



Royal Netherlands
Meteorological Institute
Ministry of Transport, Public Works
and Water Management

KNMI, Royal Netherlands Meteorological Institute

National data and knowledge
centre for:

- Weather
- Climate
- Seismology

Link between KNMI departments



Monitoring

For a reference climate,
and for monitoring change



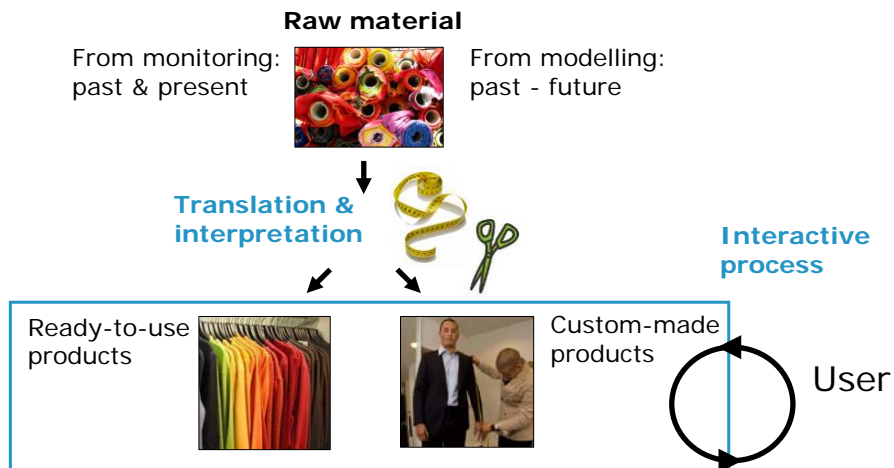
Services

Translating science
to users

Modelling

Understanding
processes and
climate change

Process of climate services



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Climate services: interactive process



Finding out the real question of the user

Precipitation extremes, but which one? Per hour? Per day?

Pointing out limitations of knowledge

Climate information at the scale of hectare is not possible

Guidance in interpretation and use



How to use different time horizons? What do details on maps mean?



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Wide range of users and requirements



	1 	2 	3 
	Energy	Urban water management	Coastal protection
Preferred climate data	Wind speed	Rainfall extremes	Sea level rise
Time resolution	Day-month-year	5-6 minutes	Yearly
Preferred time horizon	2015-2020	2050-2100	2050-2200

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Ready-to-use products, examples

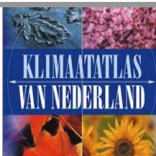


Ready-to-use products



Climate atlas

1971 - 2000



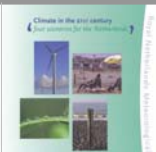
Online climate data

1950 - 2008



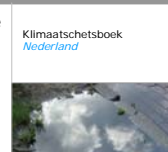
Climate scenarios

2050 - 2100



Maps: climate & impacts

2050-2100

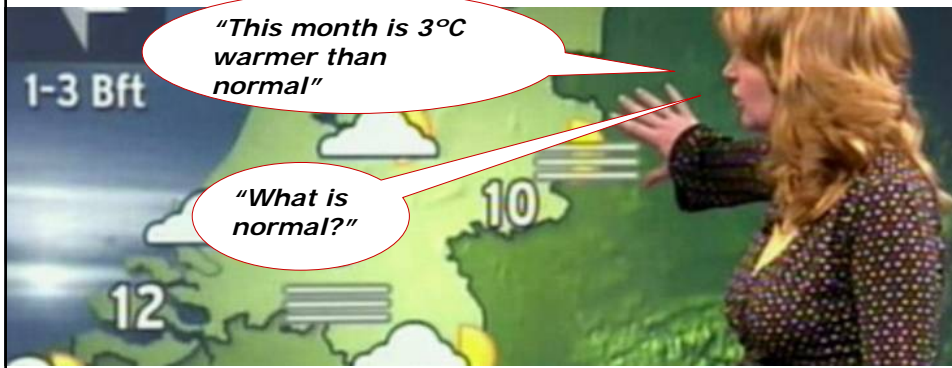


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Climate atlas



Weather providers: "We need a description of the current climate, including means and extremes"



Climate atlas



Online climate data



Climate scenarios



Maps: climate impacts



Climate atlas



Product: "Climate atlas" - Descriptions of average and extreme weather for the past 30 years

Observations

per hour, day, month
(freely available)

19650309 5.6
19650310 5.4
19650311 0.2
19650312 8.4
19650313 2.1

Processing

Climate atlas

1971- 2000

Reference climate

Overview of regional differences



Climate atlas



Online climate data



Climate scenarios



Maps: climate impacts



Online climate data



European researchers for analysis of climate change: "We need an **European meteorological database**, which is quality controlled and easily accessible"



Climate atlas



Online climate data



Climate scenarios



Maps: climate impacts



Online climate data



Product: "ECA&D" - European Climate Assessment and Dataset

- Daily observations of 9 parameters, including daily average temperatures and precipitation sums
- Derived climate change indices
- Anomaly maps, trend maps, time series

Website: <http://eca.knmi.nl>

- quality controlled
- homogeneity checked
- updated every month

- > 60 countries
- > 3000 stations



Climate atlas



Online climate data



Climate scenarios



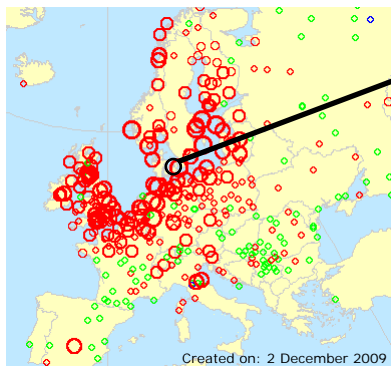
Maps: climate impacts



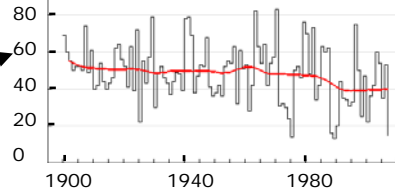
Online climate data



Trends in the number of frost days per winter, between 1979 and 2008



Number of frost days Copenhagen



Change per decade

- positive, not significant
- not significant
- negative, not significant
- 0 - -3
- -3 - -6
- -6 - -9
- < -9

Climate atlas



Online climate data



Climate scenarios



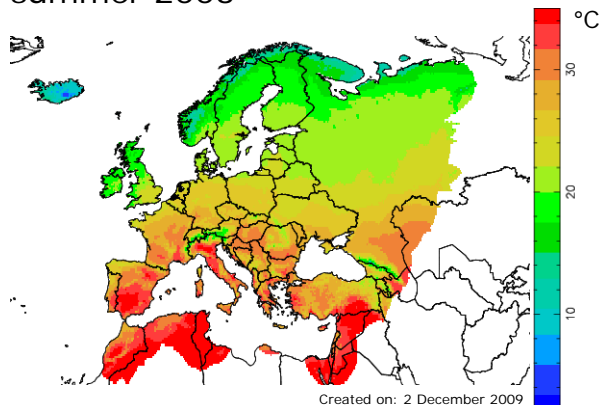
Maps: climate impacts



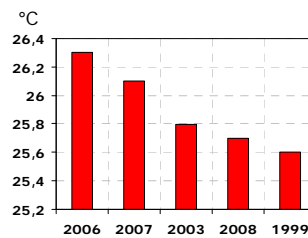
Online climate data



E-OBS (Gridded data base): Maximum temperature summer 2003



Hottest summers between 1950-2008



Climate atlas



Online climate data



Climate scenarios



Maps: climate impacts



Regional climate scenarios



A wide range of sectors: "How do we deal with uncertainty about climate change?"



Climate atlas



Online climate data



Climate scenarios



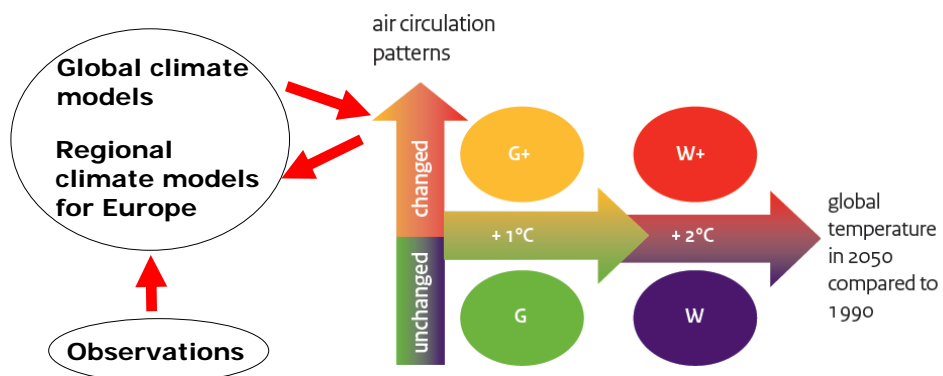
Maps: climate impacts



Regional climate scenarios



Product: "KNMI '06 climate scenarios" - Four scenarios for the Netherlands in 2050 and 2100



Climate atlas



Online climate data



Climate scenarios



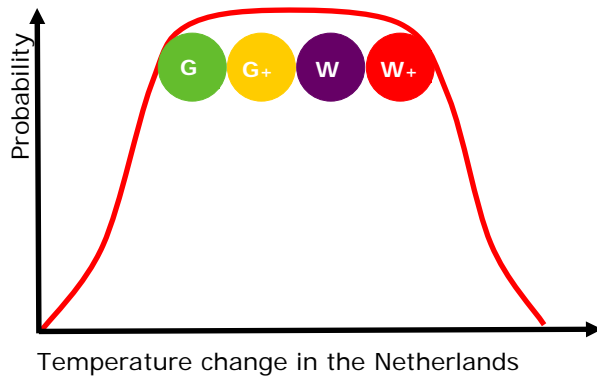
Maps: climate impacts



Regional climate scenarios



Together, the KNMI '06 climate scenarios depict the range of the most plausible changes



Climate atlas



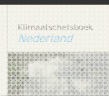
Online climate data



Climate scenarios



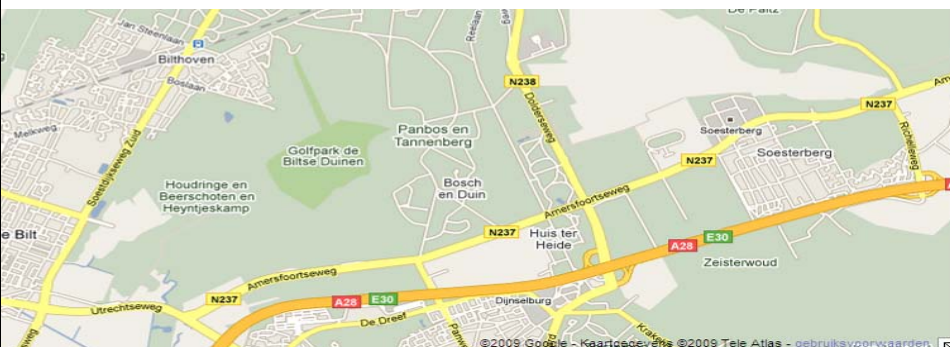
Maps: climate impacts



Climate sketch book



Provinces: "For spatial planning and adaptation we need an overview of spatial differences in climate & impacts of climate change"



Climate atlas



Online climate data



Climate scenarios



Maps: climate impacts



Climate sketch book



Product: "Climate sketch book" - maps of current and future climate and impacts

Climate scenarios



Knowledge about impacts



Climate sketch book

Current 2050 -2100

Maps

Climate & impacts

Klimaatschetsboek
Nederland

Het huidige en toekomstige klimaat

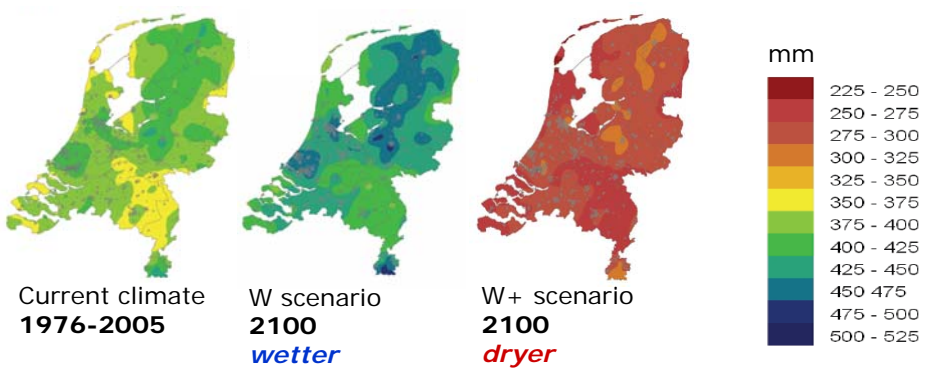


Climate atlas	Online climate data	Climate scenarios	Maps: climate impacts
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Climate sketch book



Examples of maps: Change in mean summer precipitation



Climate atlas	Online climate data	Climate scenarios	Maps: climate impacts
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Climate sketch book



Examples of maps: Regional differences in extreme precipitation



mm per 24 hours	Current climate 1906-2003	W scenario 2100	W+ scenario 2100
High+	62	95	74

Climate atlas



Online climate data



Climate scenarios

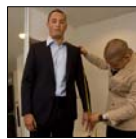


Maps: climate impacts

Klimaatstelselboek Nederland



Custom-made products, examples



Custom-made products

Urban water management
change in precipitation per hour



Railway
change in ice formation



Health organizations
heat stress



Gas plants
change in low temperatures



Urban water management



Planners of sewage systems: "Will events with extreme rainfall in short periods occur more frequently in future?"

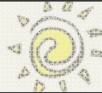


Egmond aan Zee, August '06

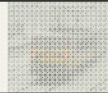
Urban water management
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Health organizations



Railway



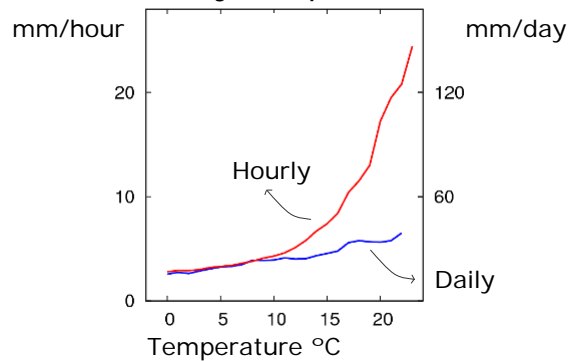
Gas plants



Urban water management



Result: The intensity of hourly extreme showers **increases** more than the intensity of daily extremes with increase of day temperature



Urban water management
22



Health organizations



Railway



Gas plants



Health organizations heat stress



Team National Heat Plan 2007: "Will summers with heat stress like 2003, 2006, become more common?"



Urban water management

Health organizations



Railway

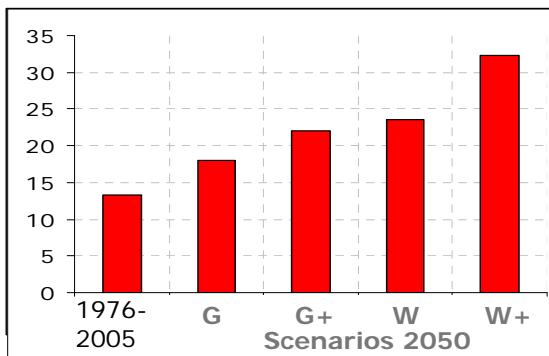
Gas plants



Heat stress: future projections



Result: Average number of days with a maximum temperature $> 27^{\circ}\text{C}$ increases



Public warning
in case of 5
consecutive days
with temperatures
higher than 27°C

Urban water management

Health organizations



Railway

Gas plants



Railway: change in ice formation



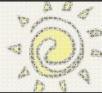
Team Betuwe Track: "Will the risk of freezing of fire extinguishing waters along railway tracks change in future?"



Urban water management



Health organizations



Railway



Gas plants



Railway: change in ice formation



Result: The chance on freezing temperatures will decrease



Current climate
1976-2005



W scenario
2050
Less freezing

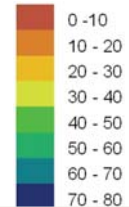


W+ scenario
2050
Less freezing

Betuwe track



Days with minimum < 0°C



Urban water management



Health organizations



Railway



Gas plants



Gas plants: change in low temperatures



Gas production company: "Will peak gas demands during extreme cold periods occur less frequently due to an increase in temperature?"

A critical threshold is the effective temperature of -16.5°C . "Effective" means that wind is also included.



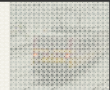
Urban water management



Health organizations



Railway



Gas plants



Gas plants: change in low temperatures



Result: The return period for years with effective temperatures $< -16.5^{\circ}\text{C}$ will increase for all four KNMI climate scenarios

Current climate 1904-2007	G scenario 2030	G+ scenario 2030
37 years	54 years	66 years

Less frequent *Less frequent*

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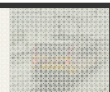
Urban water management



Health organizations



Railway



Gas plants



Questions about services?



The “KNMI Climate Desk” can be contacted for questions regarding:

- Past weather
- Climate data
- Climate change



You can find our contact information at:
www.knmi.nl

Thank you for your attention!