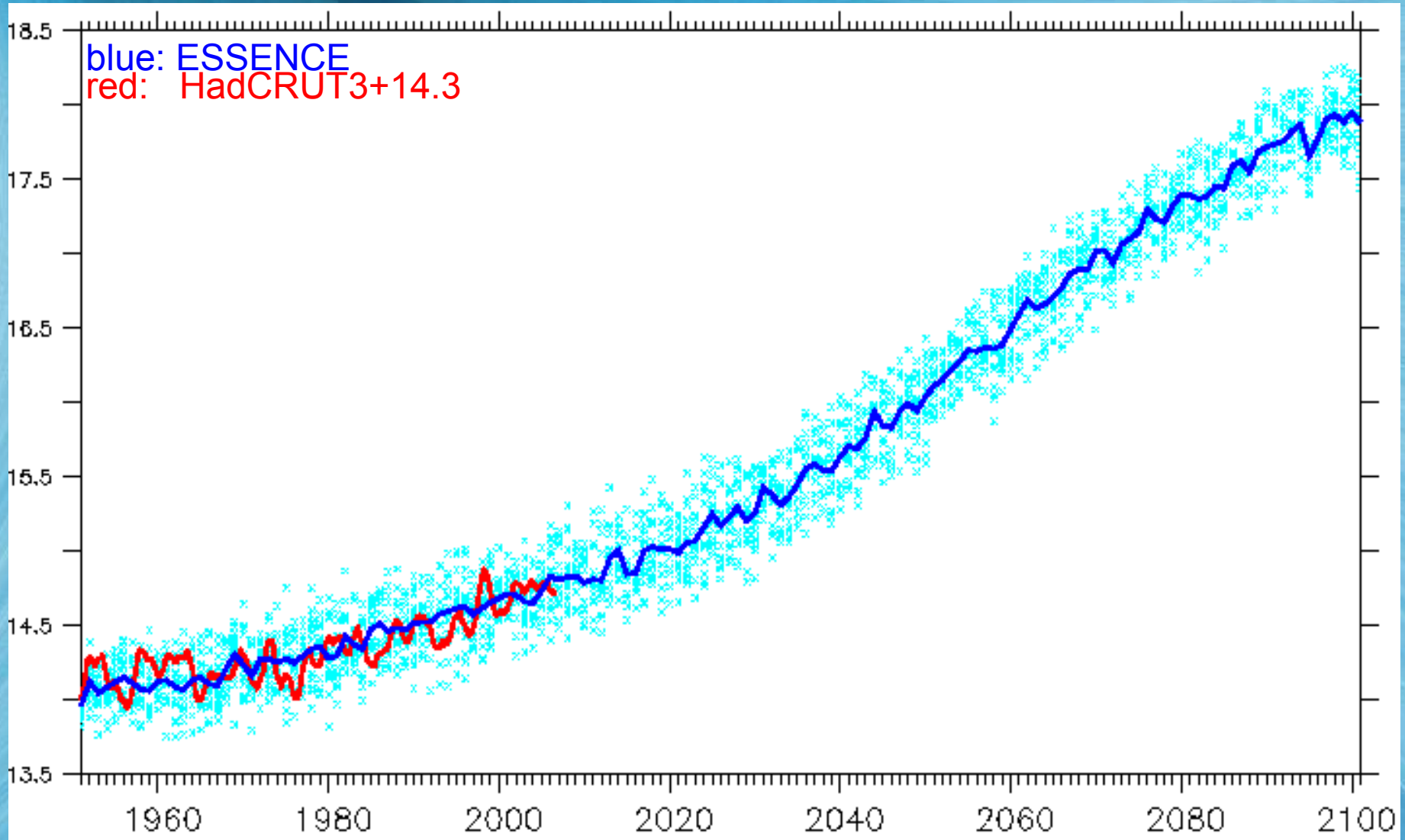
- Het ESSENCE projekt
- Klimaat extremen
 - extreme hitte
 - stormvloeden

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Wilco Hazeleger, Erik van Meijgaard, Camiel Severijns, Hans de Vries

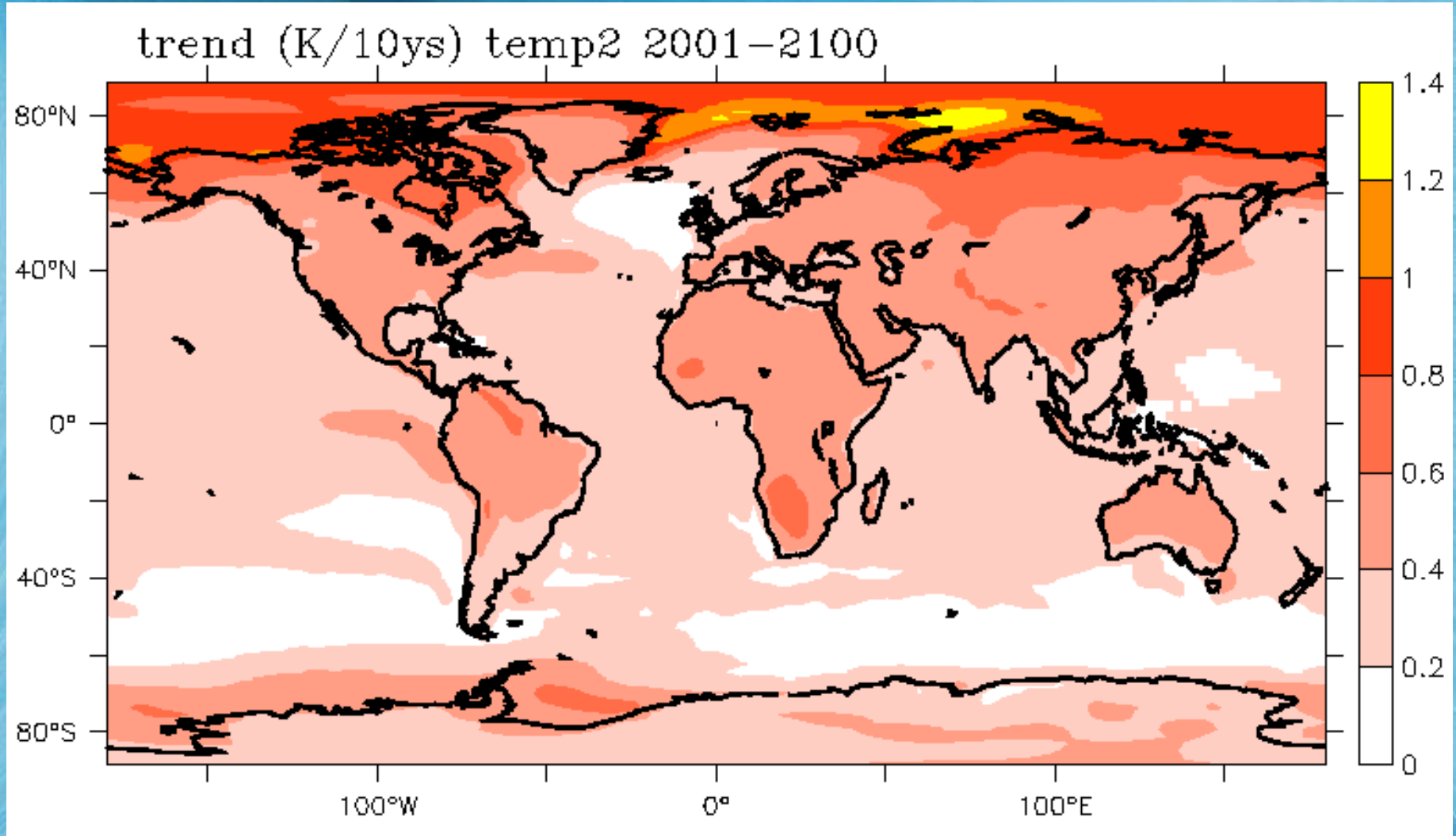
ESSENCE

- ECHAM₅/MPI-OM
- 1950 – 2100
- observed GHG's + SRES A1b
- 17 runs => good statistics

Global mean temperature



Temperature trend



The N-year return value

- value that on average occurs once per N years
- obtained by fitting a GEV to annual maxima (x):

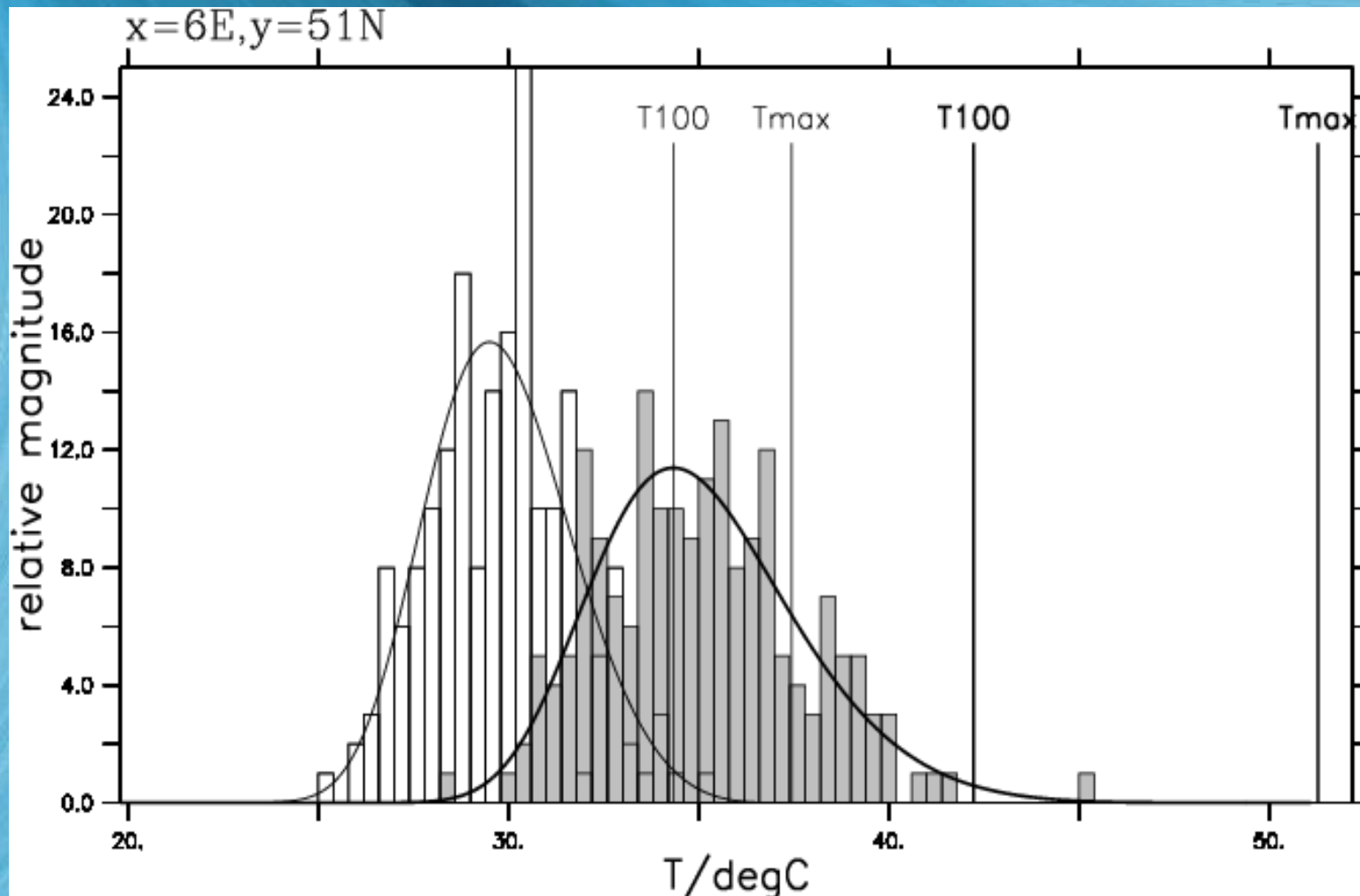
$$G(x) = \exp \left\{ - \left[1 + \xi \left(\frac{x - \mu}{\sigma} \right) \right]^{-1/\xi} \right\}$$

μ : location
 σ : scale
 ξ : shape

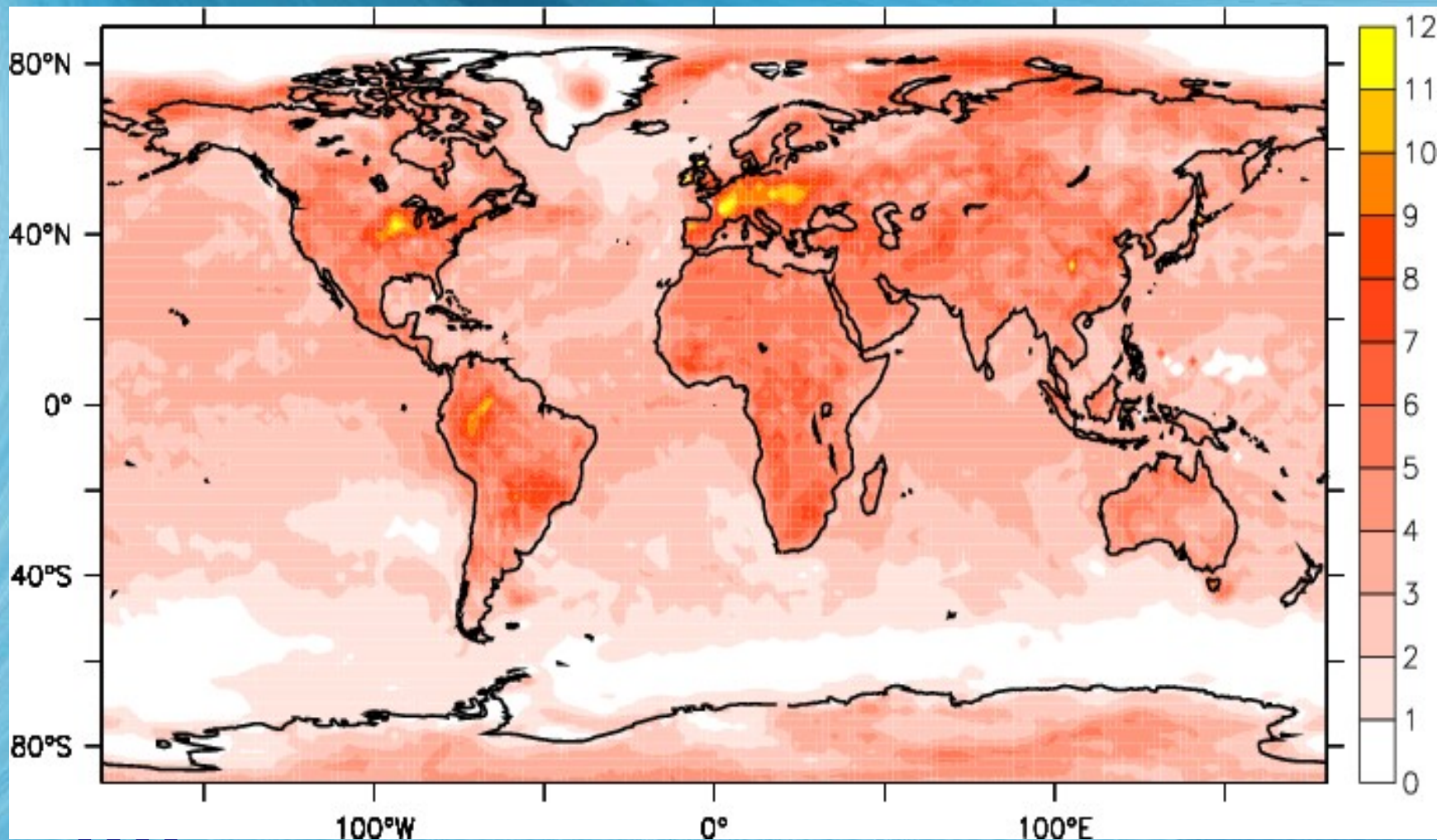
- return time $T(x)$ for level x is $1 - 1/T(x)$ percentile:

$$T(x) = \frac{1}{1 - G(x)}$$

... Example: Netherlands

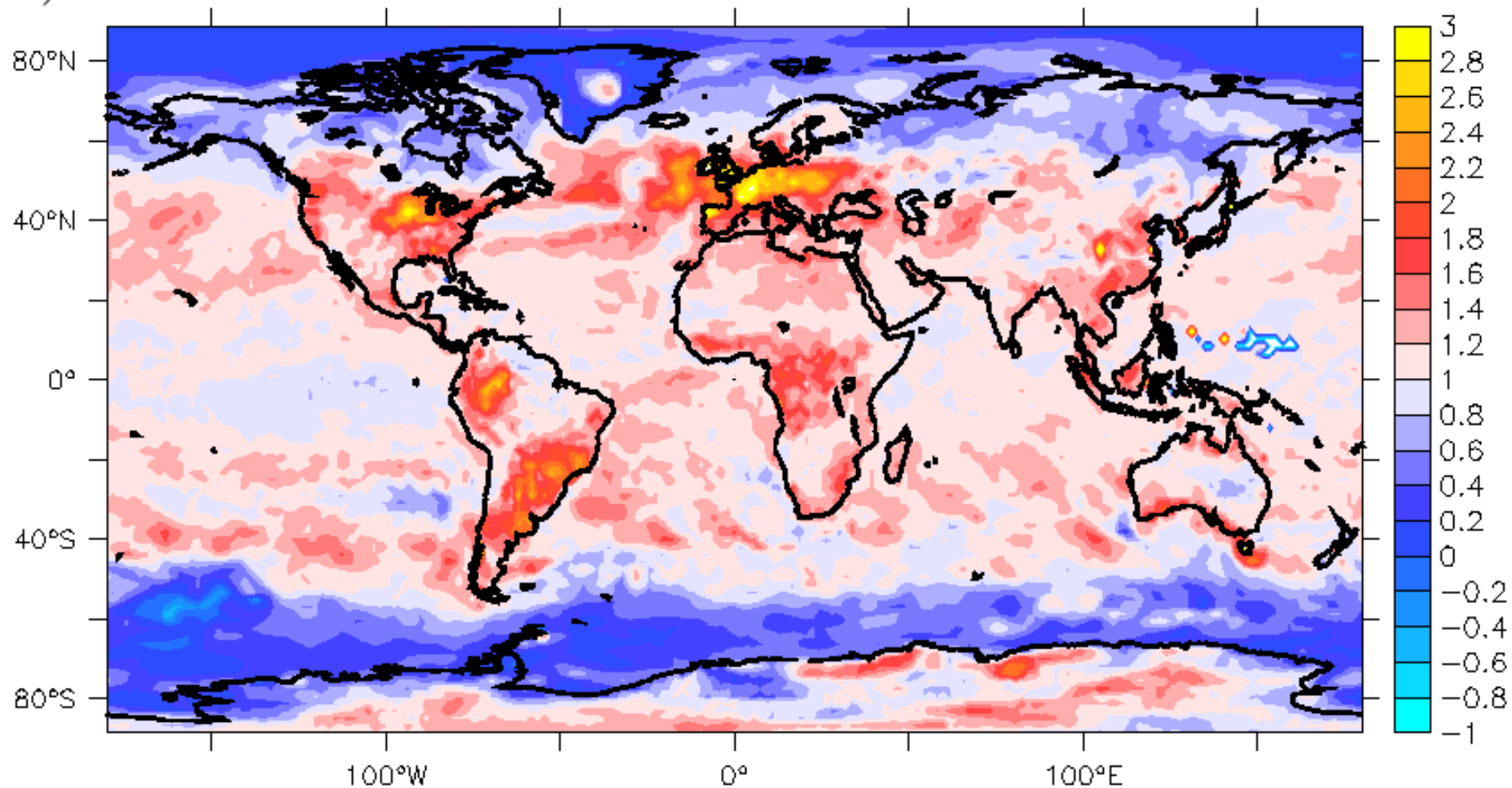


ΔT_{100}



$$\Delta T_{100} / \Delta T_{\text{mean}}$$

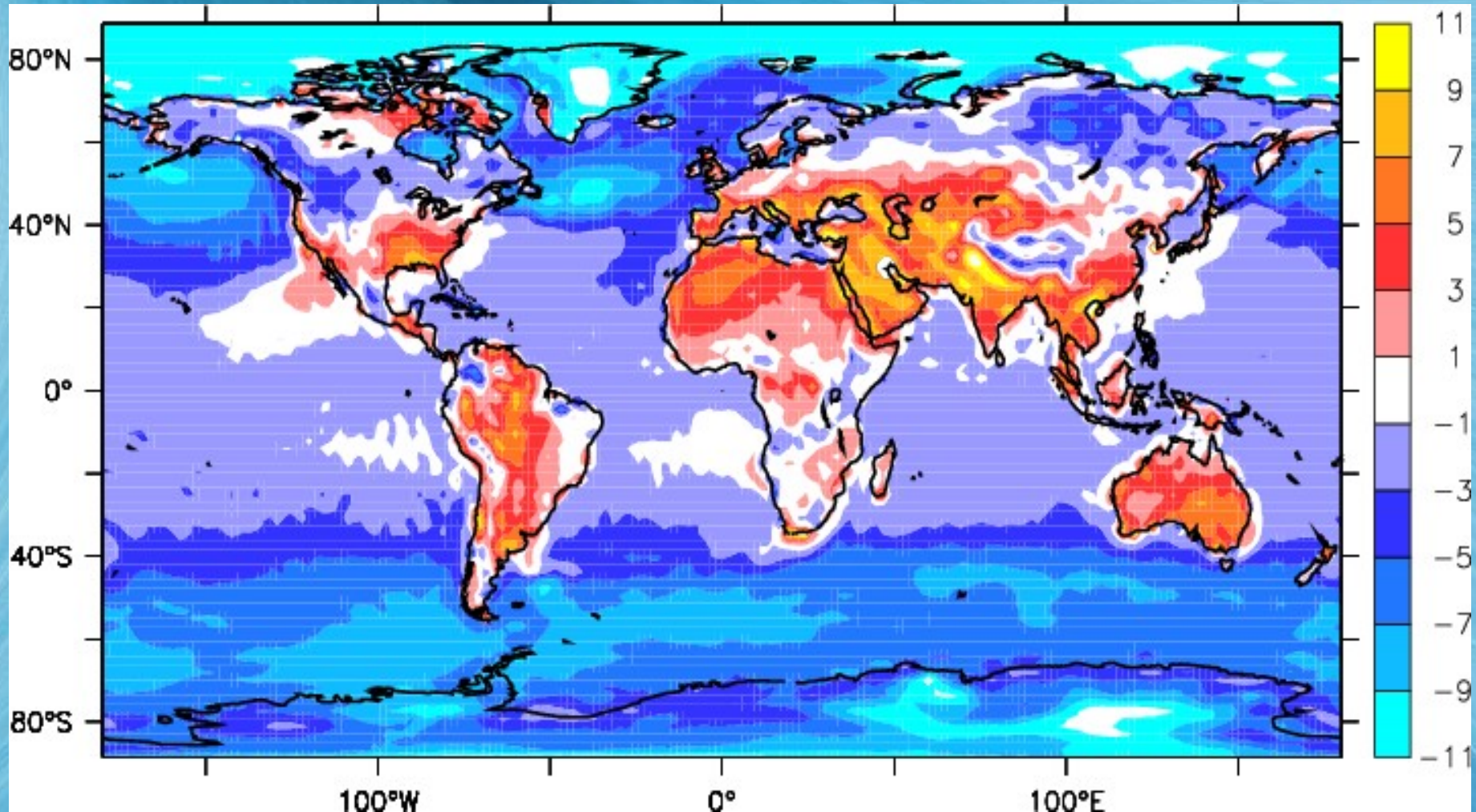
a) ΔT_{100}



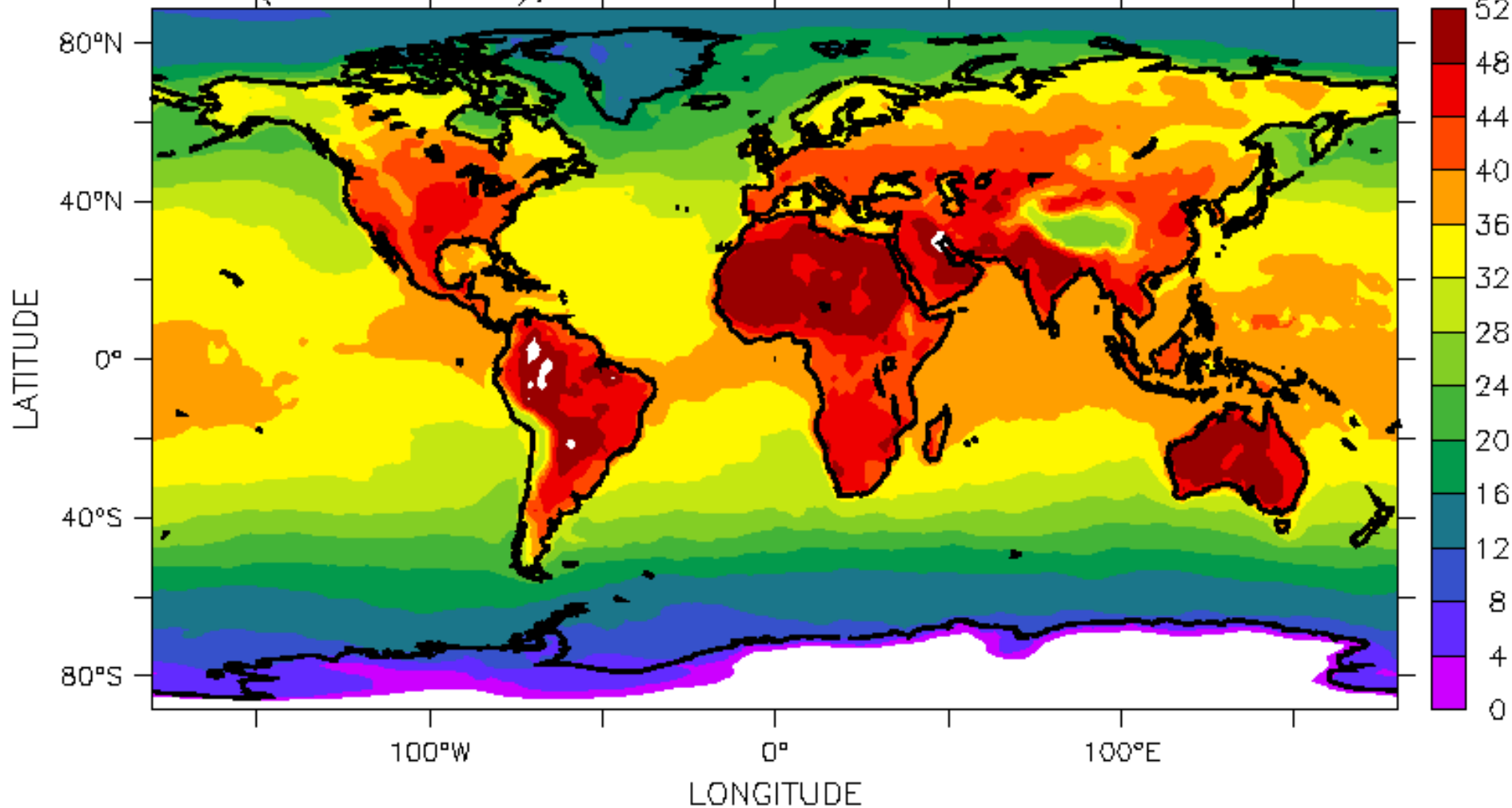
Model bias

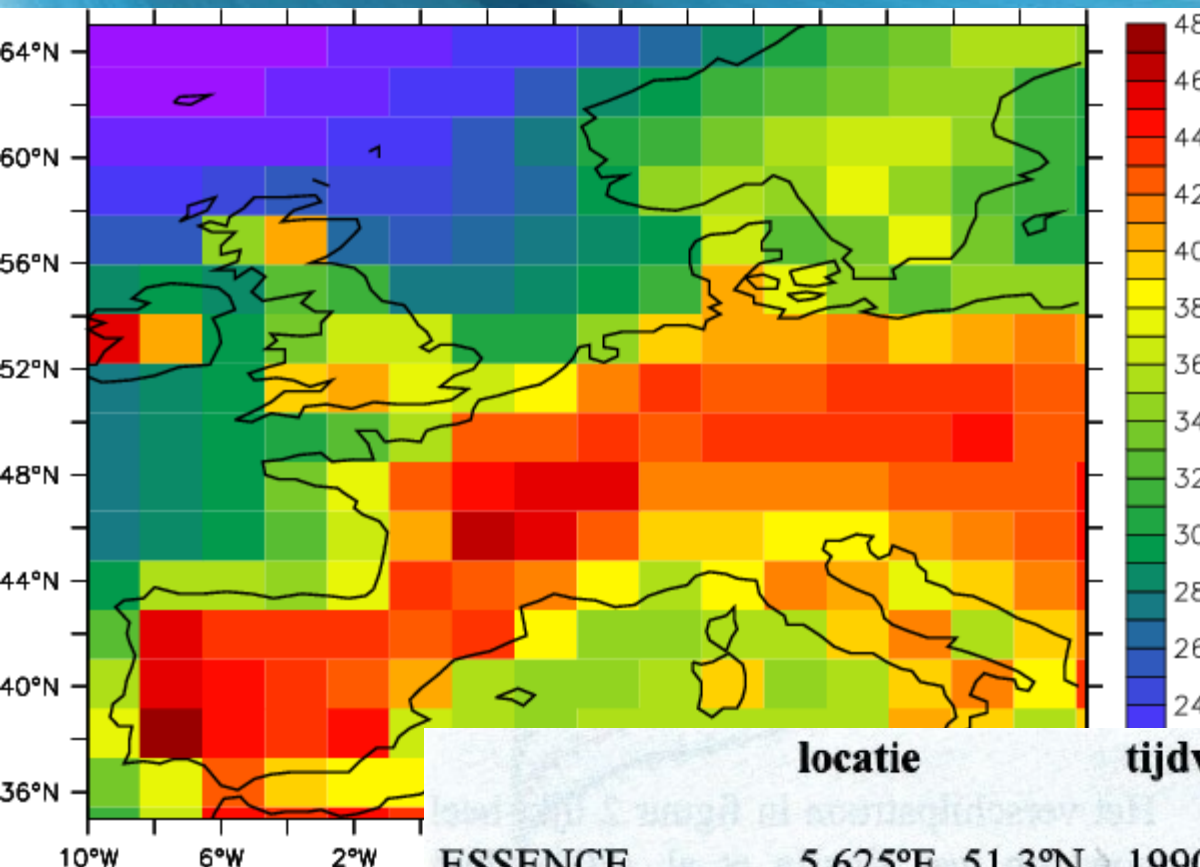
.....

$$T_{100}(\text{ESS}) - T_{100}(\text{ERA-40})$$



T100(2070-2100), bias corrected





**T₁₀₀ (2090-2100,
corrected)
Europa**

	locatie	tijdvak 'nu'	T₁₀₀(nu)	T₁₀₀(toek) = T₁₀₀(nu) + 7,9°C	
	ESSENCE	5,625°E, 51,3°N	1990-1999	34,3	42,3
	ERA-40	6,0°E, 51,0°N	1958-2001	33,7	41,6
	station De Bilt	5,2°E, 52,1°N	1901-2007	36,1	44,0
	station Eindhoven	5,4°E, 51,4°N	1951-2007	37,3	44,2
	station Maastricht	5,8°E, 50,9°N	1906-2007	37,7	44,6



Dutch Delta Committee:

What is the effect of global warming on

- maximum wind speed
- wind directions
- wave heights
- storm surge levels?

Approach

- KNMI'06 scenarios
- other literature
- ESSENCE + WAQUA



ESSENCE + WAQUA

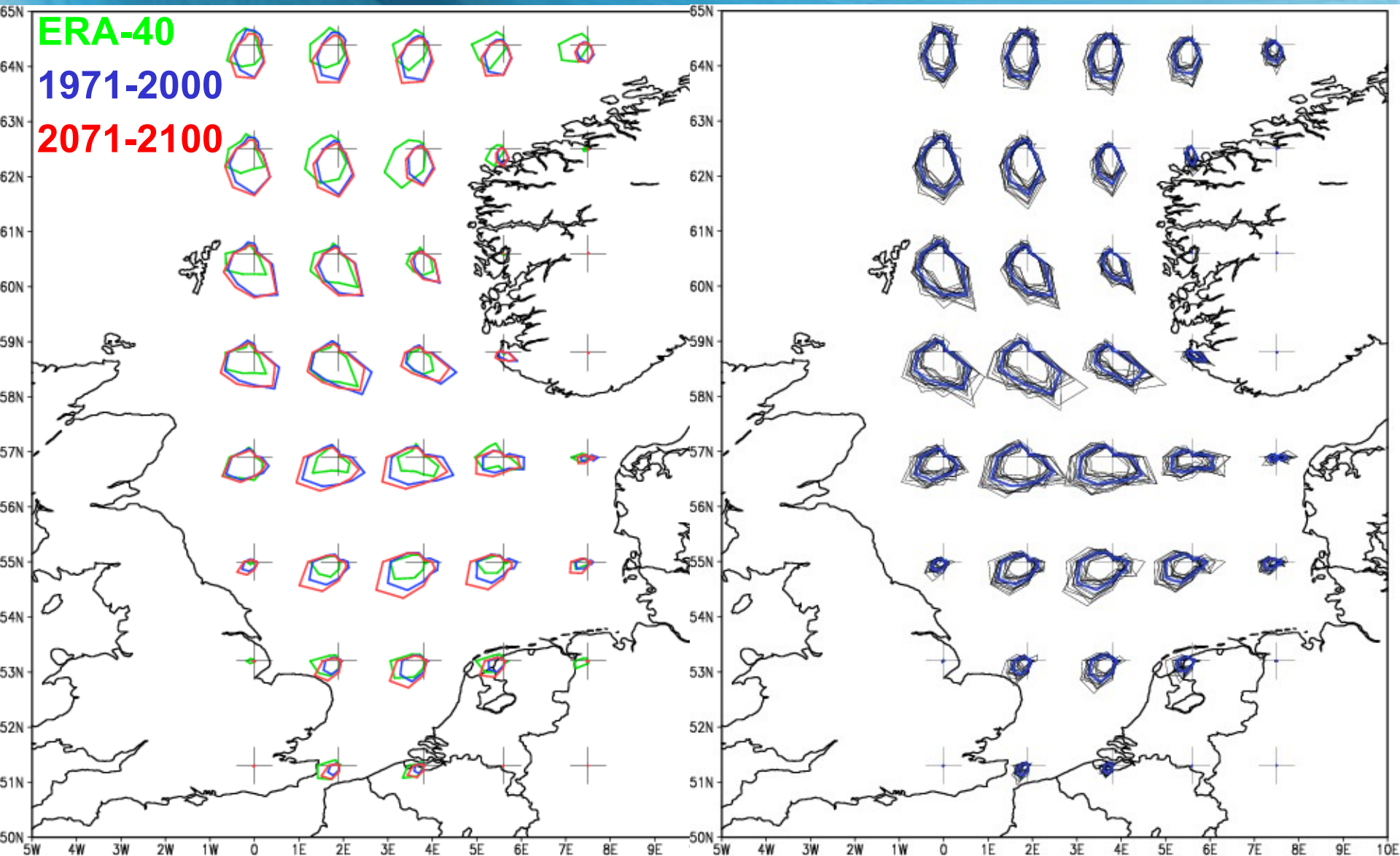
ESSENCE

- ECHAM5/MPI-OM
- 17-member ensemble
- 1950-2100, SRES A1b

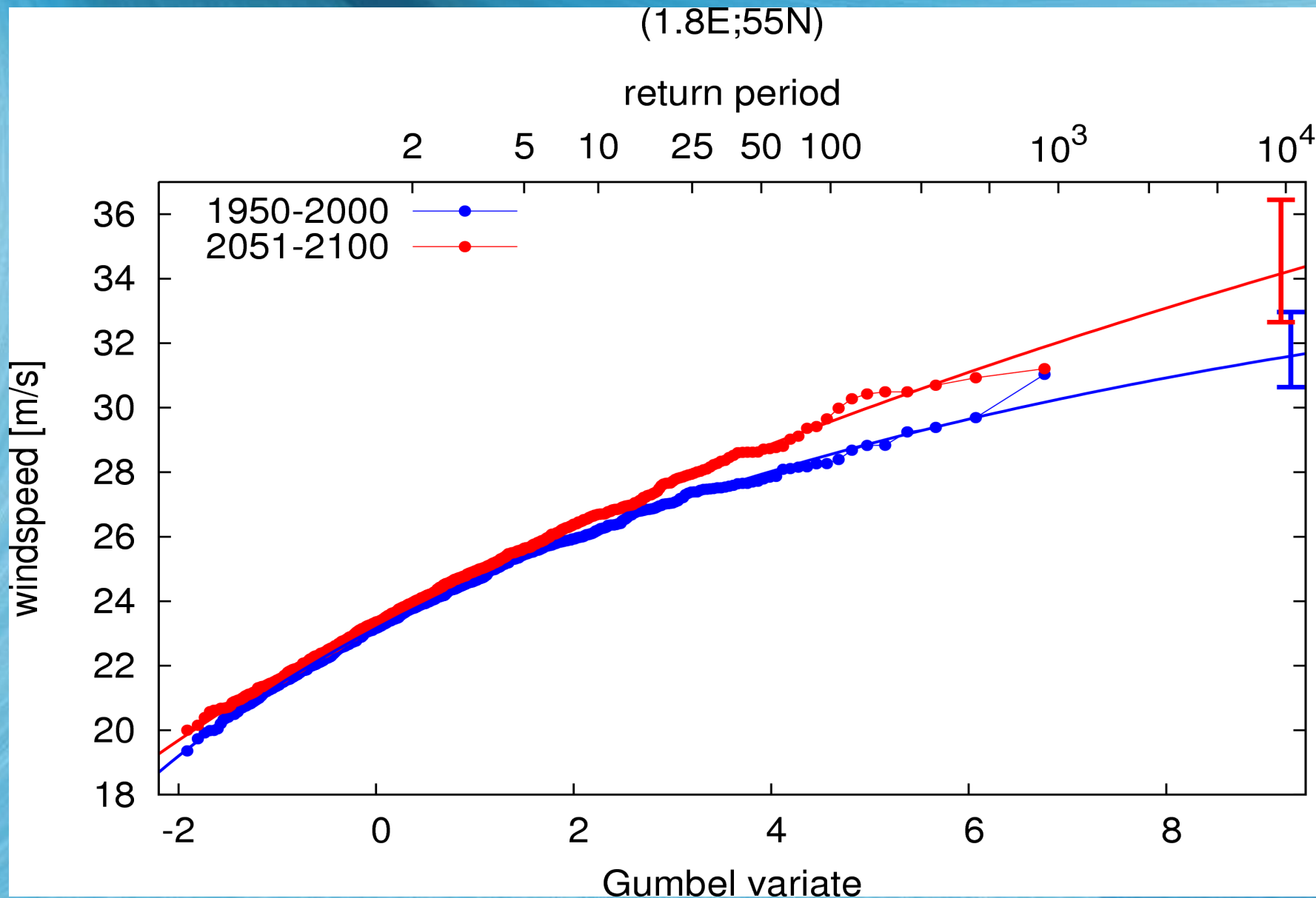
WAQUA

- storm surge model
- Northwest European shelf
- 8 km x 8 km
- output every 10 minutes

...Will the wind change ?



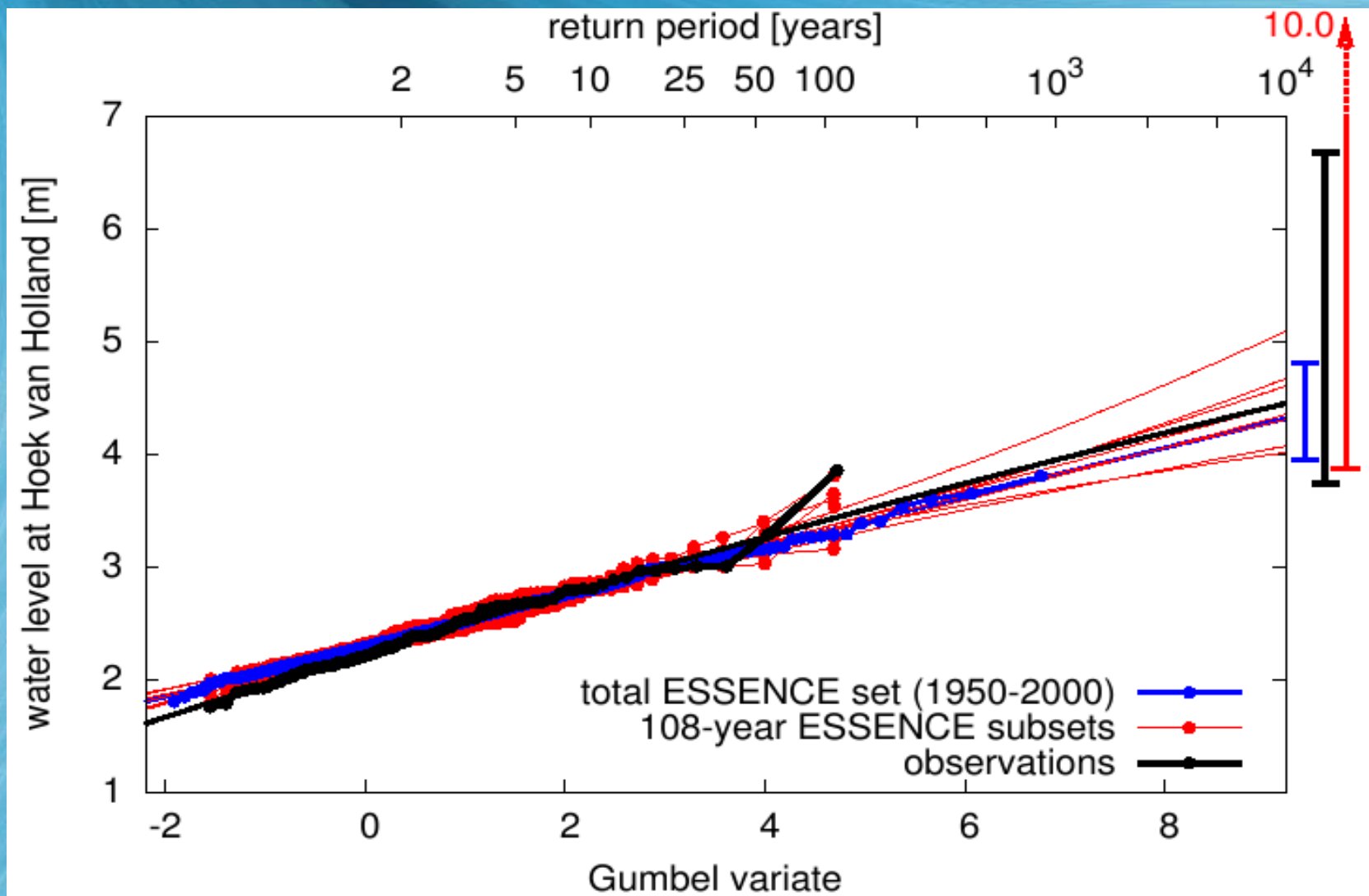
ESSENCE winds



Uncertainty present-day water levels



....

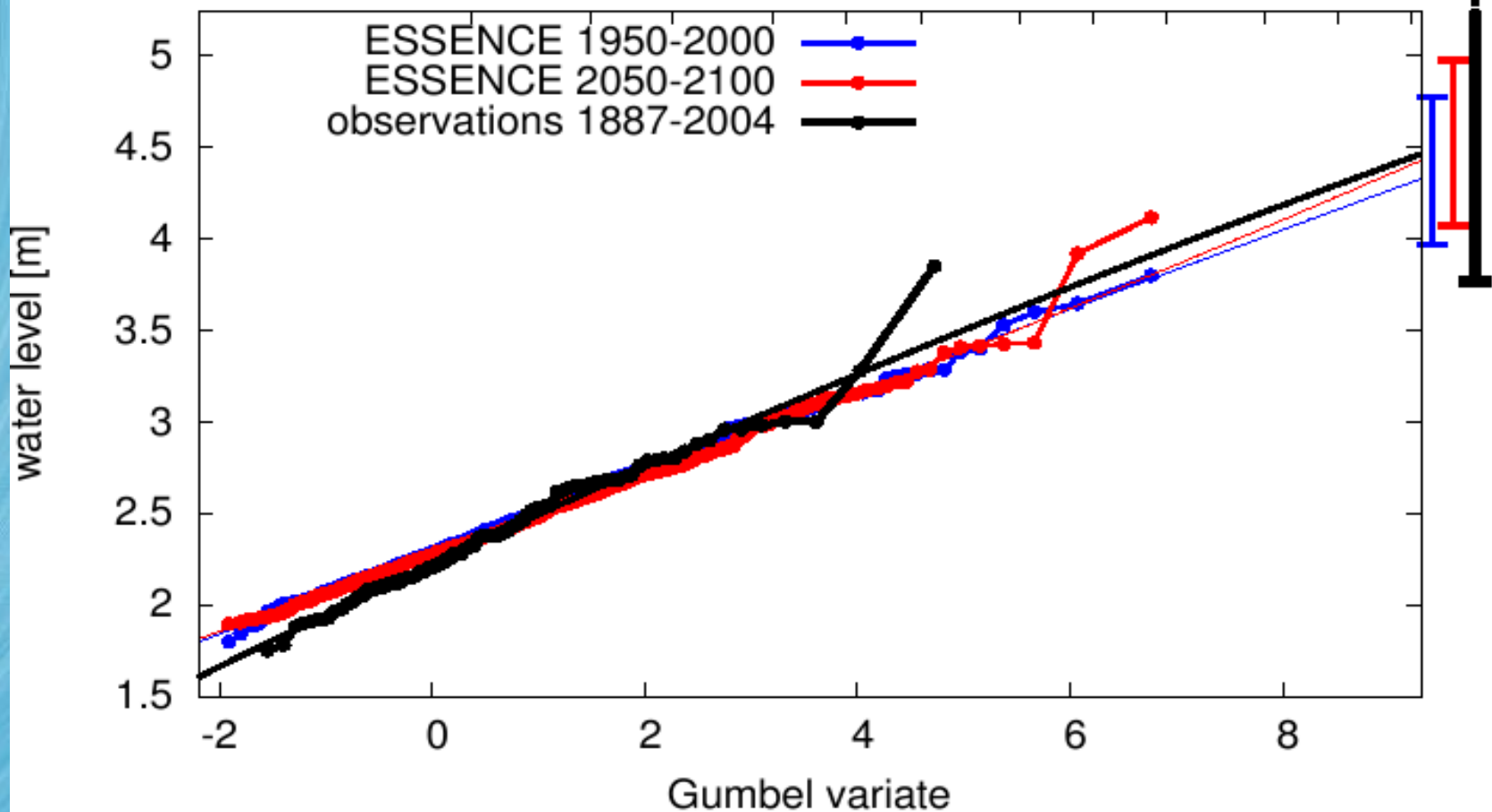


Future water levels

Hoek van Holland

return period

2 5 10 25 50 100 10^3 10^4



Conclusions

- large ensemble => good statistical basis
- temperature extremes increase faster than means ...
- ... and may reach dangerous levels within this century
- no change of **surge** heights along the Dutch coast, but ...
- ... **sea level** increases

The End !!!