



Sea level within BACC II

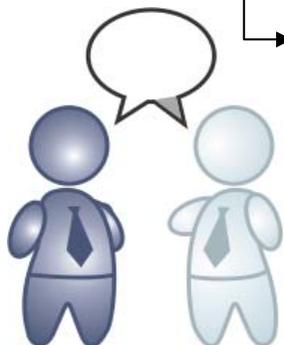
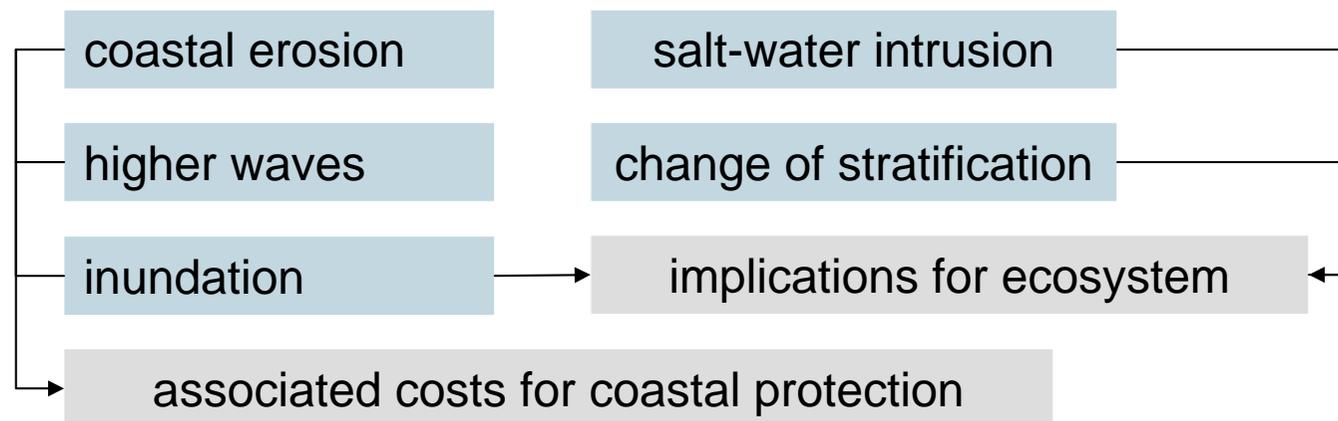
–views and vision how the chapter may look like

Birgit Hünicke

23-24 November 2010, Wallenberg Conference Centre, University of Gothenburg, Sweden

Sea-level change

- issue of increasing importance, especially in the context of anthropogenic global climate change
 - one of the key topics of IPCC AR4 (2007)
- closely linked to studies of solid earth processes and geodetic science
- impacts of sea-level rise on the coast and associated costs for coastal protection of great interest to governmental bodies and the public



→ from our recent experience from communicating with regional stakeholders it has become very clear that this issue must be considered a major issue for stakeholders and the public at large.

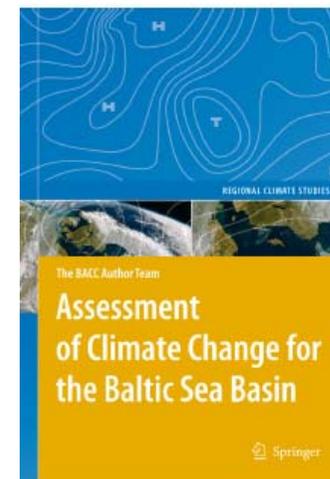
Sea level subsections included in BACC I (2008)

2	Past and Current Climate Change	35
2.3	The Baltic Sea	87
2.3.1	Hydrographic Characteristics	87
2.3.1.1	Temperature	88
2.3.1.2	Salinity and Saltwater Inflows	93
2.3.2	Sea Level	96
2.3.2.1	Main Factors Affecting the Mean Sea Level	96
2.3.2.2	Changes in the Sea-level from the 1800s to Today	97
2.3.2.3	Influence of Atmospheric Circulation	99
2.3.3	Sea Ice	99
2.3.3.1	Ice Extent	100
2.3.3.2	Length of the Ice Season	101
2.3.3.3	Ice Thickness	102
2.3.3.4	Large-scale Atmospheric Forcing on the Ice Conditions	102
2.3.3.5	Summary	104
2.3.4	Coastal Erosion	105
2.3.4.1	Western Part of the South Baltic Sea Coast	105
2.3.4.2	Middle Part of the South Baltic Sea Coast	106
2.3.4.3	South-eastern Part of the South Baltic Sea Coast	107
2.3.4.4	Summary	108
2.3.5	Wind Waves	108
2.4	Summary of Observed Climate Changes	110
2.5	References	112
3	Projections of Future Anthropogenic Climate Change	133
3.1	Introduction to Future Anthropogenic Climate Change Projections	133
3.2	Global Anthropogenic Climate Change	133
3.2.1	Global Warming in the 21 st Century	134
3.2.2	Geographical Distribution of Anthropogenic Climate Changes	138
3.2.3	Global Sea Level Rise	139
3.2.4	Global Warming and Sea Level Rise After the Year 2100	139
3.8	Projections of Future Changes in the Baltic Sea	194
3.8.1	Oceanographic Models and Anthropogenic Climate Change	194
3.8.2	Projected Changes in Sea Ice	194
3.8.3	Projected Changes in Sea Surface Temperature and Surface Heat Fluxes	195
3.8.4	Projected Changes in Sea Level and Wind Waves	196
3.8.5	Projected Changes in Salinity and Vertical Overturning Circulation	198
3.9	Future Development in Projecting Anthropogenic Climate Changes	201

Sea level references (until 05/06)

→ 4 pages

→ 40 References



BACC Report:

5 main chapters
~370 pages
+Annex

→ Sea level
NOT included in
overall summary

→ 1 pages

→ 14 References

→ 2 pages

(3 already included in 2.3.2)

Σ 49 References

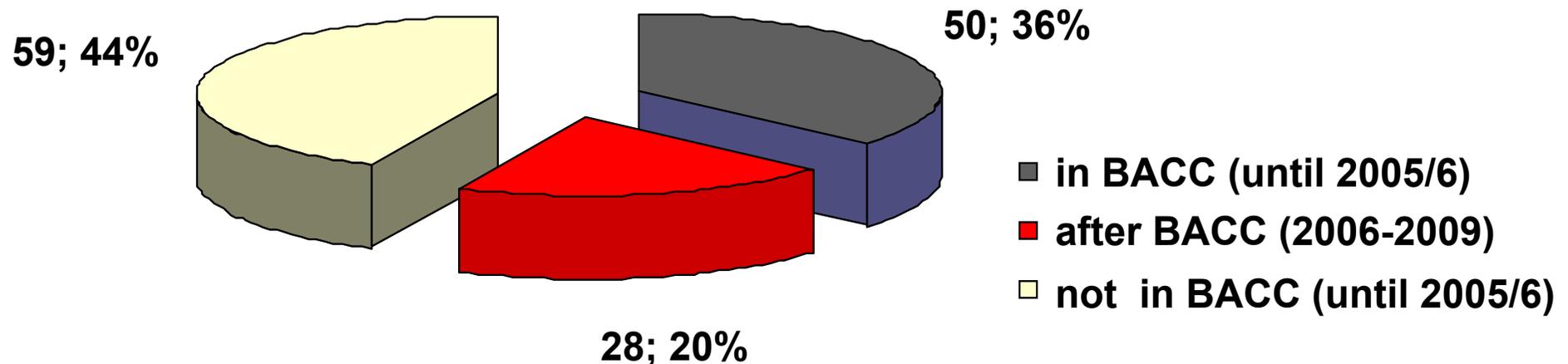
Literature Research

- literature research (internet, libraries, requests, personal communications to authors etc)

→ Σ 170 publications (preliminary Nov 10)

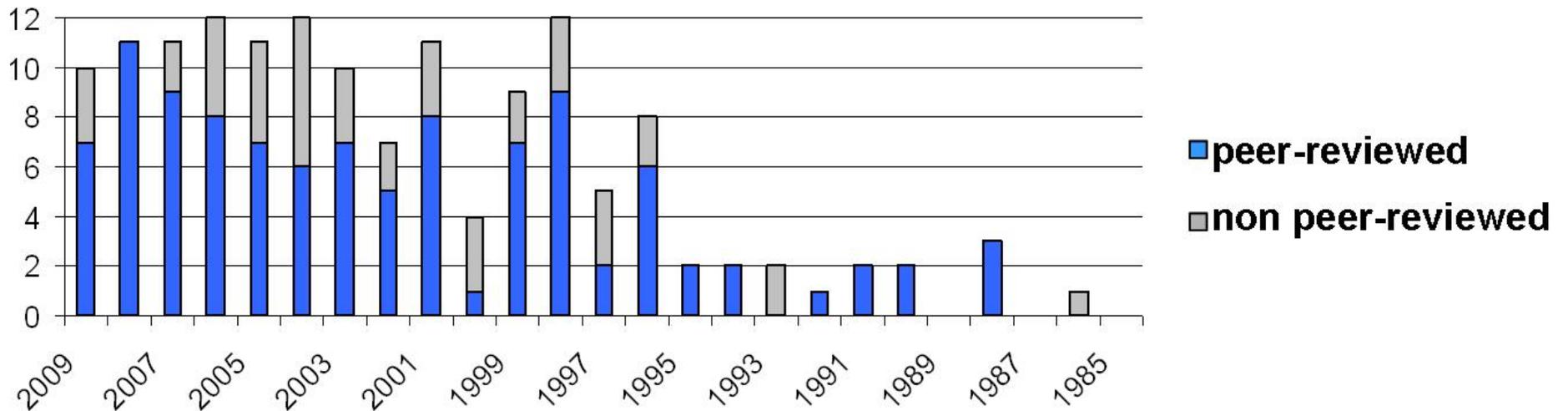


Publication Overview (total; percent)



(preliminary Nov 09)

Total Publications per Year 1985-2009



(preliminary, June 2010)

More information: http://coast.gkss.de/staff/huenicke/baltic_sea_level_changex.html

Available list of literature

NEWS



Sea level change in the Baltic Sea - A complete reference list of available literature with abstracts is currently being compiled and is constantly being extended. Check on our [BALTEX Online Publication Library](#) under the key word "sea level"...

 **Search**

Databasename: BALTEX

Title:

Author:

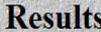
Year:

Journal:

Keywords:

Abstract:

Search is an AND-Operation for all entered words.
 Bei der Suche: Search is an OR-Operation

 **Results**

Databasename: BALTEX

The records from 1 to 135 of 135 found records are displayed.

Title	Author	Year	Journal
Quantile trends in Baltic sea level	Barbosa, S.	2008	GEOPHYSICAL RESEARCH LETTERS, VOL. 35, L22704, doi:10.1029/2008GL035182, 2008
Changing seasonality in North Atlantic coastal sea level from the analysis of long tide gauge records	Barbosa, S., M. Silva, M. Fernandes	2008	Tellus (2008), 60A, 165-177
MEAN MONTHLY SERIES OF SEA LEVEL OBSERVATIONS (1777-1993) AT THE KRONSTADT GAUGE	Bogdanov, V., M. Medvedev, V. Solodov, Y. Trapeznikov, G. Troshkov, A. Trubitsina	2000	REPORTS of the FINNISH GEODETIC INSTITUTE
The atmospheric boundary layer over the Baltic Sea ice.	Bruemmer, B., A. Kirchgaeßner, G. Mueller	2005	Boundary-Layer Meteorology, Vol. 117, No. 1, 91-109
The BALTIMOS (BALTEX Integrated Model System) field experiments: A comprehensive atmospheric boundary layer data set for model validation over the open and ice covered Baltic Sea	Bruemmer, B., A. Kirchgaeßner, G. Mueller, D. Schroeder, J. Launiainen, T. Vihma	2002	Boreal Environment Research, Vol. 7, No. 4, 371-378

<http://www.baltex-research.eu/publications/library.html>

Sea level subsections planned in BACC II (as of 4 October 2010)

1. **Introduction and summary** *Hans von Storch and Anders Omstedt*
 2. **Past climate variability**
 - 2.a The Holocene (10.000 yr) *Irina Borsenkova*
 - 2.b The historical time frame (1000 yr) *Tadeusz Niedzwiedz*
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 - iii. Vegetation, soil and freshwater biogeochemistry *Christoph Humborg*
 4. **Future climate change**
 - 4a. Skill of methods for describing regional climate futures *Joanna Wibig*
 - 4b. Projections of future climate change *Ole B. Christensen*
 5. **Impacts of current and future climate change**
 - 5a. Climate-related terrestrial ecosystem change *Pekka Niemelä*
 - 5b. Climate-related marine ecosystem change *Markku Viitasalo*
 - 5c. Socio-economic impacts (agricultural practices, fisheries, aquaculture, land use...)
Michael Köhl
 - 5d. Urban complexes *Sonia Deppisch*
 6. **Attributing causes of regional climate change**
 - 6a. Global warming *Jonas Bhend*
 - 6b. Aerosols (natural and pollutants) *NN*
 - 6c. Land use and resource management *NN*
- Annexes**
Empirical evidence for consensus and dissent among regional climate researchers
Dennis Bray

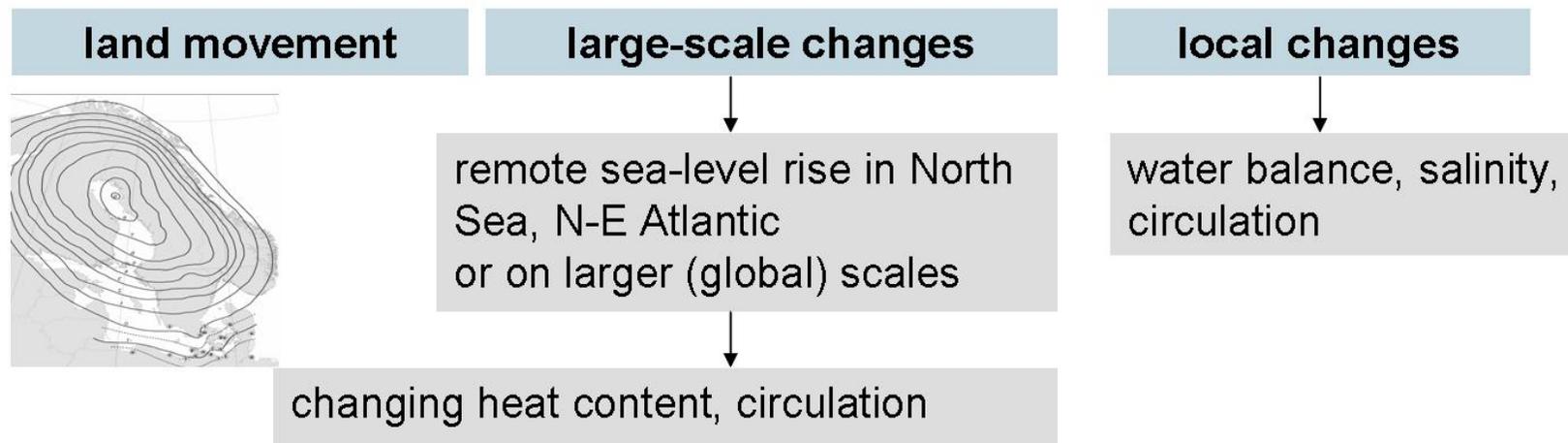


Questions of high relevance

- understanding global mean sea-level change
- global versus regional sea-level change

What effects Baltic Sea level change on a long-term scale?

-> sum of global, regional and local effects



- sea- level observations (from tide gauge records and satellite altimetry)
-

What do we know from observations

Mean RSL = absolute SL – uplift rate RSL=relative sea-level SL= sea level



absolute Sea level rise (-> values corrected for land uplift)

-> 2.1 +/-0.3mm/year for Fennoscandia (Milne et al., 2001)

-> 1.5 mm/year (1886-2009) Sweden (3mm/year 1980-2009)

-> 1.5-2.7 mm/year (1842-2005) for Estonia

-> ca. 1mm/year (1900-2000) for southwestern coastal stations (Germany, Poland)

-> ca. 2mm/year (1900-2000) for Denmark (two Baltic stations)

-> high uncertainty according to applied uplift rates (different methods)

-> e.g. Estonia uses uplift rate from national high precision leveling

-> Lithuania did not apply uplift rate because „researchers recommend different estimates of land sinking in the Lithuanian Region (between 0-2mm/year)“

What do we know from observations

Mean RSL = absolute SL – uplift rate RSL=relative sea-level SL= sea level



relative sea level rise (-> values not corrected for land uplift)

-> 1.3 mm/year (1898-2002) for Lithuania (3.8mm/ year 1961-2002)

-> 1.2 mm/year (1842-2005) for Estonia

-> 0.6-1.7 mm/ year (1900-2000) for Southwestern coastal stations (Germany, Poland)

-> 0.69 -1.04 mm/ year (1900-2000) for Denmark (two Baltic stations)

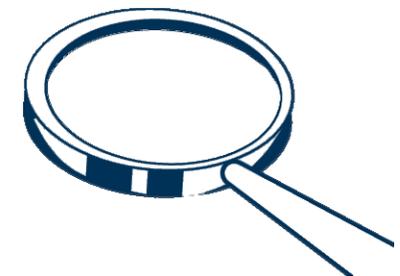
-> relative to land

-> the important value for regional impact studies!

Questions of high relevance

for example ...

- Are satellite-altimeter observations currently useful for the study of Baltic Sea level variability?
- Are there new efforts made in the development of advanced geodetic techniques for measuring vertical land movement at tide gauges?
 - > need of precise and homogenous land uplift rates for the Baltic Sea
 - > need for more precise GIA models (correction due to GPS)
 - > need for dense GPS networks, placed near to tide gauge tides (ongoing)
- Which sea-level data is available for the Baltic Sea community and which of the data have been quality controlled by peer-reviewed scientific studies?
 - > future studies should investigate the along-track satellite altimetry data of the coastal area, to link these trend values tighter to tide gauge data
- Which studies about Baltic Sea level projections exist up-to-date, as they are a priority for coastal engineers and planning authorities?
- Which climatic data were used so far for studying the climatic influence on sea level in the Baltic Sea? Has full advantage been made of existing data?
- Which available input data are used up to date by coastal engineers for hydrodynamic or sediment transport models? **Which data is used for impact studies?**



What is known? What is very likely? And what is still uncertain?

Questions of high relevance

for example ...

- > one of the highest uncertainties: ice sheet discharge (melting but also flow)
- > gravitational effects of ice disappearance

Milne et al., 2009; Tamisiea et al., 2002

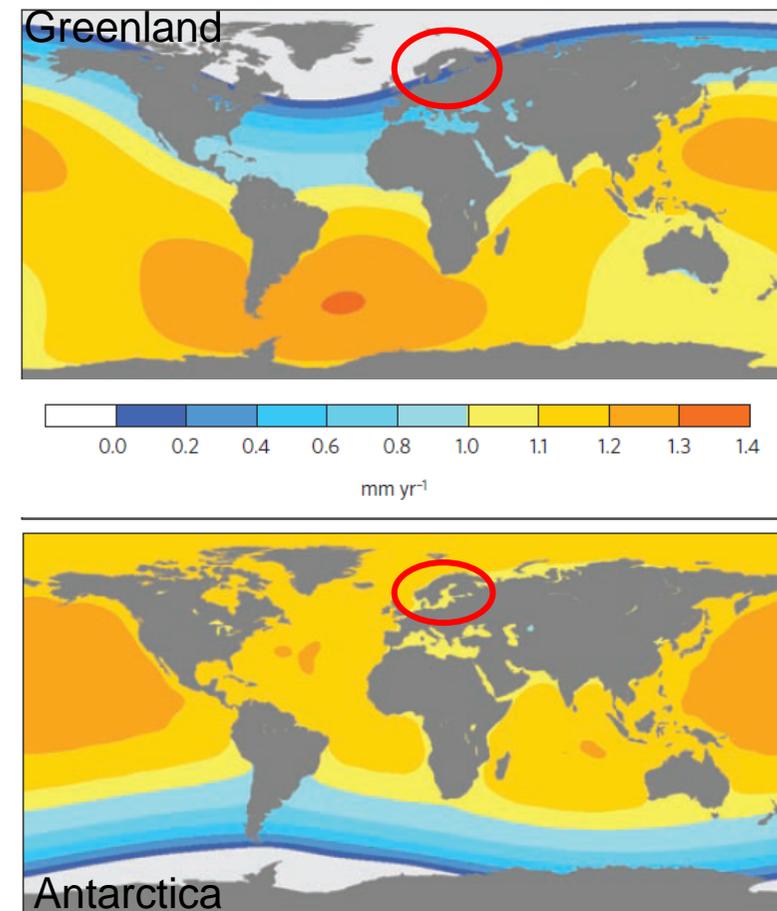
Model predictions of the change in global sea level if ice sheets were to lose mass at 1mm/year of global mean sea-level equivalent

-> sea-level fingerprints:

-> predicted response departs significantly from the mean

-> a reduced rise and even fall in areas close to the ablating ice mass

-> amplified rise in areas far removed from the melt source



What is known? What is very likely? And what is still uncertain?

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- Empirical evidence for consensus and dissent among regional climate researchers
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Storm surges,
 waves
 extreme events
 coastal erosion

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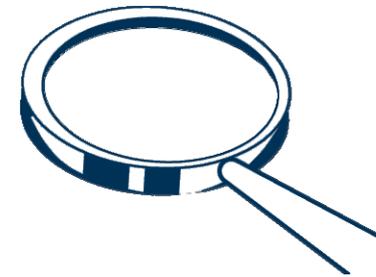
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Holocene water-level variations?
(relative sea-level curves versus eustatic -> crustal movement)

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global versus regional sea-level projections

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often based on projected global sea-level rise projections and present vertical movements -> uncertainties..

6. Attributing causes of regional climate change

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Annexes

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SURBACC –summary of comments regarding sea level to improve BACC

„Sea-level changes and impacts thereof should be more comprehensively covered.“

„stronger focus in the sea-level issue“

„Next report should be more comprehensive on sea-level rise. This could include new assessment of the global sea levels as well.“

„need of better net of measuring points, both, for meteorology and for sea level“

„...improve knowledge of coastal erosion“

„add chapter on the socio-economic implication of climate change to provide a further basis for the development of public policy and the public understanding of implications of climate change“

„effect on marine ecosystems and socio-economic should hopefully be better included“

-> discussion of uncertainties