## Mid-latitude Cyclones and Winter Windstorms in a Changing Climate

#### Spring Campus Berlin 2017

Research Workshop III: "Climate Change in Cities. Mitigation, Adaptation"

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https://visibleearth.nasa.gov/



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2

## •Mid-latitude Cyclones

## Winter Windstorms

# Changing Climate







## Outline



#### Extra-tropical cyclone: low pressure system



Source: http://www.ecmwf.int

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## Mid-latitude Cyclones



Monday 27 March 2017 0000 UTC ECMWF t+0 VT: Monday 27 March 2017 0000 UTC Surface: Mean sea level pressure / 850hPa wind speed



Source: http://www.ecmwf.int

#### 

Source:

#### Source: www.wetterpate.de

#### Names of high and low pressure Systems: www.wetterpate.de



http://www.berliner-wetterkarte.de

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## Winter wind storm



- Wind storm related to extra-tropical cyclone
- Low pressure system
  - Balancing air masses
  - Wind
- Further analysis
  - Identification of cyclones and wind storms

## Example: Wind Storm Daria



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<sup>10</sup>m wind speed in ERA-INTERIM



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## Storm track density

- Wind storm tracks per winter season
- Maximum at the North Atlantic







## Impact of storms





Source: Aon Benfield

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**Example** 

## Loss potential



- Loss is function of
  - Storm severity (Leckebusch et al.; 2008)
  - Population density (Donat et al.; 2011)



Population density Data source: CIESIN. Taken from (Donat et al. (2011)

## Climate change I







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## Climate change II





Source: Zappa et al. (2013)

## Change of Strong cyclones





 Higher wind speed in Northern Europe

Source: Zappa et al. (2013)

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## Change of loss potential





Source: Donat et al. (2013)

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Loss increase

 High variability of different climate models

## Summary



- "Intense winter storms constitute one of the most important natural hazards affecting Central Europe" (Donat et al.; 2010)
- Loss is function of storm severity and population density (Donat et al.; 2011)
- Future simulations show
  - less cyclones (Zappa et al.; 2013)
  - more strong ones, higher wind speed over Europe (Zappa et al.; 2013)
  - higher loss potentials in European region (Donat et al.; 2013)