



Present knowledge about the climate change in Hamburg The climate assessment for the Metropolitan Region of Hamburg

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Outline


- The climate assessment for the Metropolitan Region of Hamburg – some background information
- Some details about climate change and changes in the Elbe estuary
- The North German Climate Atlas
- Summary



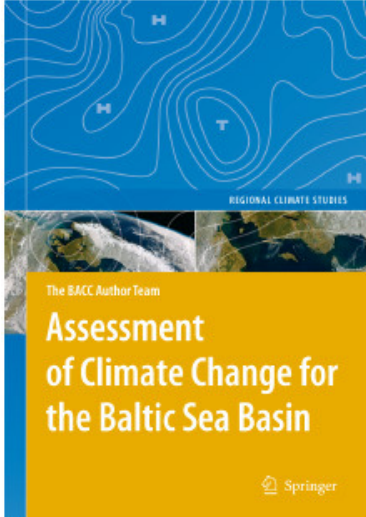
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Regional Climate Assessments


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- We need assessments about the **regional past, present and possible climate changes** in the future and the potential **regional Impacts**.
- Stakeholder and policymaker need a scientific basis to assess the **regional needs and options for adaptation**.
- Regional assessments show the **state of scientific knowledge** about
 - Regional climate
 - Regional climate change
 - Regional impact of climate change



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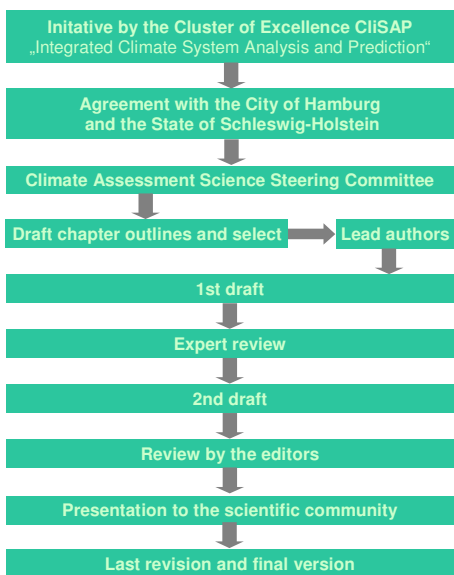


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graph TD
    A[Initiative by the Cluster of Excellence CliSAP  
„Integrated Climate System Analysis and Prediction“] --> B[Agreement with the City of Hamburg  
and the State of Schleswig-Holstein]
    B --> C[Climate Assessment Science Steering Committee]
    C --> D[Draft chapter outlines and select]
    D --> E[1st draft]
    E --> F[Expert review]
    F --> G[2nd draft]
    G --> H[Review by the editors]
    H --> I[Presentation to the scientific community]
    I --> J[Last revision and final version]
    D --> K[Lead authors]
    K --> E
            
```

Only information from independent scientific publications


State of knowledge 01. August 2009



Coordination of the whole Process:
North German Climate Office

Publication of the book in November 2010


KlimaCampus Autoren Team (2010):
Klimabericht für die Metropolregion Hamburg,
Hrsg.: von Storch H., Claussen M.,
Springer Verlag Heidelberg


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The Climate Assessment for the Metropolitan Region of Hamburg








The Metropolitan Region of Hamburg


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The Climate Assessment for the Metropolitan Region of Hamburg






Regional climate - the past (1800 – 2006) and possible changes until 2100

1. The climate of the metropolitan region based on meteorological measurements and observations
(Gudrun Rosenhagen/Seewetteramt des Deutschen Wetterdienstes Hamburg
 Michael Schatzmann/Meteorologisches Institut der Universität Hamburg)
2. The regional climate and possible changes in the future until 2100 (Achim Daschkeit/KomPass Umweltbundesamt)
3. The regional climate and changes in the German Bight (Ralf Weisse/Institut für Küstenforschung des GKSS
 Forschungszentrums Geesthacht)
4. The regional climate and changes in the Elbe estuary (Norbert Winkel/Bundesanstalt für Wasserbau Hamburg)

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Climate change and the possible impacts on ecosystems

1. **Climate induced changes in terrestrial and semi-terrestrial ecosystems** (Kai Jensen Biozentrum Klein Flottbek der Universität Hamburg)
2. **Climate induced changes in aquatic ecosystems: Elbe, Wadden Sea and North Sea** (Franciscus Colijn/Institut für Küstenforschung des GKSS Forschungszentrums Geesthacht und Forschungs- und Technologiezentrum Westküste der Christian-Albrechts-Universität zu Kiel, Hans Ulrich Fanger/Institut für Küstenforschung des GKSS Forschungszentrums Geesthacht)


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Waldemar Börs

Climate change and the possible impacts on economic sectors

1. **Climate induced changes in the tourism industry** (Harald Heinrichs/Institut für Umweltkommunikation der Leuphana Universität Lüneburg)
2. **Climate induced changes in agriculture** (Frank-M. Chmielewski/Landwirtschaftlich-Gärtnerische Fakultät der Humboldt-Universität zu Berlin)

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Management and planning tools and technical adaptation

1. Adapt to climate change – management and planning tools (Jörg Knieling/Arbeitsgebiet Stadtplanung und Regionalentwicklung der HafenCity Universität Hamburg)
2. Adapt to climate change - technical adaptation tools (Nicole von Lieberman/Institut für Wasserbau der Technischen Universität Hamburg-Harburg)

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Some details about

- The climate of the metropolitan region based on meteorological measurements and observations
- The regional climate and possible changes in the future until 2100
- The North German Climate Atlas
- The regional climate and changes in the Elbe estuary

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Temperature

- The average temperature increased about 1 °C since 1900. The trend intensified within the last 25 years.
- The strongest temperature increase is during winter.

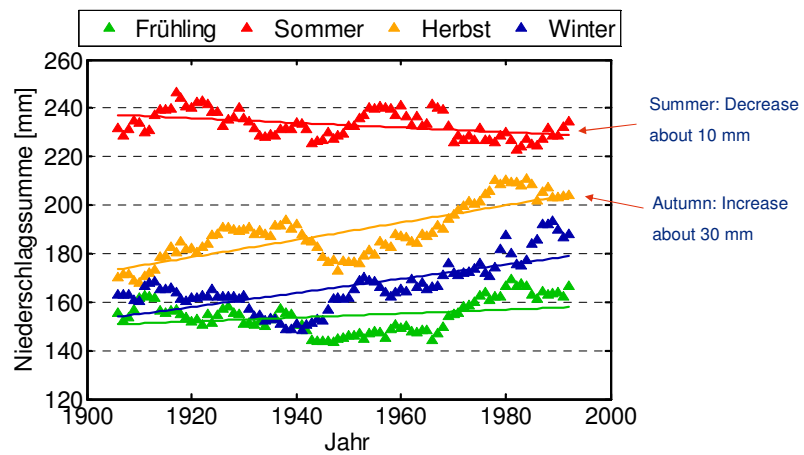
Precipitation


- The annual average increase is about 8 mm per decade since 1891.
- The observations show a slight decrease during the summer month while the other seasons show an increase. The highest increase was observed in autumn.
- Strong rain events slightly increased.

Wind

- Neither the average wind speed nor the storms show an increase since the beginning of the 21st century.

Seasonal precipitation 1900 – 1990






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Possible future changes until 2100


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- The results of climate scenarios show a range of possible climate changes in the future.
- Model results for the A1B emission scenario show (keeping the uncertainties of climate modeling in mind):
 - An increase of the annual average temperature between 0.75 – 1.75 °C until 2050 and until 2100 an increase between 2.5 – 3.0 °C (compared to 1961-1990).
 - Total annual precipitation will not change until 2050 but scenarios show an increase until 2100.
 - Changes of precipitation within the seasonal cycle (summer months more dry and winter months more humid).
 - More summer days, more hot days, more tropical nights, less frost and ice days per year.

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Possible future changes until 2100

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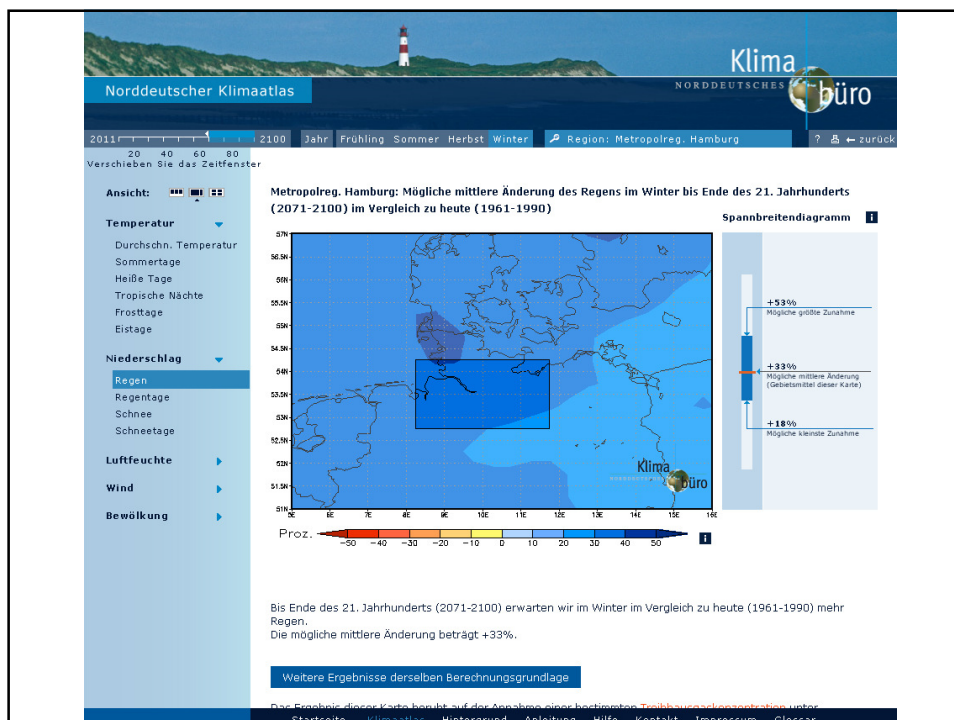
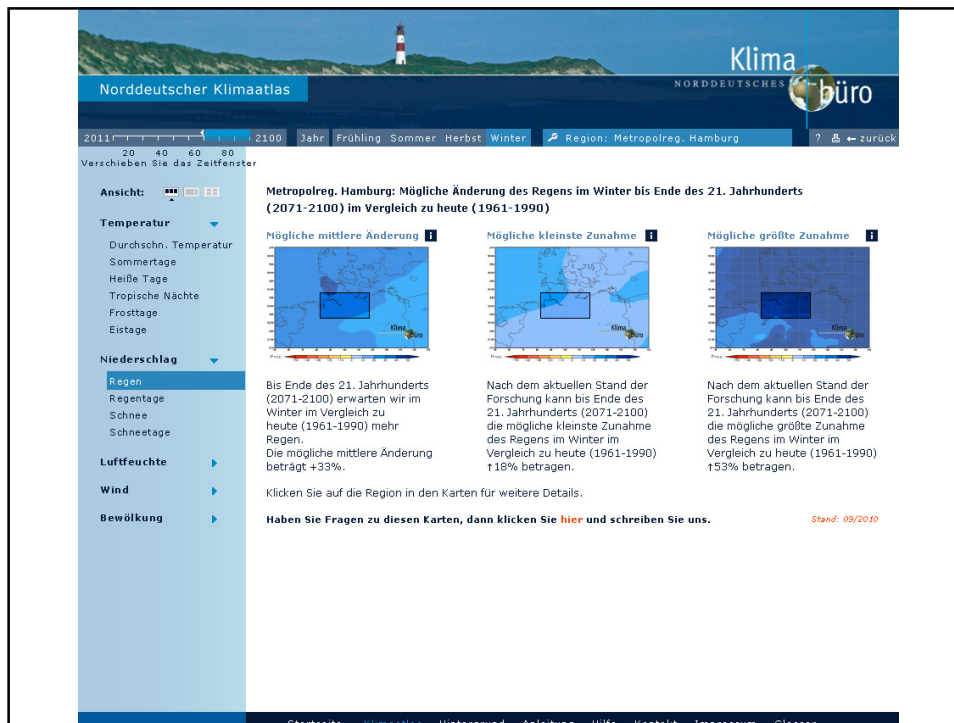
Norddeutscher Klimaatlas

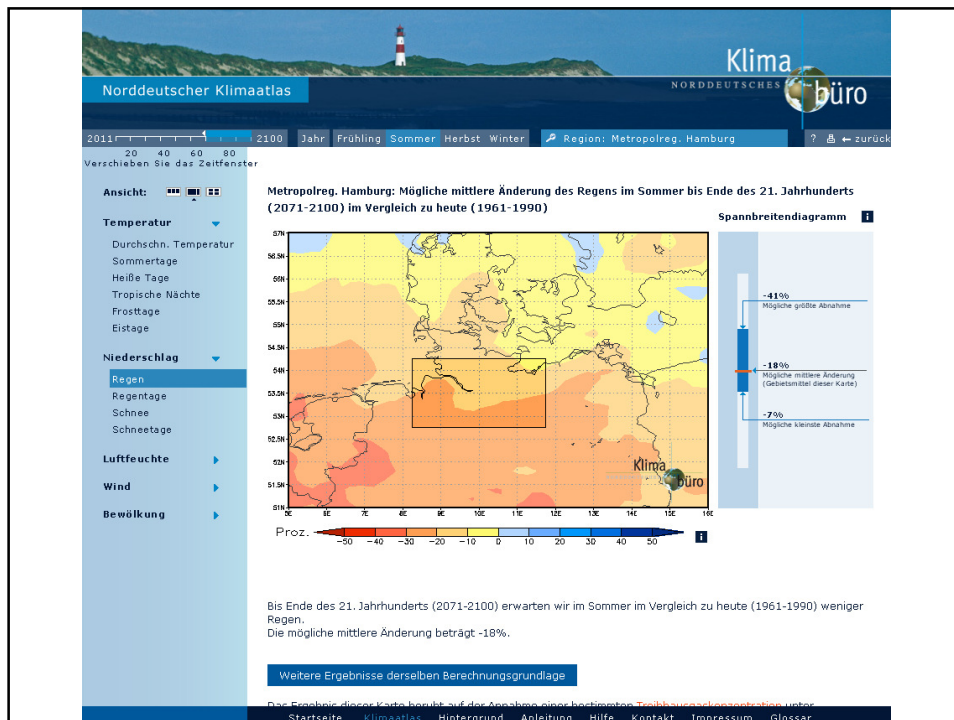
The North German Climate Atlas

- The digital Atlas about regional climate change in northern Germany consists 12 regional climate scenarios and is online since 2009.
- It shows changes of various climate variables at different time windows in the future.
- Maps show the minimum and maximum change and the nearest neighbor to the mean value.

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The regional climate and changes in the Elbe estuary

- Since 1950 **mean low water** at the tide gauge Hamburg St. Pauli decreased about 0.7 m and **mean high water** increased about 0.5 m. Today the mean tidal range is about 3.60 m, 1950 it was about 2.40 m.
- Storm surge heights rose and today **storm surges** in St. Pauli are 0.5 m higher than in Cuxhaven.
- Mainly due to **modifications of the Elbe estuary** related to coastal defence and improvement of the shipping channel.
- For the North Sea scenarios show a **rising sea level** and changes in the wind climate towards **higher wind speeds** and **more westward winds**, thus storm surge heights could increase about **30 to 110 cm** until 2100.

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Elbe Estuary

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The regional climate and changes in the
Elbe Estuary

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Summary

- Regional climate assessments provide a **scientific basis** to understand climate and its changes and to find **knowledge gaps**.
- The assessment shows that **climate in the Metropolitan Region of Hamburg is changing**. Summer months are getting warmer and more dry. Winter months are getting warmer and more humid.
- The improvement of the shipping channel in the Elbe estuary led to a decrease of the low water level, to an increase of the high water level and to an increase of the storm surge heights.
- In the North Sea **storm surge heights could increase about 30 to 110 cm** until 2100.
- The assessment shows that scientific knowledge about climate and climate change in the Metropolitan Region of Hamburg exists only to a limited extent.
- Research will help to understand the complexity of regional climate and its changes and will help to develop regional adaptation tools.



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