



PIANC And The Environment

International Navigation Association

Environmental Commission - EnviCom

Climate Change and Navigation

AGA, 26. May 2008, Beijing, China

PIANC and Climate Change

PIANC is “The global organisation providing guidance for **sustainable** waterborne transport, ports and waterways”.

Time to act

Significant changes in climate and their impacts are visible regionally, and are expected to become more pronounced in the next decades.

Changes in the water balance and the discharge of rivers bring pressure on inland navigation being a reliable transport mode in future. There are new perspectives for marine/polar navigation. Every infrastructure project has to deal already today with the possible impact of climate change.

The European Commission recently developed the concept of **climate-proofing**, defined as “*Ensuring the sustainability of investments over their entire lifetime, taking explicit account of a changing climate.*” This may become an important driver in all future planning processes.

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Two different aspects:

1. Climate protection

How can the navigation sector contribute to the reduction of greenhouse gas emissions?
(Measures for Mitigation)

2. Climate adaption

How will the navigation sector be affected and what adaptation strategies and measures are necessary?
(Inland and Maritime navigation)

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Strategy

Review of the available knowledge about climate change with regard to possible impacts for navigation:

Create a common ground within PIANC

- to develop in what areas PIANC should elaborate technical guidance about climate change for the navigation sector.
- to communicate that PIANC has recognised the challenges of climate change.

PIANC and Climate Change

First step: EnviCom Task Group 3

Mandate: Review of climate change drivers, impacts, responses and mitigation for navigation sector

started in March 2007 and finished in April 2008

Members represent a broad cross-section of

- **disciplines:** climate change specialists (meteorologists and forecasters), hydrology experts (water balance and discharge specialists), oceanographers, hydraulic engineers in the field of maritime and inland navigation.
- **countries:** Germany, United Kingdom, USA, France, Norway, corresponding: Belgium, Spain, Australia, Japan, South Africa

EnviCom Task Group 3



International Navigation Association
Environmental Commission - EnviCom

Task Group 3
Climate Change and Navigation

**Waterborne transport, ports and waterways:
A review of climate change drivers, impacts,
responses and mitigation**



Report printed in
May 2008

Chairman

Dr. Hans Moser
Federal Institute of Hydrology
Koblenz
Germany

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Hydraulic Research
Wallingford
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PIANC EnviCom TG 3 report

The report includes the following matters (1):

1. Identification of the relevance of climate change for maritime and inland navigation.
2. Summary of the realistic impact scenarios (e.g. environmental, technical, economic, political) by documenting the existing uncertainties with the use of climate models. The report shows potential impacts on navigation, distinguishing between maritime and inland navigation.
3. Summary of examples where climate change already creates problems for navigation.

PIANC EnviCom TG 3 report

The report includes the following matters (2):

4. Discussion on how the navigation sector could contribute to reduce climate change impacts (e.g. reduction of CO2 emissions and alternative fuel concepts). Support navigation as an environmentally sound and sustainable mode of transportation.
5. Discussion of climate impacts and responses to prepare the navigation sector for the projected climate scenarios with the aim of adapting navigation infrastructure, equipment and daily practice for future sustainability.

PIANC EnviCom TG 3 report

Waterborne transport, ports and waterways: **A review of climate change drivers, impacts, responses and mitigation**

Summary

1. The starting point for this review
 - 1.1 Global climate change
 - 1.2 Contributions to greenhouse gas emission
 - 1.3 Climate change impacts and responses

2. Need and approach
 - 2.1 Need
 - 2.2 Terms of reference
 - 2.3 Review of pertinent literature**

Review of pertinent literature (1)

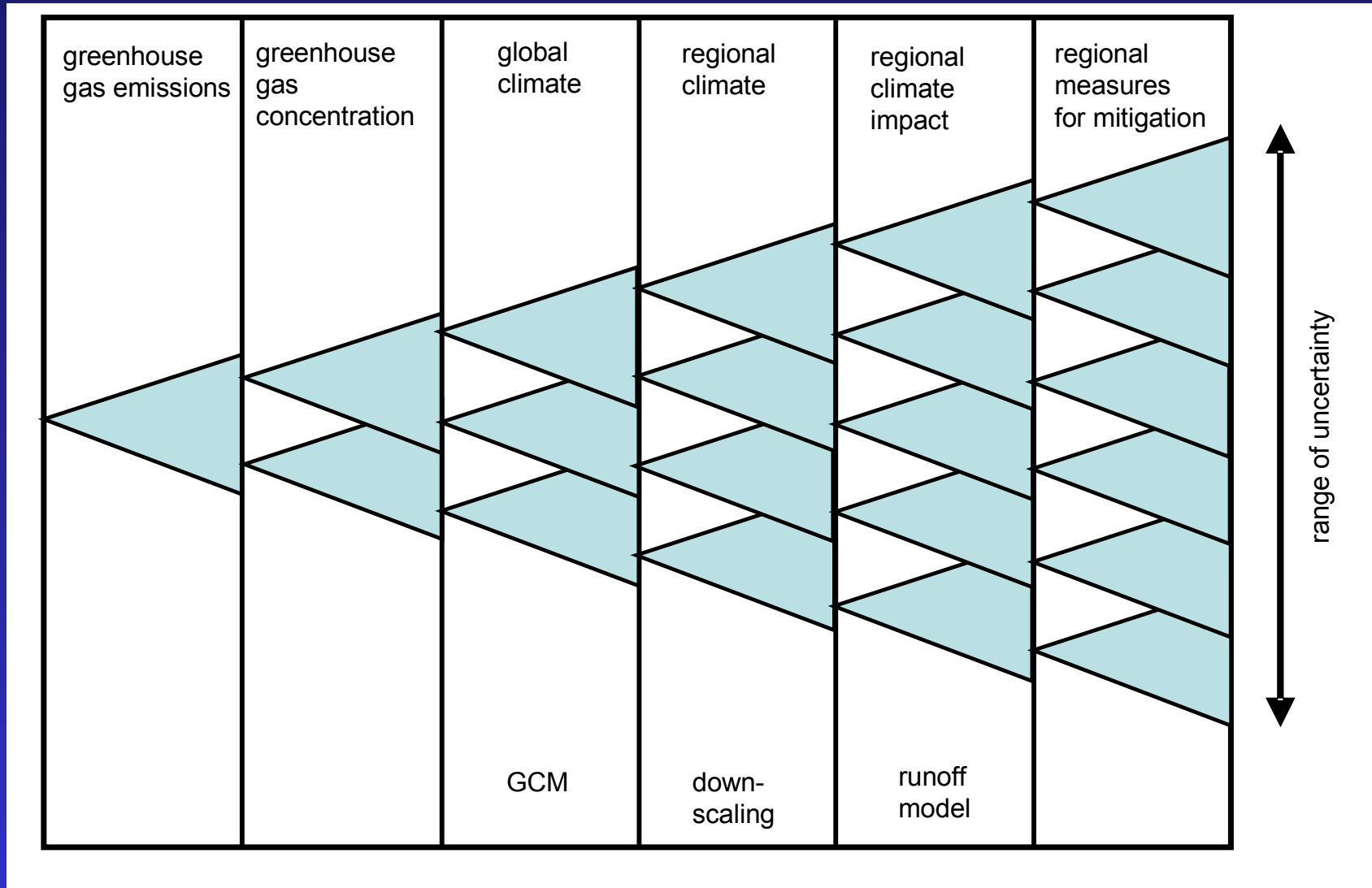
Although large-scale climatic processes are driven by the ocean-atmosphere exchange system, very few studies are available on maritime impacts compared to continental impacts due to shorter data series and fewer human consequences.

Impacts on navigation have to be deduced from research undertaken in specific fields (e.g. coastal risks, water supply, nuclear plant protection) and more generally from IPCC Working Group 2 reports.

IPCC has invested considerable time and effort in developing a consistent framework and specific language to describe uncertainties, including both value and structural uncertainties.

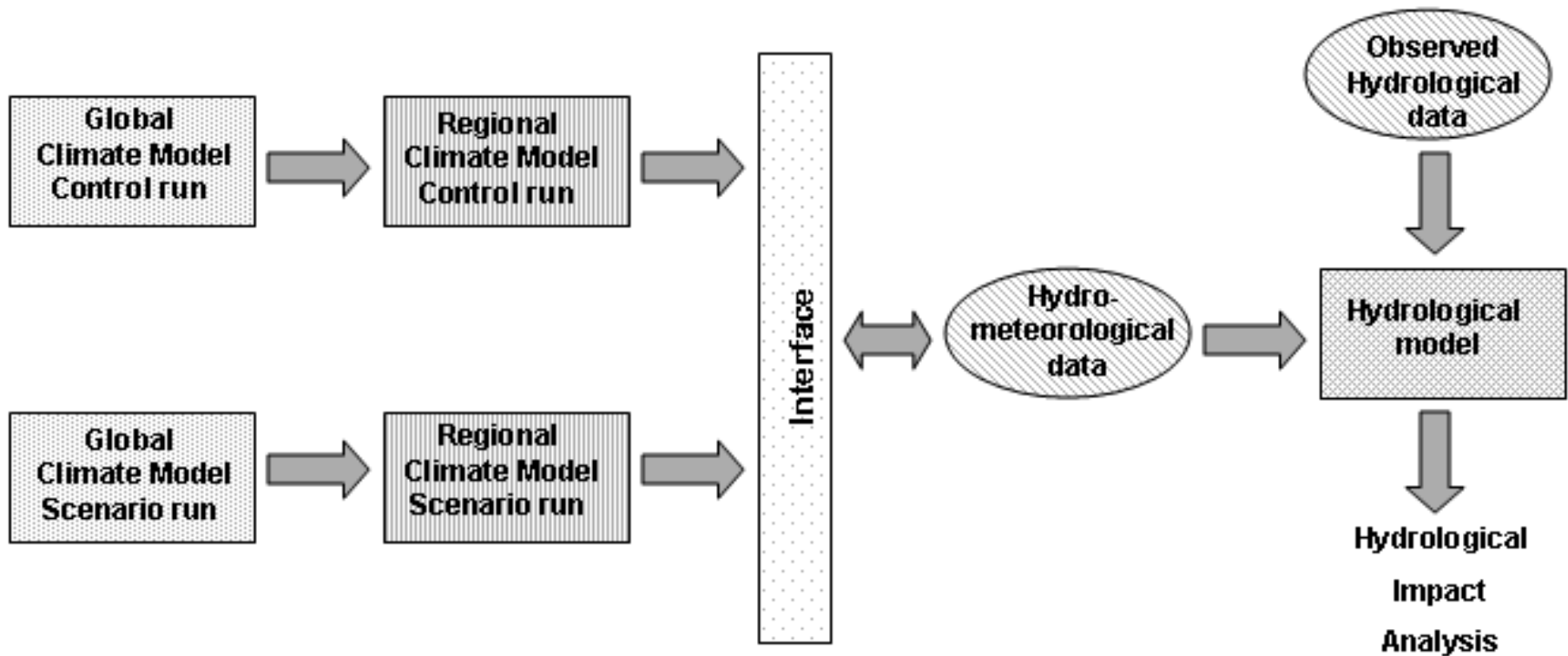
In view of the international peer review of IPCC uncertainty guidance, PIANC Task Group TG 3 has adopted the same terminology in its discussion of climate impacts.

Dealing with uncertainties (1)

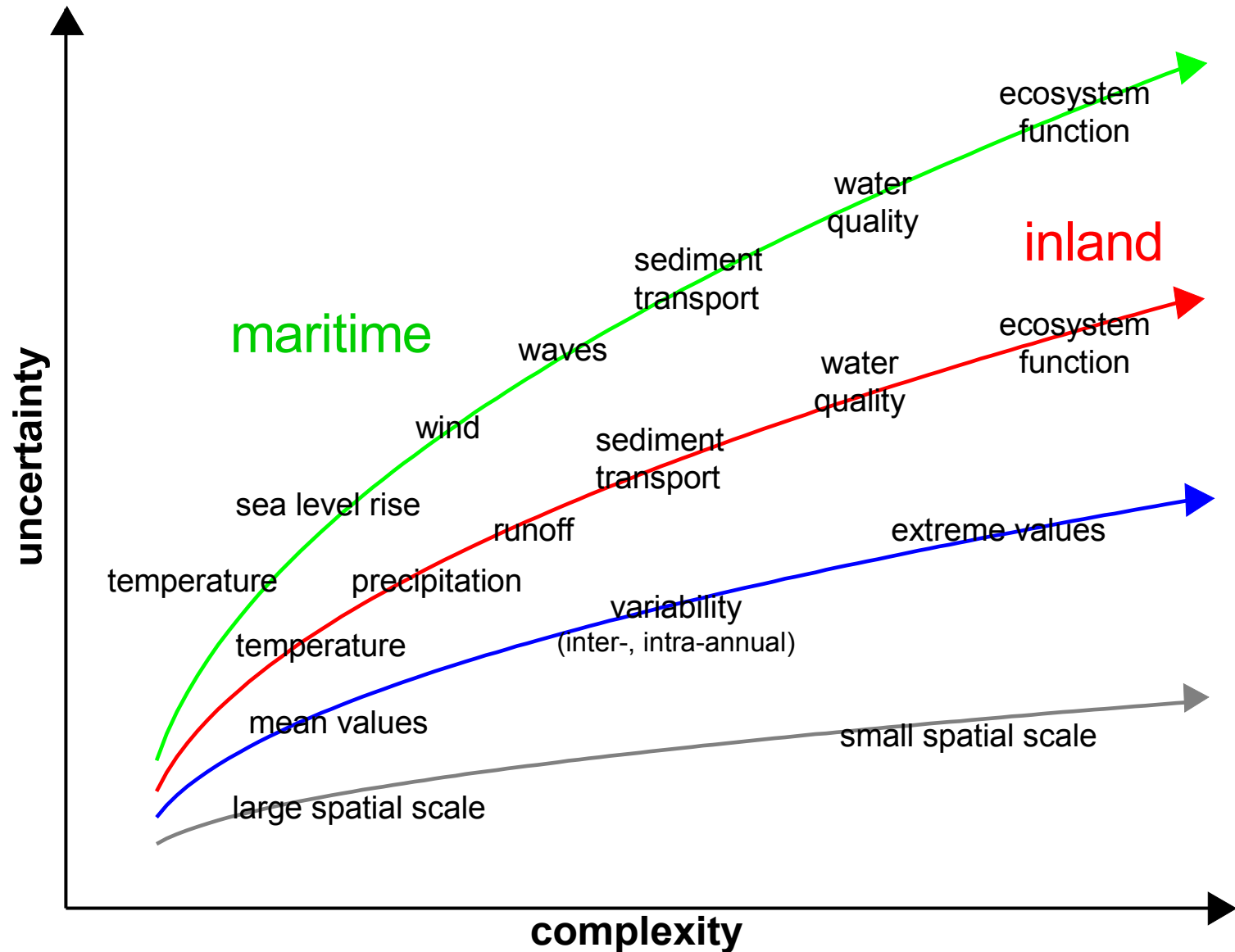


Dealing with uncertainties (2)

Methodology of coupling results of global and regional climate models in hydrological impact analysis of climate change

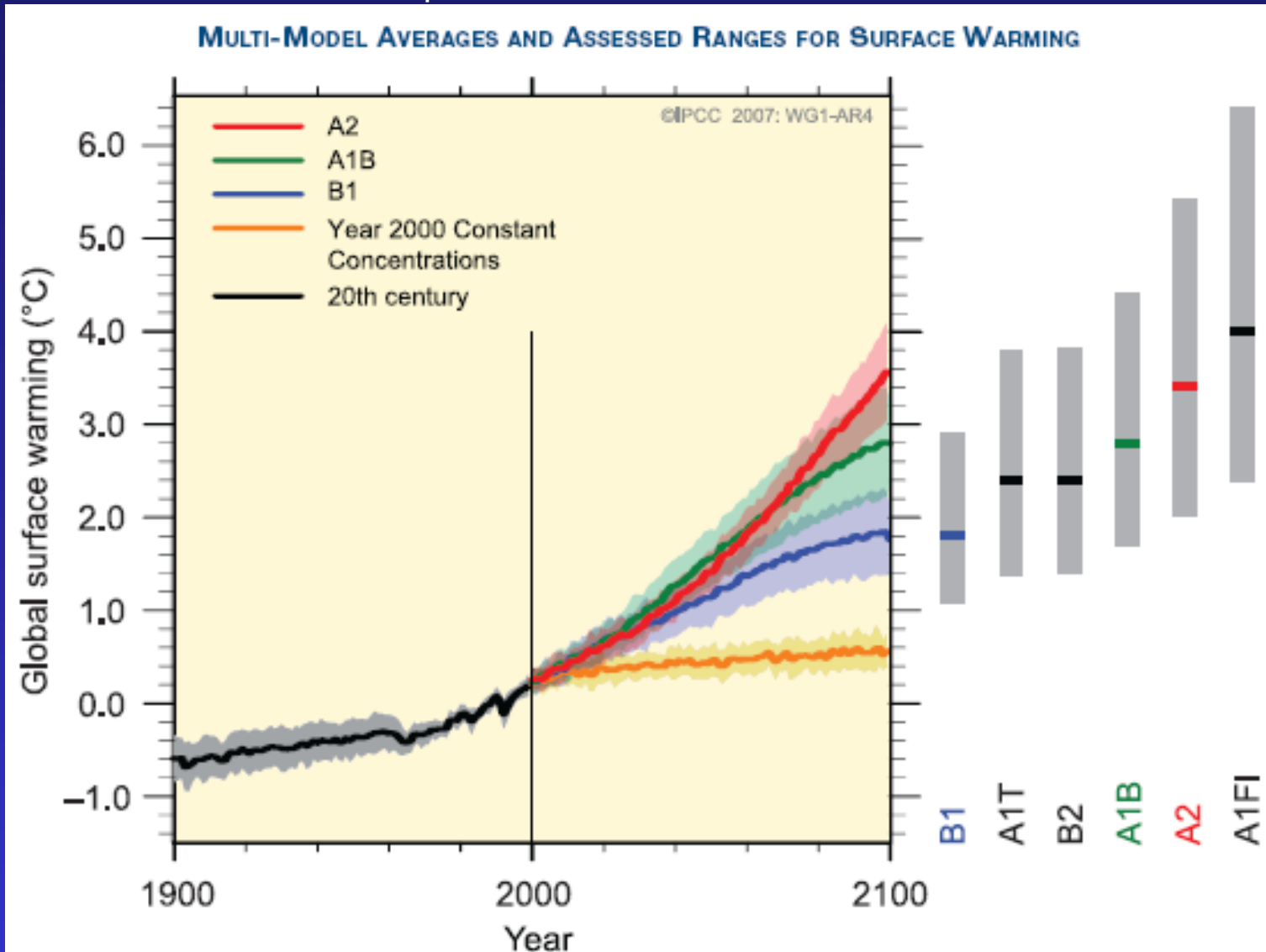


Dealing with uncertainties (3)



Global Warming Predicted Change in Temperature

reproduced from IPCC, 2007d



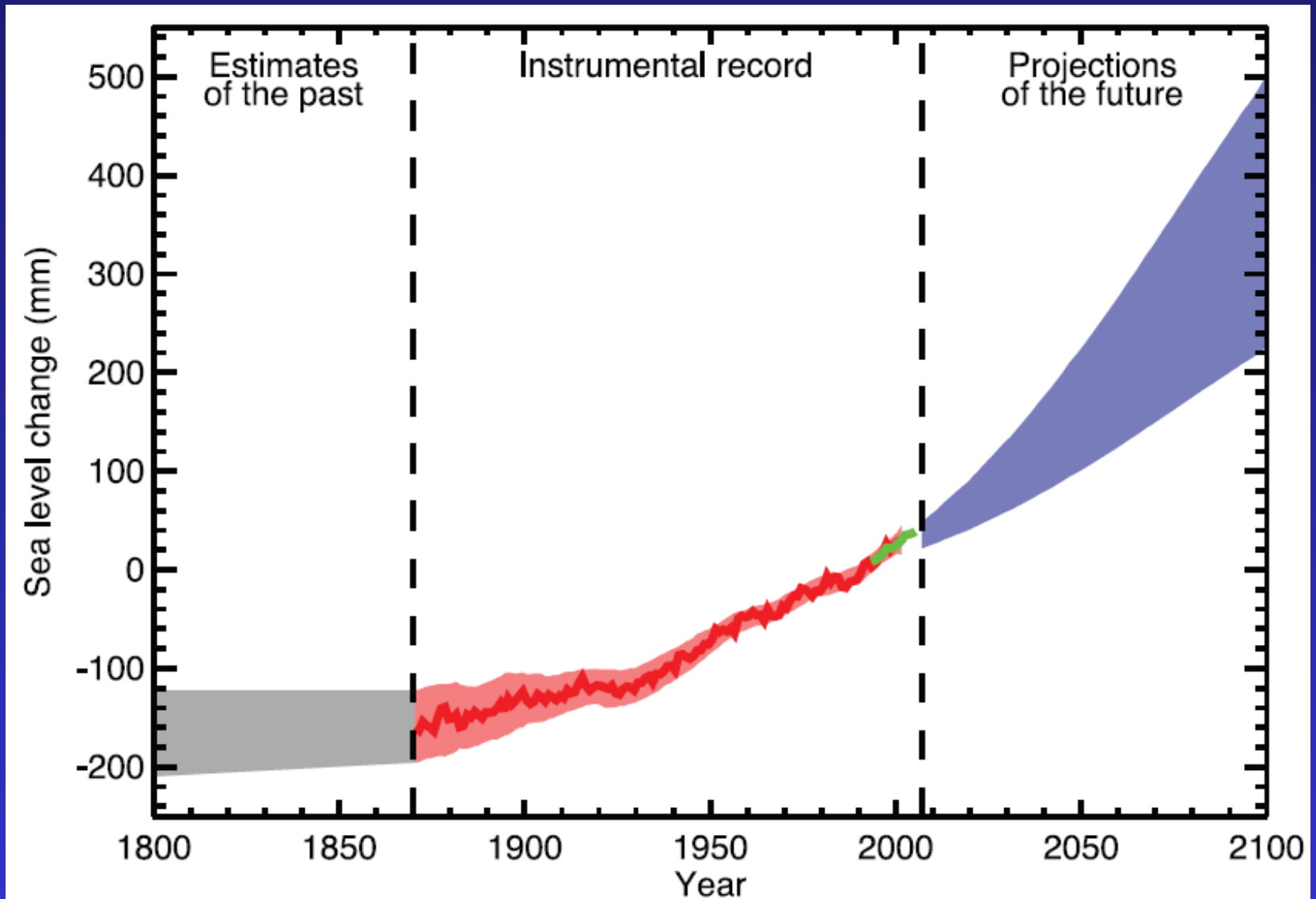
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3. Maritime navigation

- 3.1 Drivers of change relevant to navigation
 - 3.1.1 Sea level
 - 3.1.2 Wind conditions
 - 3.1.3 Wave action
 - 3.1.4 Tide and surge propagation and range
 - 3.1.5 Ocean circulations and coastal hydrodynamics
 - 3.1.6 Coastal and estuarine morphology
 - 3.1.7 Storm events
 - 3.1.8 Sea chemistry
 - 3.1.9 Designated environmentally protected areas
 - 3.1.10 Ice conditions
 - 3.1.11 Icing

Sea level rise

Observed and projected (SRES-A1B scenario)
(reproduced from IPCC, Bindoff et al., 2007)



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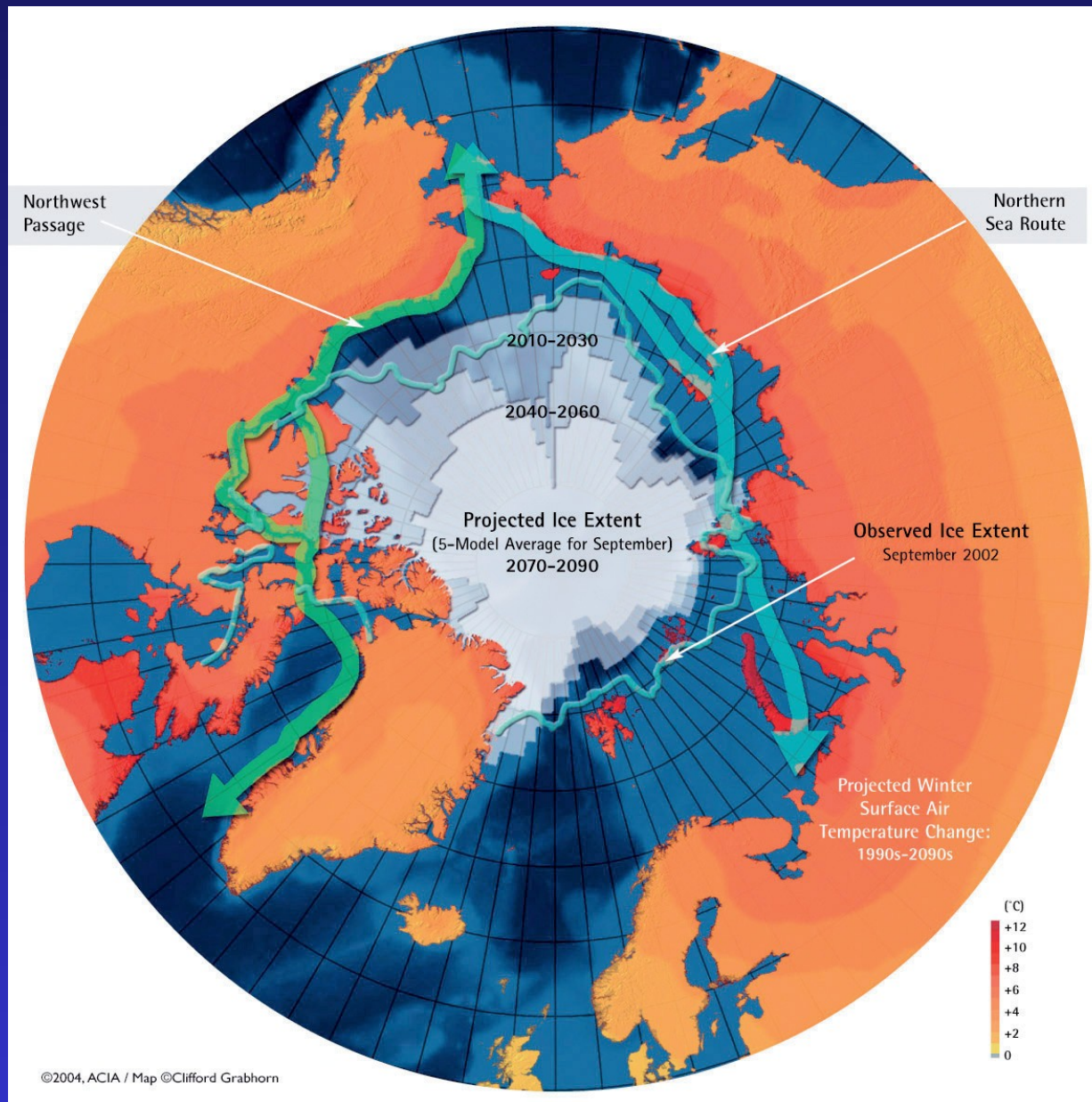
- 3.2 **Potential impacts** on maritime navigation
 - 3.2.1 Increase of global mean sea level and storm surges
 - 3.2.2 Increase of wind conditions
 - 3.2.3 Evolution of wave action
 - 3.2.4 Evolution of tidal propagation and range
 - 3.2.5 Changes in ocean circulations and coastal hydrodynamics
 - 3.2.6 Changes in ocean coastal and estuarine morphology
 - 3.2.7 Changes in storm events
 - 3.2.8 Changes in sea chemistry
 - 3.2.9 Relocation of designated environm. protected areas
 - 3.2.10 Changes in ice conditions
 - 3.2.11 Changes in icing
- 3.3 **Responses**

Drivers and impacts on maritime navigation

extract from EnviCom TG3 report, 2008

Drivers	Potential impact	Port	Coastal area	Offshore structure	Vessels
Increase in power and reach of storm surge, coastal flooding, spray zone and erosion patterns	Degradation, failure and replacement	x	x		
	Changed dredging requirements	x			
Change in magnitude and duration of storm surges and incidents of water over sea wall structures	Low land flooding	x	x		
Wave attack at a higher water level reducing the energy loss of breaking	Increased vulnerability of structures	x	x	x	

New Opportunities for Maritime Navigation



The Arctic ice cap
is shrinking in
summer and
thinning



Opening of new
shipping lanes

Observed and projected Arctic sea ice extent (reproduced from ACIA, 2004, 2005)

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1. Inland navigation

- 4.1 **Drivers of change** relevant to navigation
 - 4.1.1 Water supply in the navigable river sections
 - 4.1.2 Water temperature
 - 4.1.3 Extreme hydrological conditions
 - 4.1.4 River morphology
 - 4.1.5 Changes in ice cover

- 4.2 **Potential impacts** on navigation
 - 4.2.1 Water supply in the navigable river sections
 - 4.2.2 Water temperature
 - 4.2.3 Extreme hydrological conditions
 - 4.2.4 River morphology
 - 4.2.5 Changes in ice cover

- 4.3 **Responses**

Drivers and impacts on inland navigation

Drivers	Impacts	Rivers, channels, canals, lakes	Locks, dams, infrastructure	Operational control	Ves sels
Water supply: increased precipitation Extreme conditions: more extreme floods	Increased water level and velocity	X	X	X	X
	Changes in sedimentation processes (bank failure, local scour, locations of aggradation and degradation)	X	X	X	
	Manoeuvrability		X		X
	Increased loads on structures		X		
	Decreased development land area available		X		
	Reduced regularity of the port		X	X	
	Reduced capacity of natural systems to recover	X			
Water supply: decreased precipitation Extreme conditions: more extreme droughts	Decreased water level and velocity	X	X	X	X
	Reduced regularity of the port		X	X	
	Changes in sedimentation processes (locations of aggradation and degradation)	X	X	X	
	Reduced capacity of natural systems to recover	X			

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5. Mitigation – Navigation contributions to reduction of greenhouse gas emissions
 - 5.1 Technical, operational and transport management measures for mitigation of GHG emissions from navigation
 - 5.2 Policies and instruments to create incentives for mitigation action
 - 5.3 Costs and efficiency of mitigation of GHG emissions
 - 5.4 Interdependencies between mitigation, safety and environmental protection
 - 5.5 Climate change mitigation – opportunities for navigation
6. Conclusions

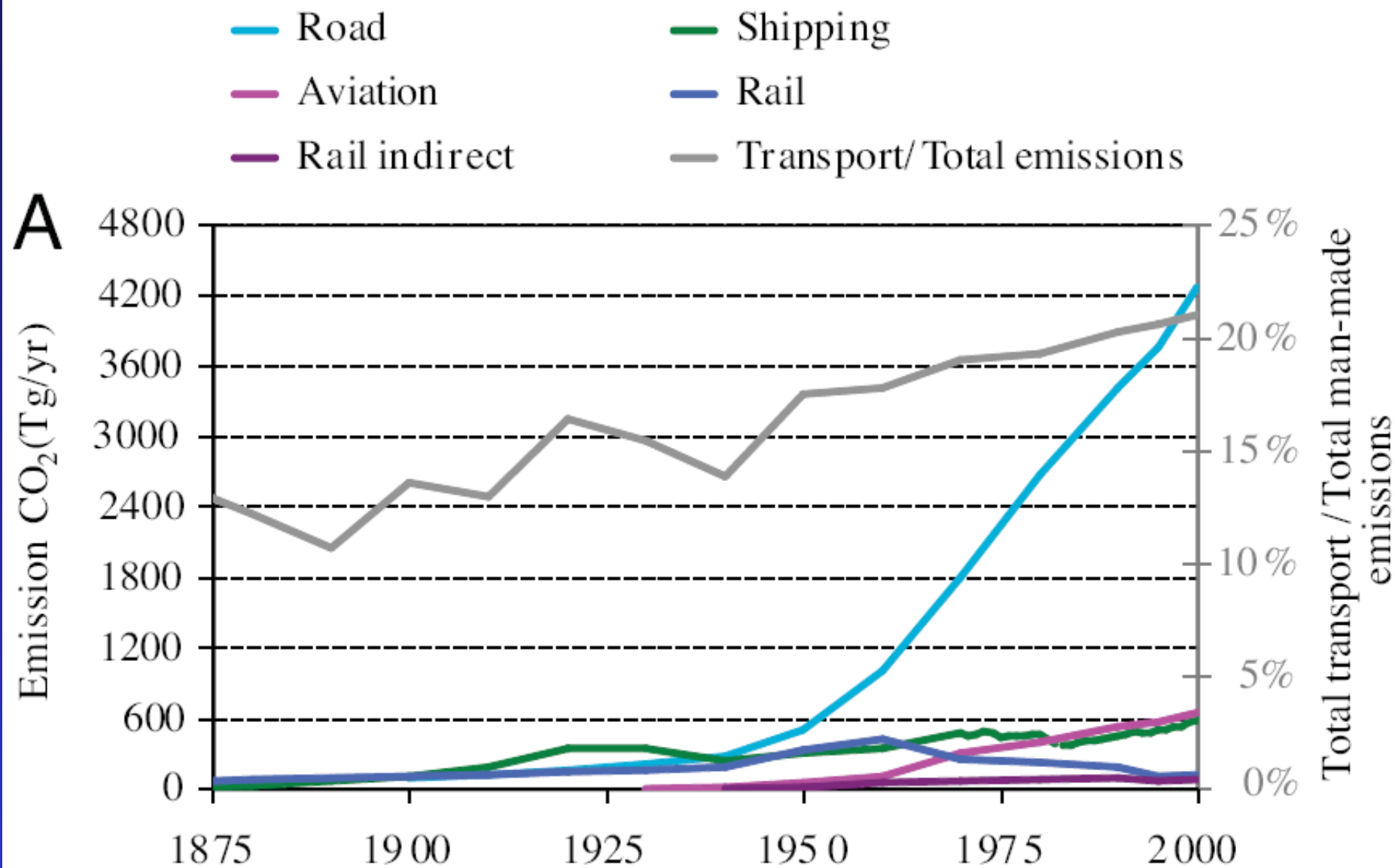
References

Navigation and CO₂ emissions

- main CO₂-emissions come from the seas (40 %), the vegetation (27 %) and the soil (27 %).
- about 4 % of global greenhouse gas (GHG) emission is due to anthropogenic causes
- of the anthropogenic emission, transportation and traffic is responsible for about 23 % of energy-related GHG emissions and to this part navigation contributes less than 10 %

Although navigation is not a main driving force to increase climate change caused by GHG emissions, the navigation sector should evaluate the possibilities to contribute to a reduction of anthropogenic GHG emissions to emphasize navigation as an environmentally sound mode of transportation.

Transport modes and CO₂-emissions



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Conclusions

TG3-report is an excellent and fundamental stepping stone for the navigation sector to prepare for the challenges of Climate Change.

Recognition of current climate change impacts and future impacts provides an opportunity for the navigation community to shape policies, adaptation strategies and mitigation measures for inland and maritime navigation.

Create a continuing dialogue for consideration of adaptation or mitigation strategies to climate change by the navigation community.

Climate Change will affect maritime and inland navigation in different ways.

Existing uncertainties and gaps about the impact of CC for navigation infrastructure have to be reduced for concrete adaptation measures.

The navigation sector should evaluate the possibilities to contribute to a reduction of anthropogenic GHG emissions (mitigation) to emphasize navigation as an environmentally sound mode of transportation.

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Next steps

All PIANC commissions will use the basic information and recommendations from TG 3 report to deepen their views on relevant technical aspects related to climate change:

e.g. PIANC (EnviCom, MarCom) is going to start already now a new WG with IAPH about

“Onshore electrical power supply”
(Reducing emissions in ports)

PIANC is going to communicate the TG3-report and further activities into relevant climate change policy activities (IMO, LC, EU, OSPAR).

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On behalf of PIANC EnviCom
and the EnviCom Task Group 3

Thank you for your attention.

Harald Köthe
Chairman PIANC EnviCom

