



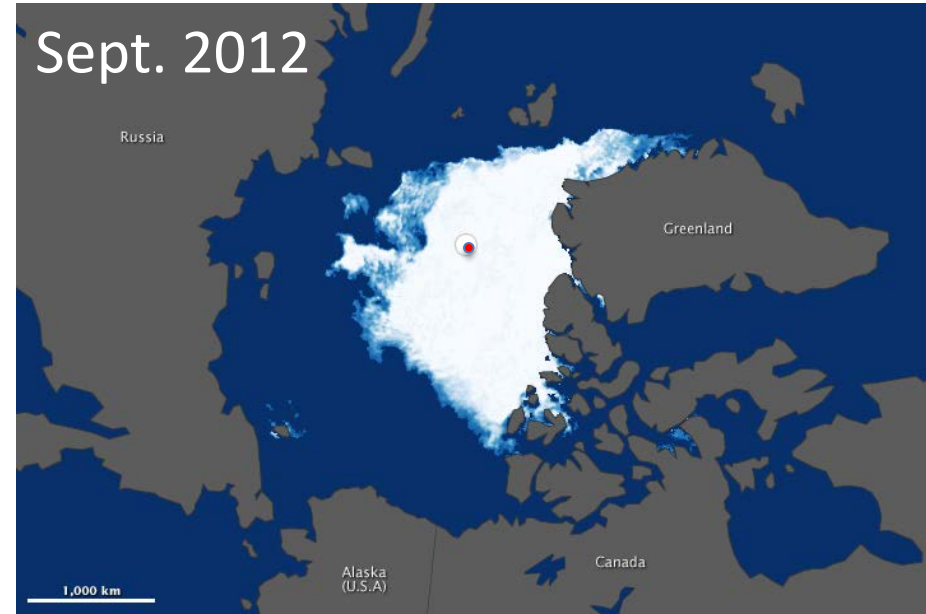
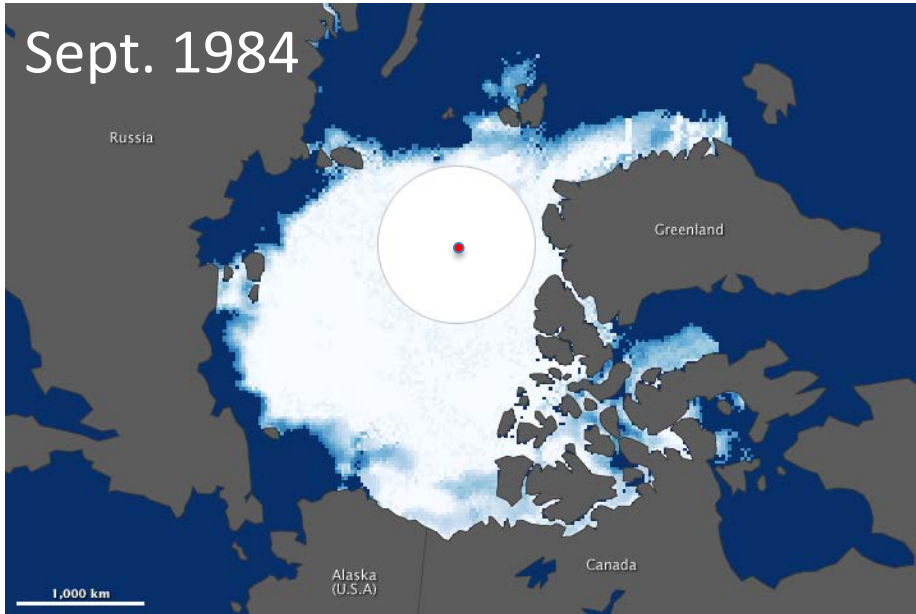
Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

Klimaatinformatie voor '*Disaster risk reduction*'

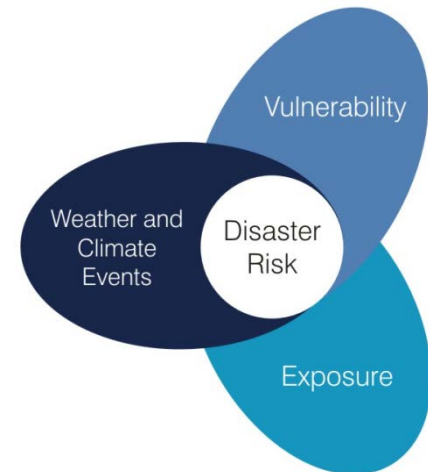
*Gerard van der Steenhoven
Hoofddirecteur KNMI &
ITC - Universiteit Twente*

6^{de} Lizard Symposium "Laat innovaties
werken", Utrecht, 3 november 2016

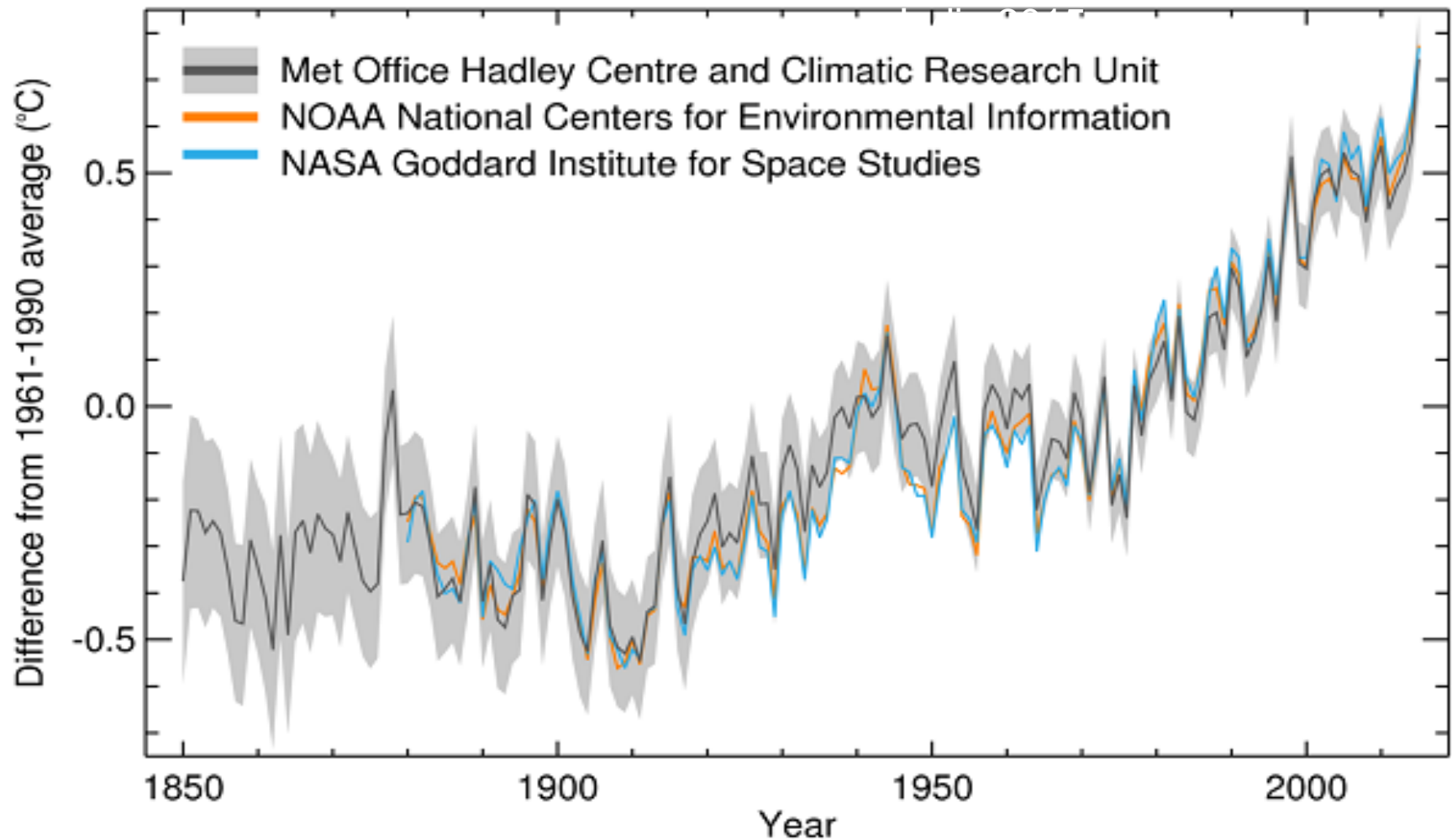
Largest Risk: *climate change*



- Disaster risk reduction:
 - Improve knowledge climate change
 - Vulnerability dikes, dunes & polders
 - Exposure of life and properties



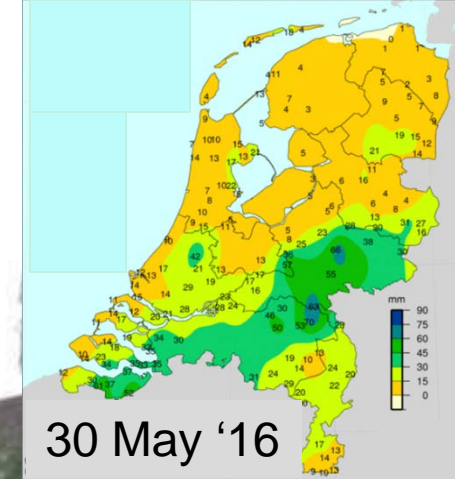
Global average temperature



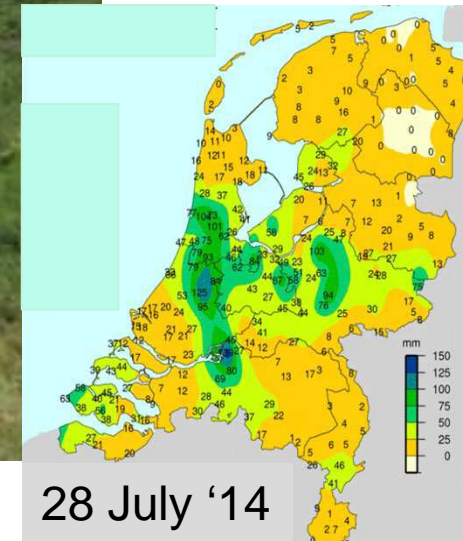
Heavy rains in the Netherlands



→ Likelihood 3x higher
in new climate



30 May '16



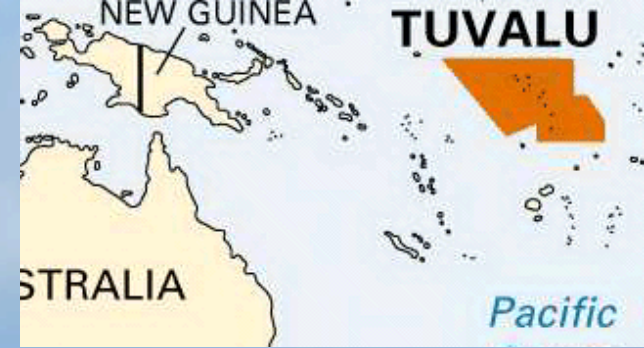
28 July '14

Drought in California 2014

Lake Oroville,
19 August 2014:
40 m below normal



Small Island States



Funafutu Atoll



Two worldwide UN agreements in 2015

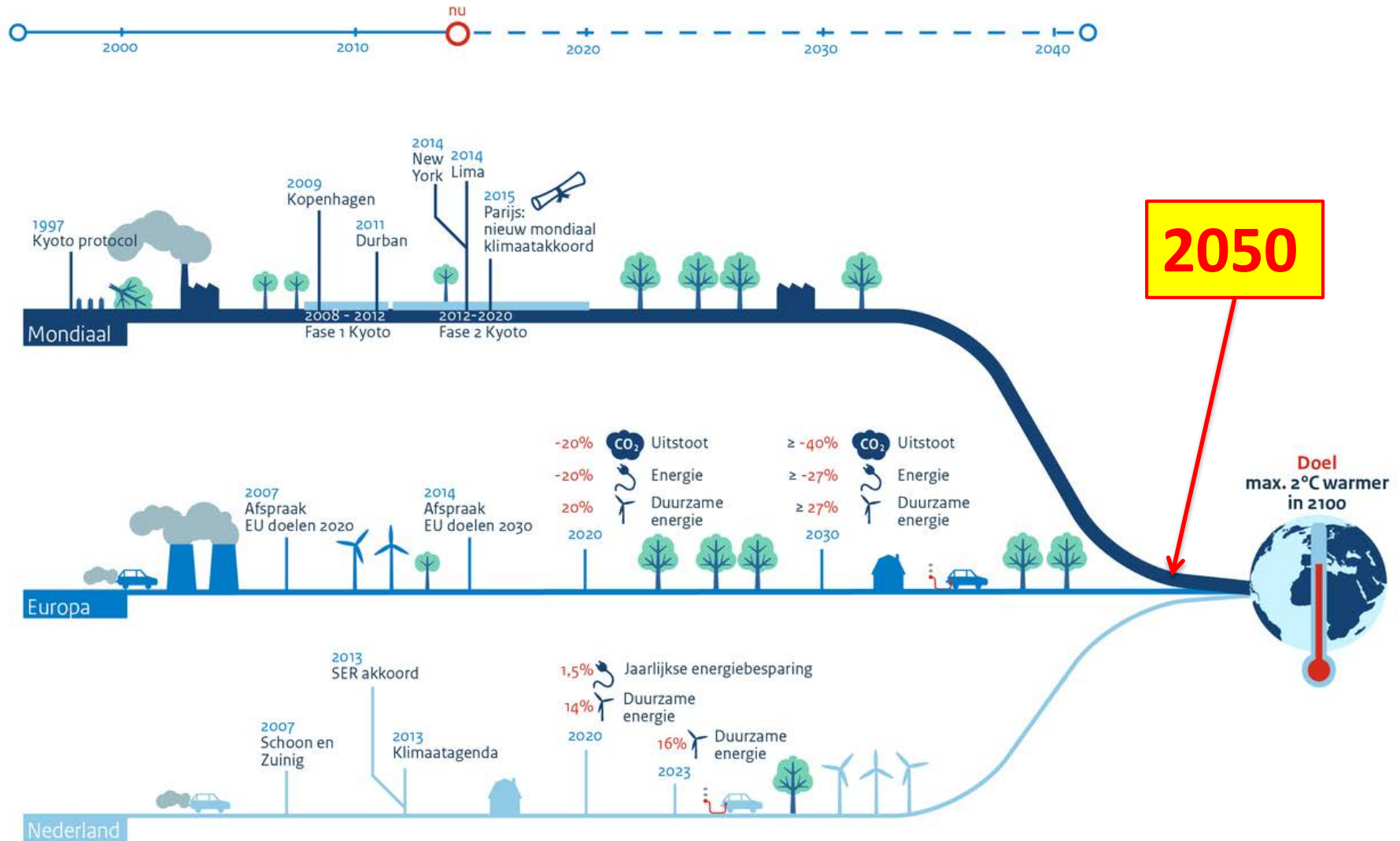


→ Sendai 2015: reduce losses in lives and livelihoods in 2015 - 2030

→ Paris 2015: limit ΔT_{global} to 1.5 - 2 °C



Three policy levels towards $\Delta T < 2^\circ\text{C}$



Climate change as innovation driver

- Mitigation: reduce CO₂ emissions
 - Adaptation: modify infrastructure
 - Societal: change public attitude
- innovation

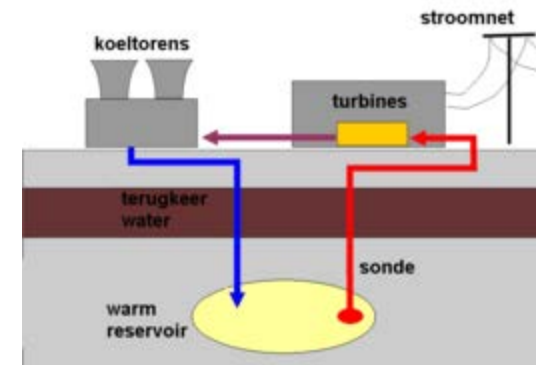
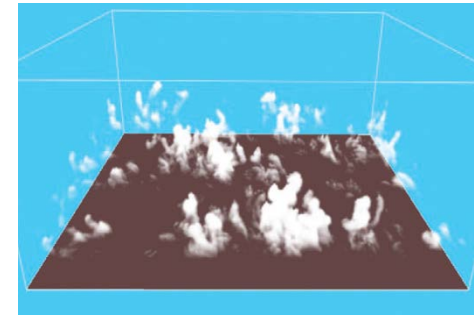


Climate information & mitigation

- Energy transition:

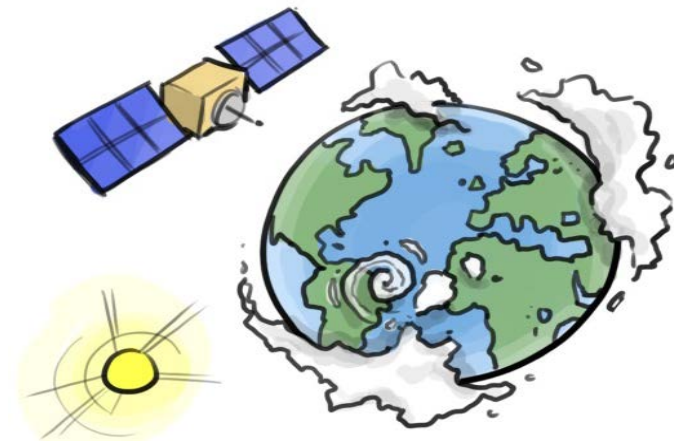
- Wind at sea → wind @ 300 m, new satellites
- Solar power → cloud resolving weather models
- Geothermal energy
- CO₂ capture and storage

} Seismology



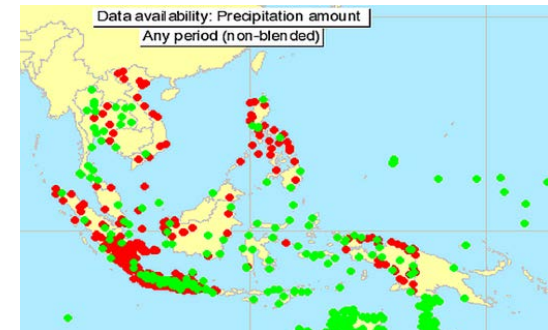
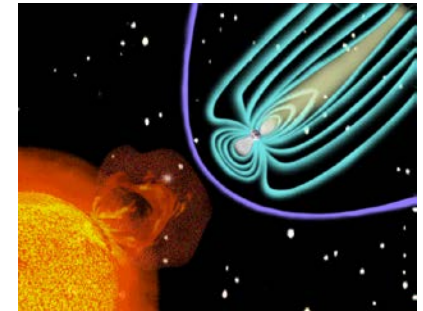
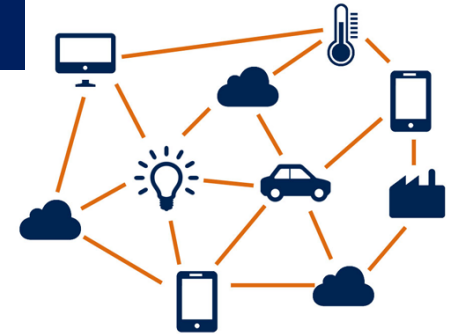
- Climate monitoring:

- Trend monitoring (climate series)
- Emission sources (Tropomi satellite)
- Impact analyses (on infrastructure)



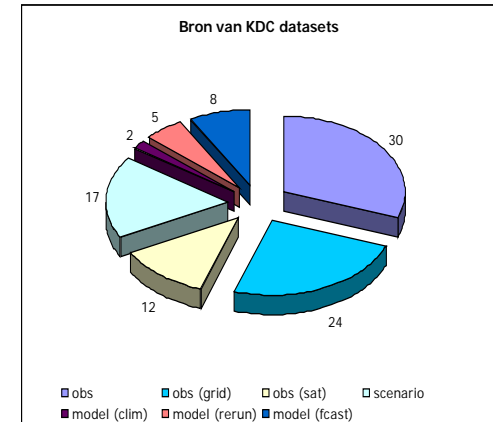
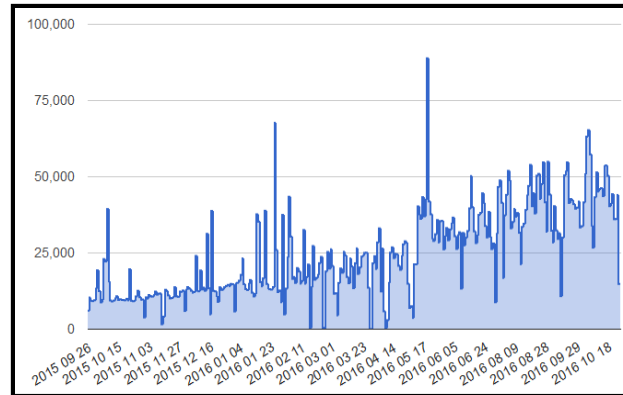
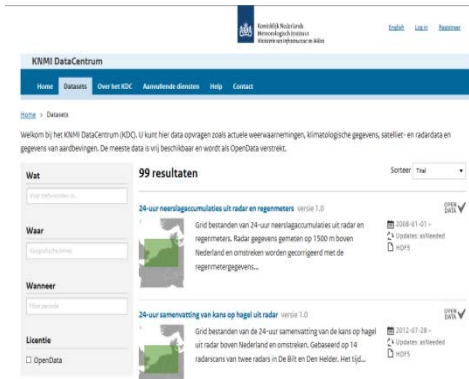
Climate information: future trends

- Urban climate & future weather
 - Big data & internet of things
- Mobility:
 - Electric cars → space weather
- Climate of the 22nd century:
 - Enhanced icecap melting & sea levels
- International policy:
 - Climate services in SE-Asia



KDC KNMI DataCentrum

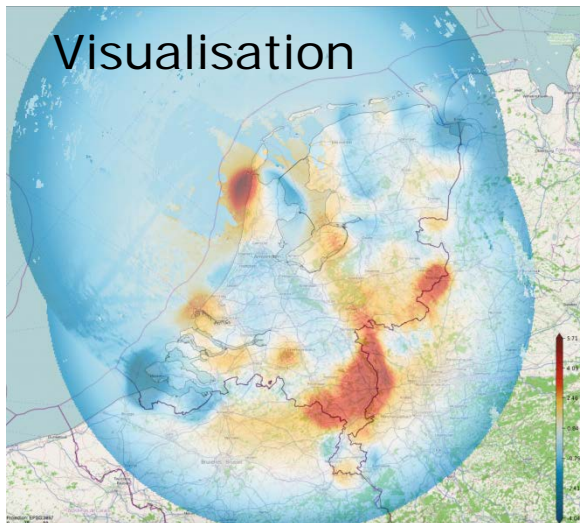
The data access point for all KNMI Data



Operational since 2012

1,2 10^6 downloads/month

113 Data sets



Key features:

- Easy to use
- Open Data ('15)
- Search
- Web services



Web address:

data.knmi.nl

Climate information & adaptation



Deltaprogramma 2015

Werk aan de delta

De beslissingen om Nederland veilig en leefbaar te houden

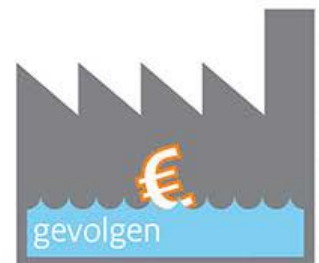


Nationaal Modellen en Data Centrum
voor de leefomgeving: www.nmdc.eu



overstromingskans

x

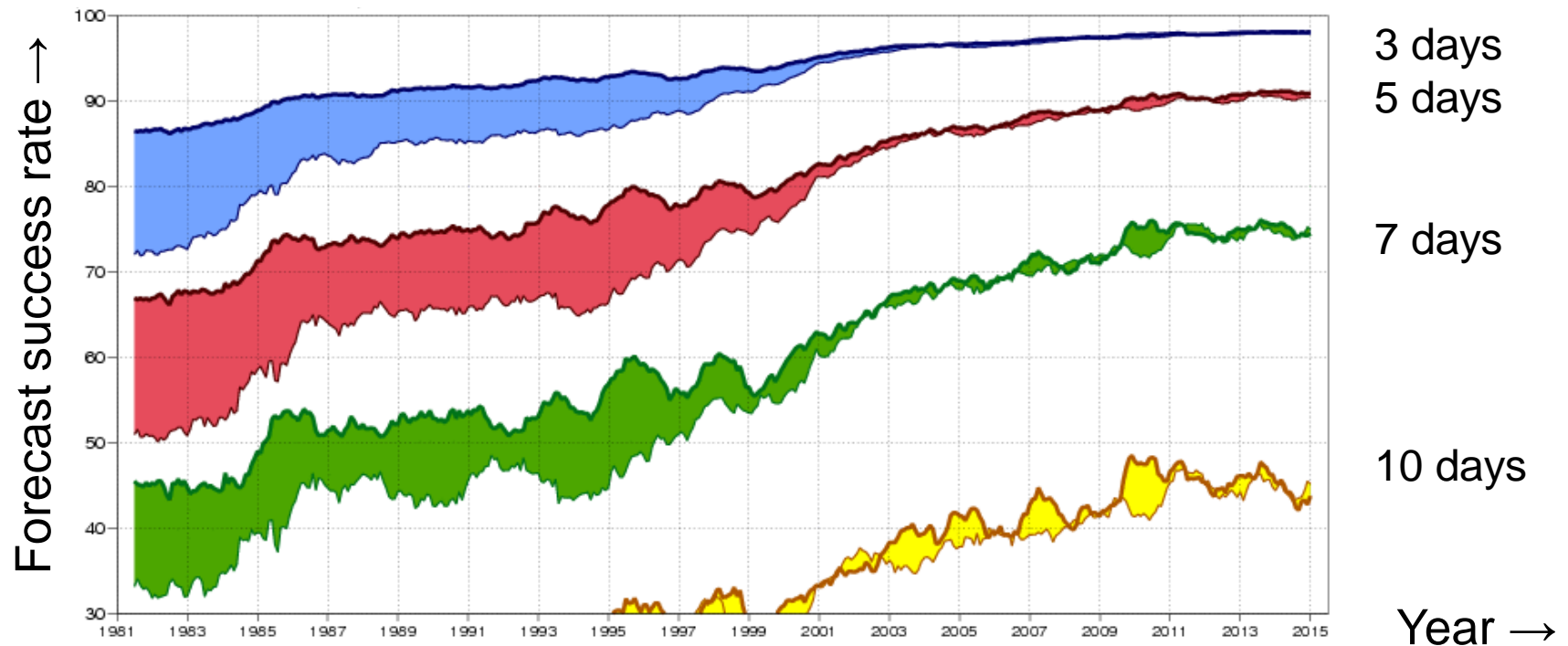


Nieuwe benadering: risico = kans x gevolg

Climate information & early warning

- High-impact weather → forecasts 2 weeks ahead of time

Improvement of ECMWF global weather forecasts 1981 - 2015



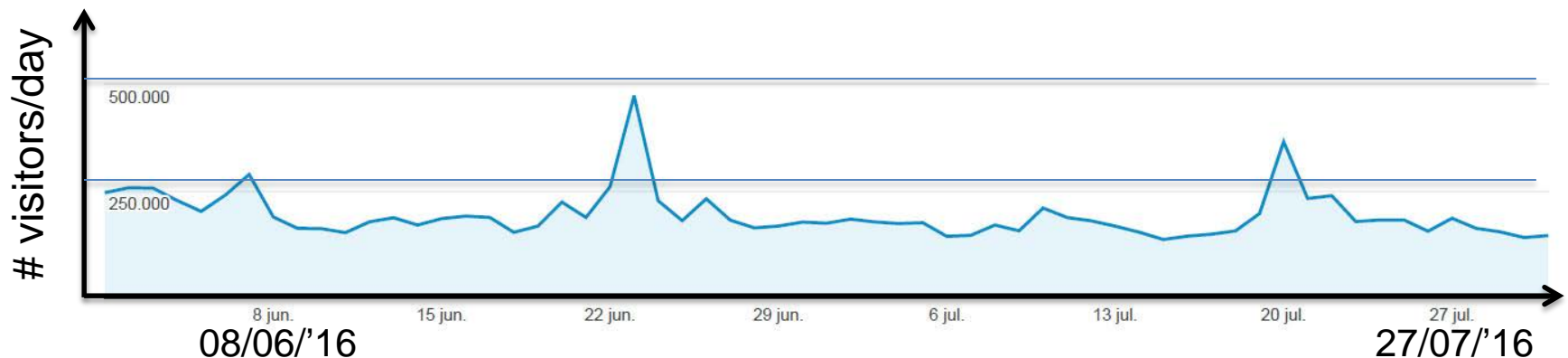
- From weather room to *Early Warning Center (EWC)*

Societal change

- Raising climate change awareness
- Impact-based (climate) warnings
- Social science: measure & study response



Weather warnings and climate information: www.knmi.nl



- Sessions: 11.784.833
- Users: 3.001.533
- Page retrievals: 24.661.065



Concluding remarks

- Climate science:
 - The climate is changing now
 - Climate neutrality required by 2050
 - Two week forecasting horizon & Early warning centres
 - Climate change drives innovation
- Climate information trends
 - New massive open data sources:
 - www.knmi.nl, data.knmi.nl and www.eumetsat.int (1,5 Pb/year)
 - New satellites: precision, new observables & space weather
 - Internet of things & big data: urban climate, self-driving cars
 - Societal change: climate awareness