



Royal Netherlands
Meteorological Institute
*Ministry of Infrastructure
and Water Management*

Wind in KNMI '14 and new developments

Recap: KNMI '14

Wind in KNMI '14

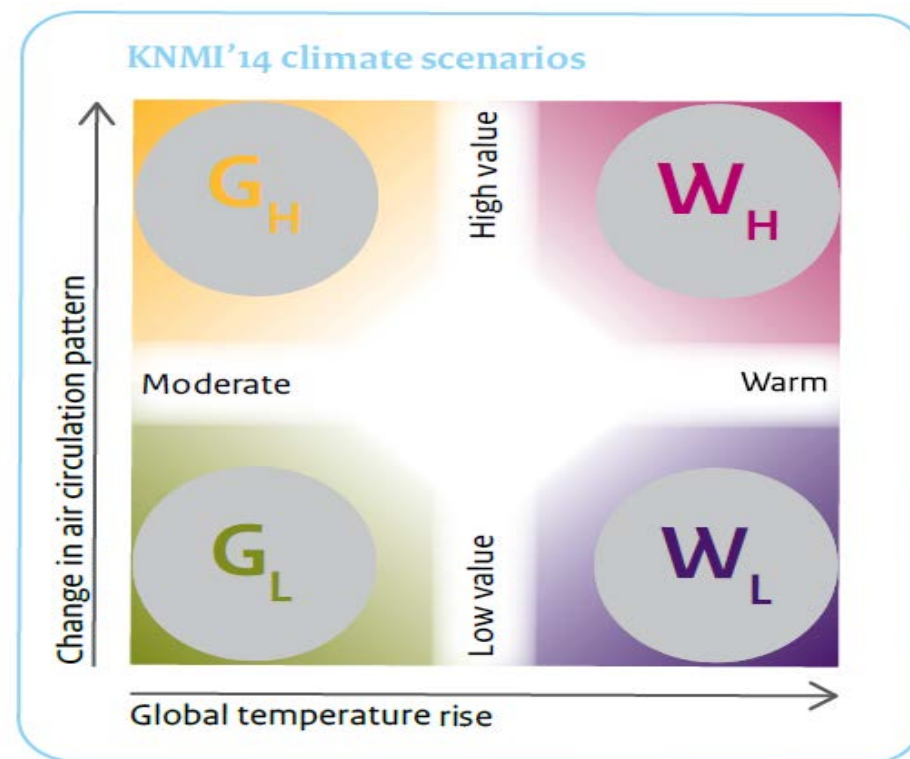
New developments

Andreas Sterl, KNMI



Recap: KNMI '14 climate change scenarios for the Netherlands

- translation of global results to local/regional scale
- possibilities of future climate
 - global temperature increase
 - **G**ematigd (moderate)
 - **W**arm (warm)
 - circulation change
 - **L**aag (low)
 - **H**oog (high)





Overall changes

- temperature will continue to rise
- mild winters and hot summers will become more common



- precipitation in general and extreme precipitation in winter will increase
- intensity of extreme rain showers in summer will increase
- hail and thunderstorms will become more severe



- sea level will continue to rise
- the rate of sea level change will increase



- changes in wind speed are small



- number of days with fog will diminish and visibility will further improve
- solar radiation at the earth's surface will increase slightly



Scenario differences and natural variations

- changes in temperature differ between the four scenarios
- changes in 2050 and 2085 are greater than the natural variations at the 30 year-time scale



- more dry summers in two (G_H and W_H) of the four scenarios
- natural variations in precipitation are relatively large and thus the scenarios are less distinct



- rate of sea level rise greatly depends on global temperature rise
- there is no distinction between scenarios with different air circulation



- more frequent westerly wind in winter in two (G_H and W_H) of the four scenarios
- the wind and storm climate exhibits large natural variations



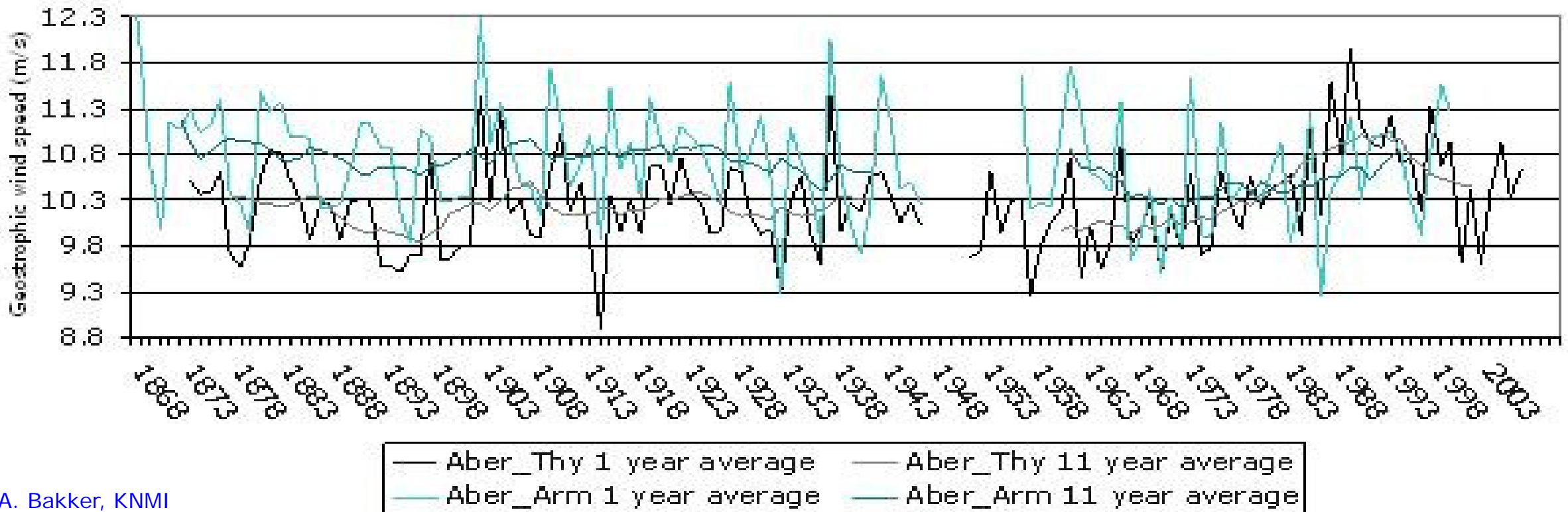
- natural variations differ for different climate variables





Wind North Sea

Past: Variability – no trend

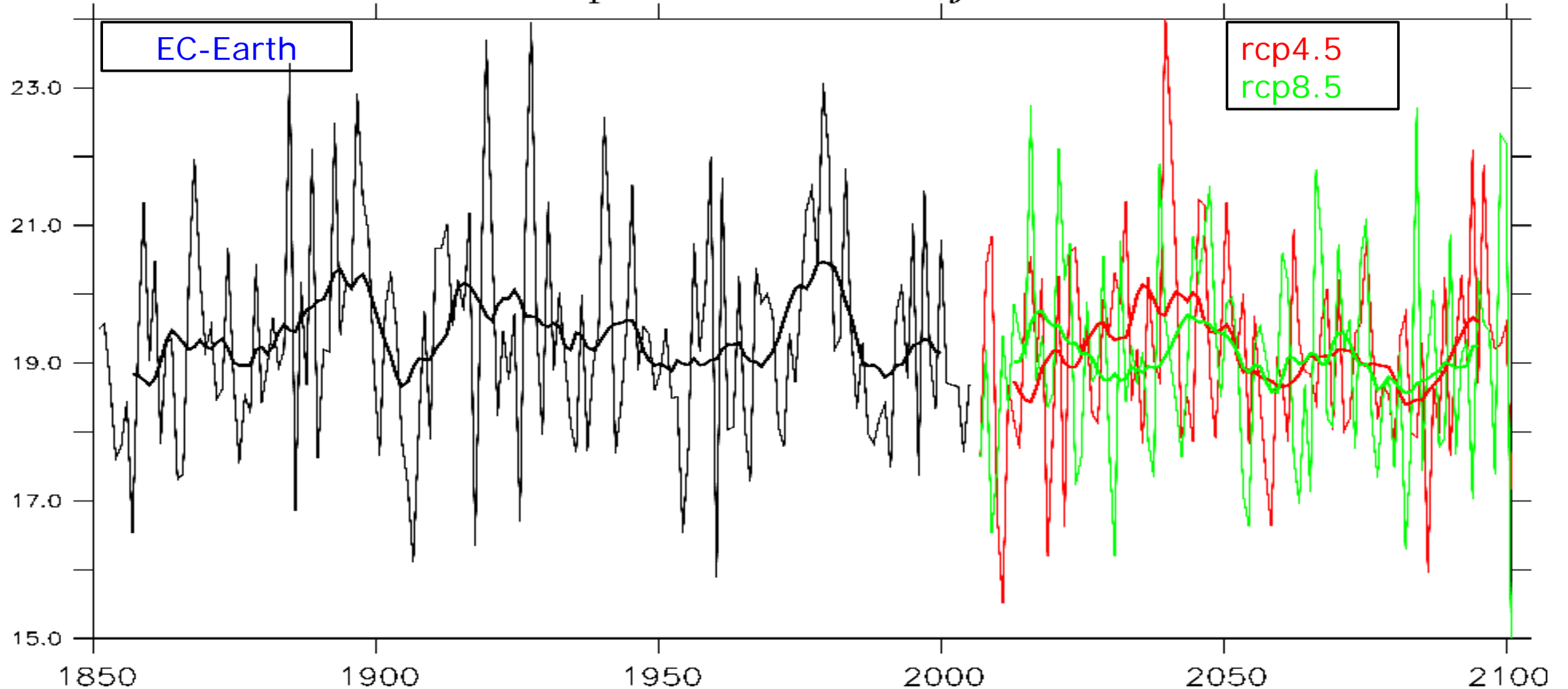


A. Bakker, KNMI



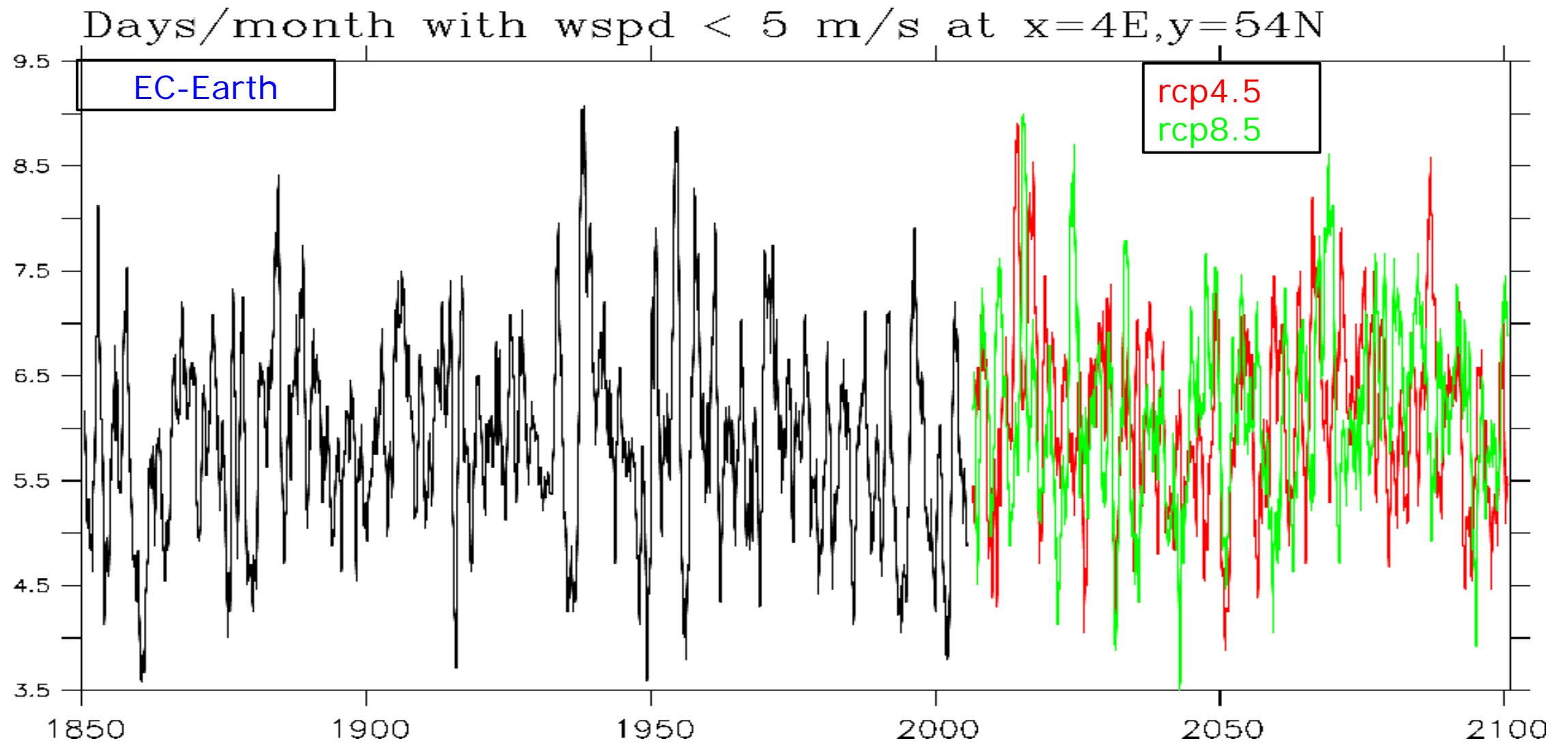
Projections: High winds

Annual max wind speed at $x=4E, y=54N$

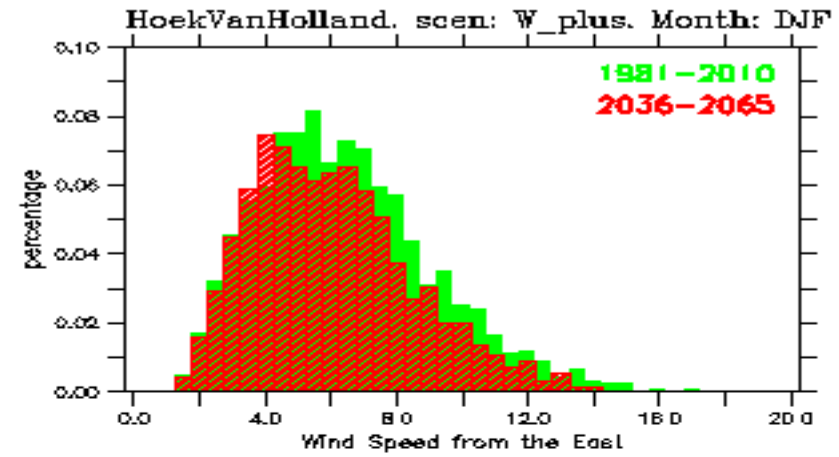
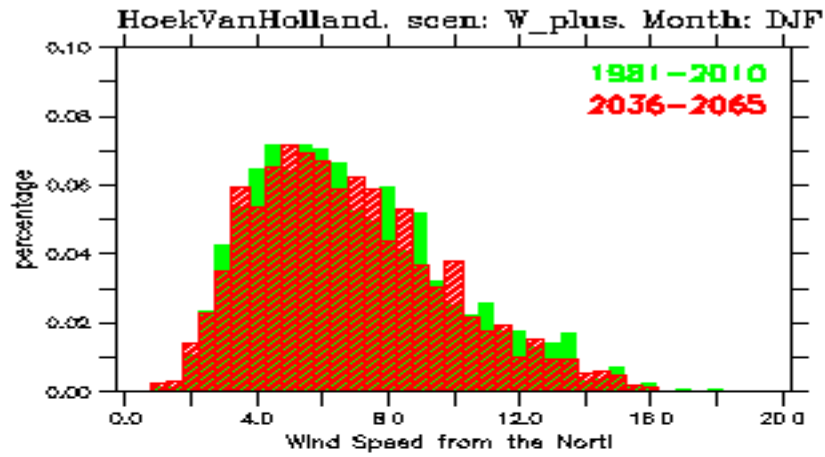




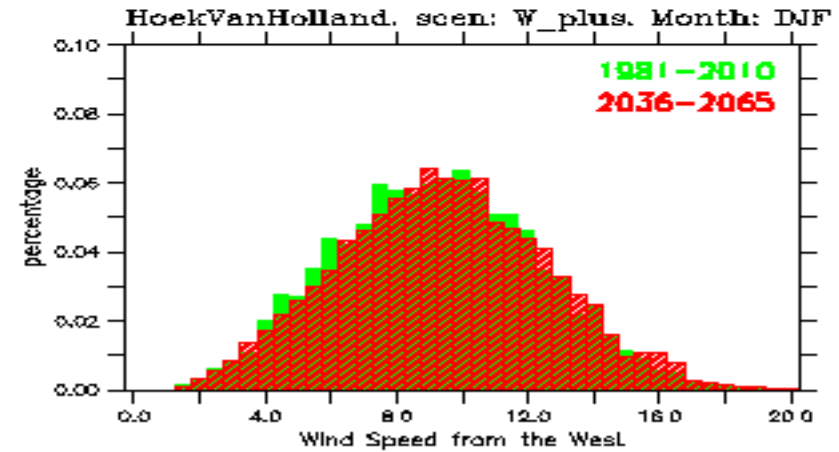
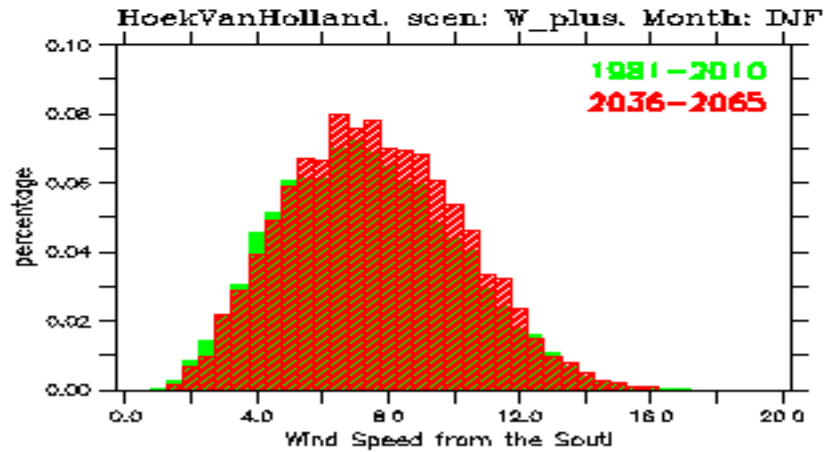
Projections: Low winds



Wind directions



slightly less



slightly more



Summary – wind in KNMI'14

- Large variability (inter-annual, inter-decadal)
- No systematic future changes for mid-latitude
- Extreme winds *slightly* more often from south / west, ...
- ... and *slightly* less often from north / east



New developments – why new scenarios?

General

new IPCC report (AR6, due 2021)

Specifically

Precipitation

Better understanding of heavy precipitation (changes)

Sea level rise

Better understanding of ice sheet behaviour

=> Upper limit for SLR much higher than hitherto assumed

Wind

Hurricanes on North Sea

confirmed by GFDL

new hi-res models

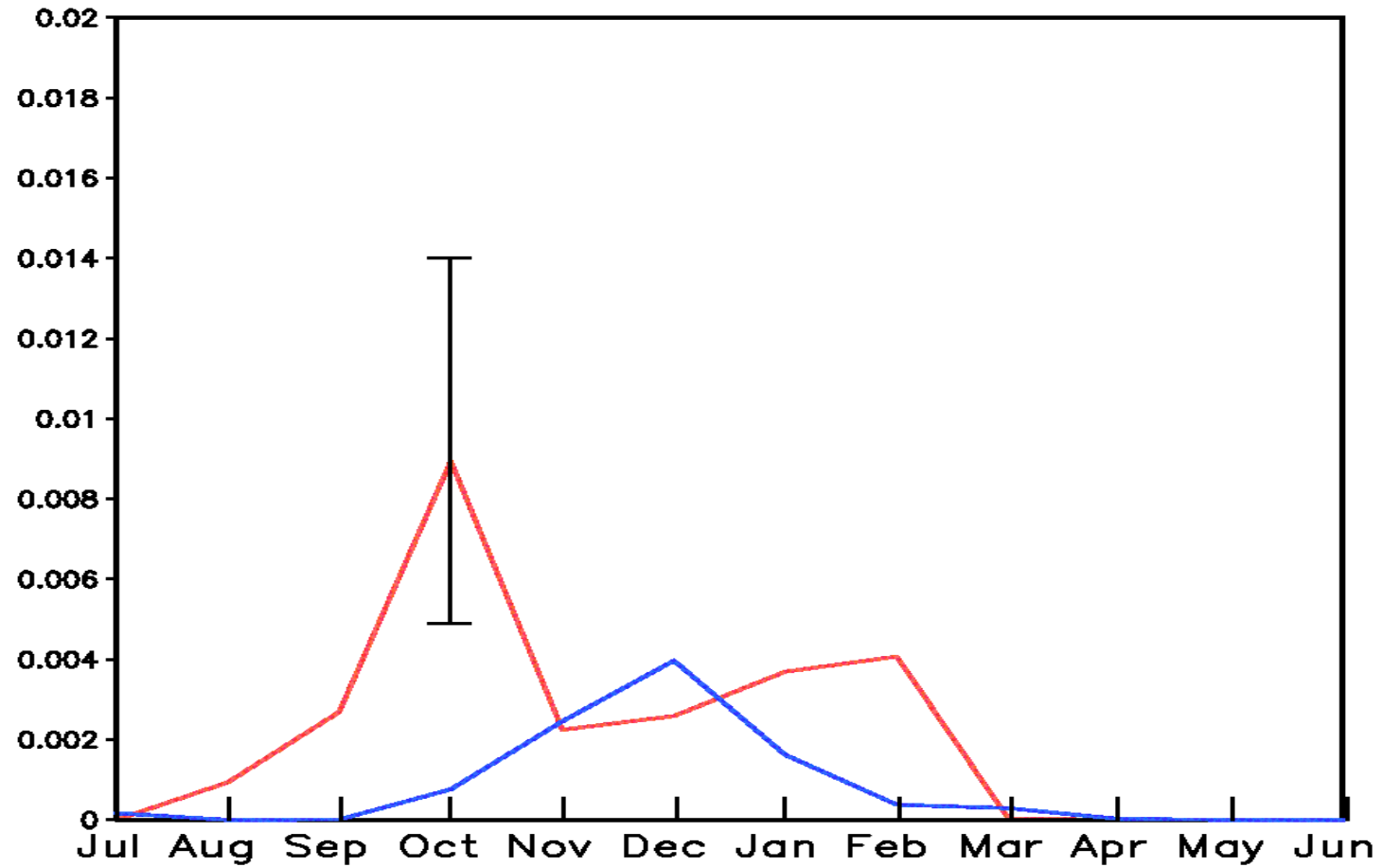
Low-wind episodes – Schrier



WSP10 North Sea Beaufort 11–12

EC-Earth run at high resolution (25km), but uncoupled:

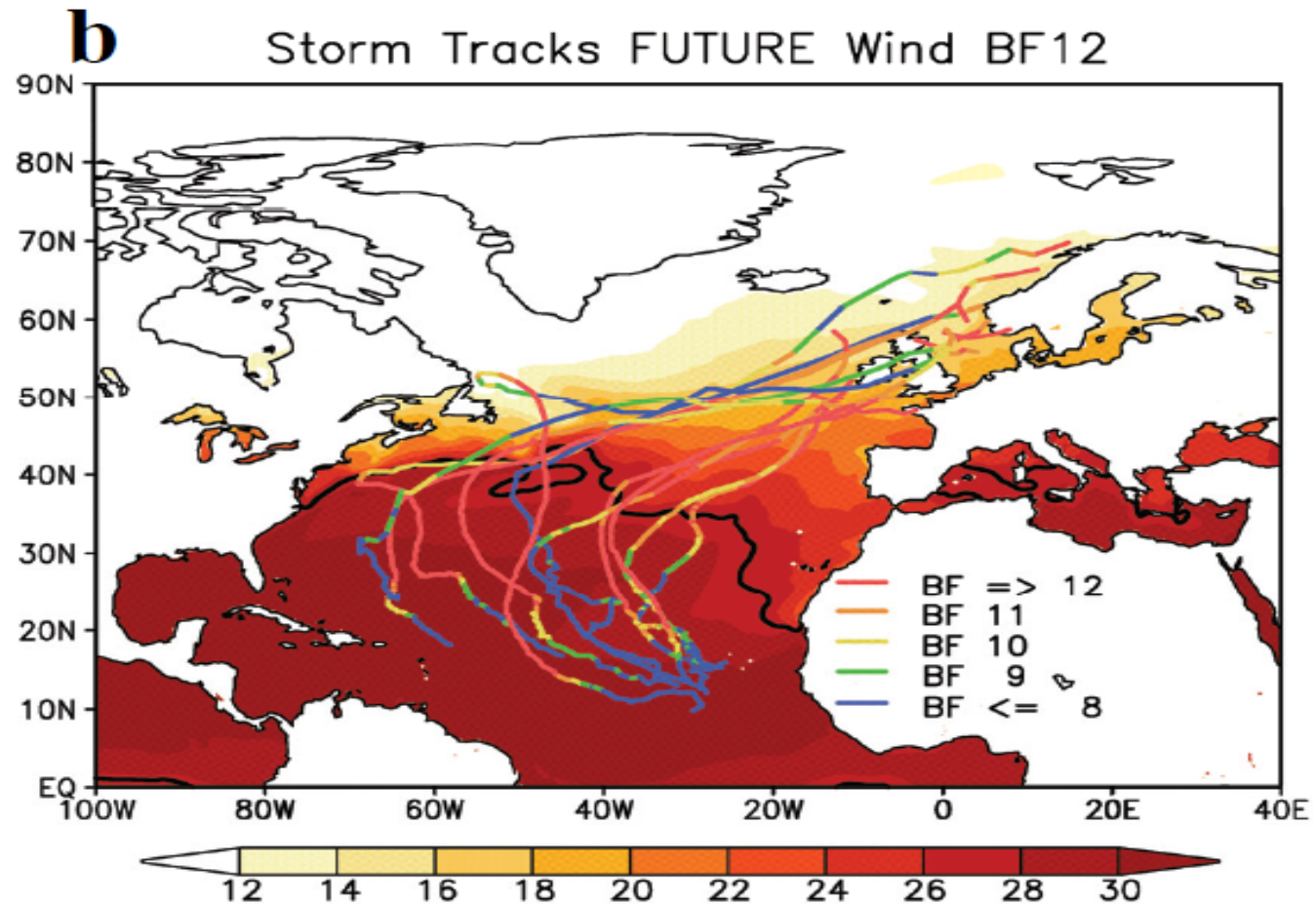
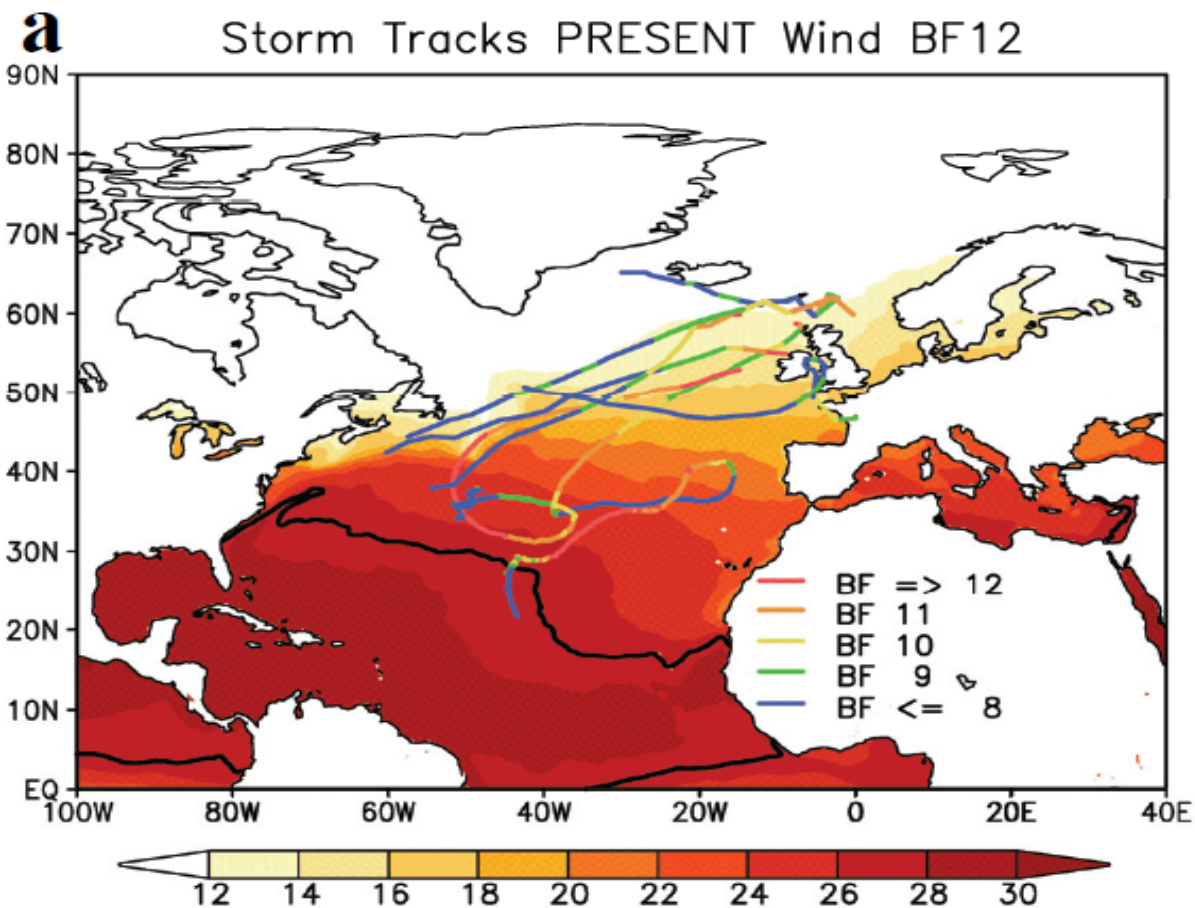
Increase of heavy storms, esp. in early fall



Frequency distribution of 3-hourly 10m windspeed



Tropical storms on the North Sea?





Low wind – wind energy

Renewable energy (wind and PV):

- highly variable (NAO)
- variability >> climate change
- **danger**: low wind conditions

in TWh	Winter (DJF)			Lowest yield months	
	PV & wind	PV	Wind	Wind – DEC	Wind – FEB
Average over H+ and H- scenarios	116	11	105	35	31
Sample 003	75	12	63	12	
Sample 080	73	12	61		12
Sample 101	74	10	64	17	

Ravestein et al., submitted



Summary

Wind

- Large variability (inter-annual, inter-decadal)
- No systematic changes in future for “ordinary” mid-latitude storms in GCM output or in downscaled RCM output
- Slight indication of less winds from the North, more from the West
- **But:** possible new source of storms: hurricanes!
- Low wind: substantial impact on energy production, but variability >> climate change