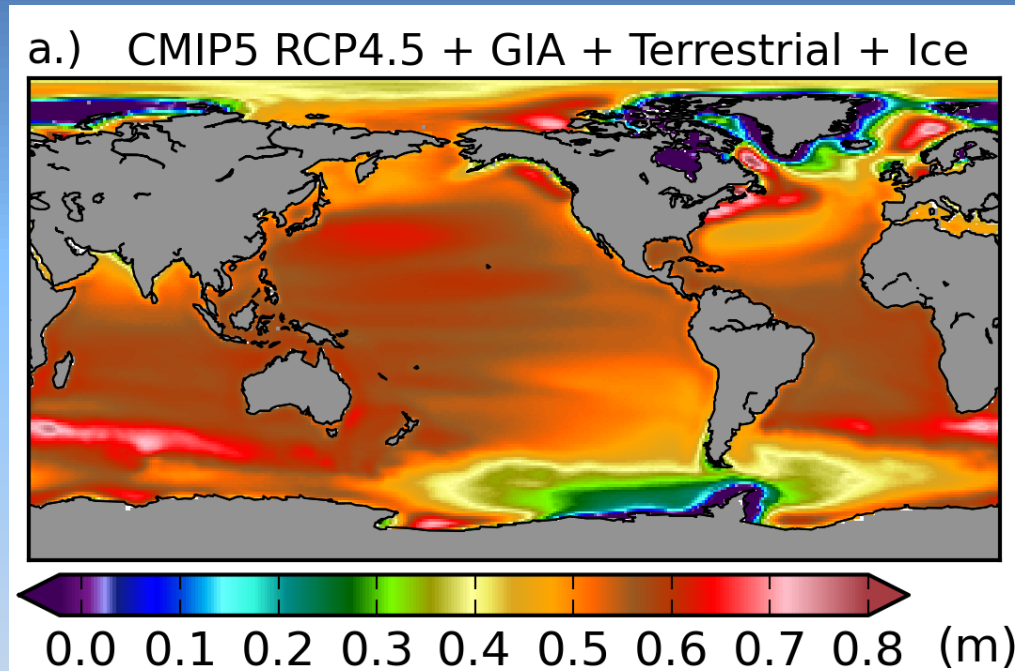


# GC Regional Sea-Level Change and Coastal Impacts



Carson et al., 2015

Robert Nicolls, Detlef Stammer, Roderik van de Wal.  
The GC Sea Level Steering Team

# Overarching Goal

**Integrated interdisciplinary program** on SL research reaching from the global to the regional and local scales to:

- Establish a **quantitative understanding** of the natural and anthropogenic mechanisms of regional to local sea level variability;
- Promote advances in observing systems required for an integrated SL monitoring;
- Foster the development of SL predictions and projections that are of increasing benefit for coastal zone management.

# Work Programm

Five parallel, but interconnected, working groups:

1. **An integrated approach to paleo time scale sea level estimates**
  2. **Quantifying the contribution of land ice to near-future sea level rise**
  3. **Causes for contemporary regional sea level variability and change**
  4. **Predictability of regional sea level**
  5. **Sea level science for coastal zone management**
  6. **Global sea level change**
- The GC group will provide an **assessment of the state of affairs of sea level research every 2 years** and will use the resulting information to make adjustments of its science plan and recommendations for international sea level research efforts.
  - The GC team will write **summaries on data and modeling issues**, bringing together information and recommendations from all working groups.

# Activities 2017

- International Sea Level Conference, NY, July 2017
- Individual WP activities
- FAFMIP Workshop, Princeton, July 2017
- Workshop on high-end sea level rise, Hamburg, September 2017
- ISSI workshop on coastal sea level
- OSM Session on contemporary sea level changes
- 1<sup>st</sup> Global sea level budget paper submitted (Cazenave et al, 2018)



INTERNATIONAL WCRP/IOC CONFERENCE 2017  
**Regional Sea Level Changes  
and Coastal Impacts**

**D. Stammer, R. Nicholls, R. van de Wal**



THE EARTH INSTITUTE  
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## ***The CONFERENCE VISION was***

*that we the **collective expertise** of the international sea level community, would:*

- Address existing challenges in describing and projecting regional and coastal sea level changes, and in quantifying intrinsic uncertainties.
- Review the state of the science, by prioritizing international research plans and by initiating new collaborations.
- **Conference was a success. First time combination of physical sea level science and coastal adaptation science.**



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## ***General Conference Outcome***

- **Our understanding of mean sea-level rise and its closure over the last century has improved substantially** with nearly a quarter of a century of altimetry data, Argo and GRACE being major contributions.
- **Elevated local sea level often can be related to climate modes (NAO, PDO, El Nino). But further research is needed to understand regional patterns in sea level.**
- **Physical understanding of the ice sheets has improved, but ice-ocean interaction remains poorly constrained.**



## ***General Conference Outcome***

- **We still lack information on sea level change in global coastal zones.**
- **The availability of high resolution regional sea level projections and high-end projections** are important for science and decision makers alike.
- **Impact and adaptation assessments and planning require a range of different drivers-- subsidence, mean changes, extremes and waves.**
- There are encouraging signs that these can be provided. Our understanding of extreme sea levels is also improving. Trends in extremes largely follow mean sea-level changes.
- **Human-induced land subsidence is a major problem in some coastal areas, such as China's coastal cities.**



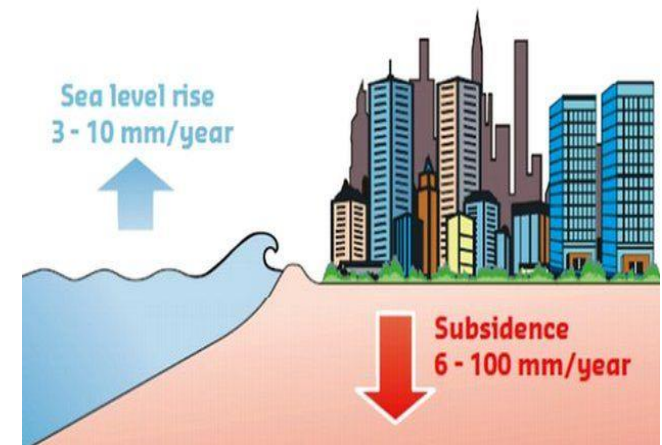
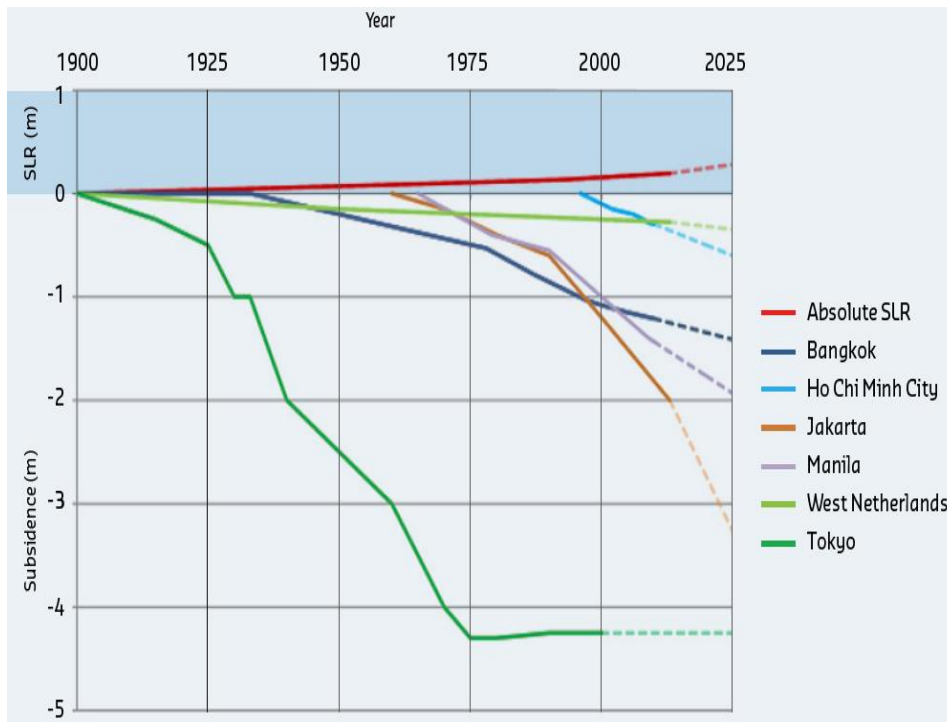
## ***General Conference Outcome***

- **Stakeholders require diverse sea-level rise information and they may not always receive the type of information that is required.** This is an important lesson that we need to heed. There is a real opportunity to co-produce the information that is needed with relevant stakeholders.
- **Strong dialogue between sea-level scientists and the impact and adaptation community to ensure** that appropriate information is provided, such as present and projected changes in future mean and extreme sea levels, wave conditions and potential impacts such as coastal erosion.
- **The conference recognizes the need for an enhanced and internationally coordinated sea level change program, including the provision of appropriate sea-level change services as part of a wider sea-level rise impact and adaptation effort.**
- **This program should be designed to serve the needs of local to national stakeholders, and the global community to cope with present and future sea-level change risks.**



# INTERNATIONAL WCRP/IOC CONFERENCE 2017 Regional Sea Level Changes and Coastal Impacts

**Land subsidence  
can contribute to  
RSLR much more  
than SLR**



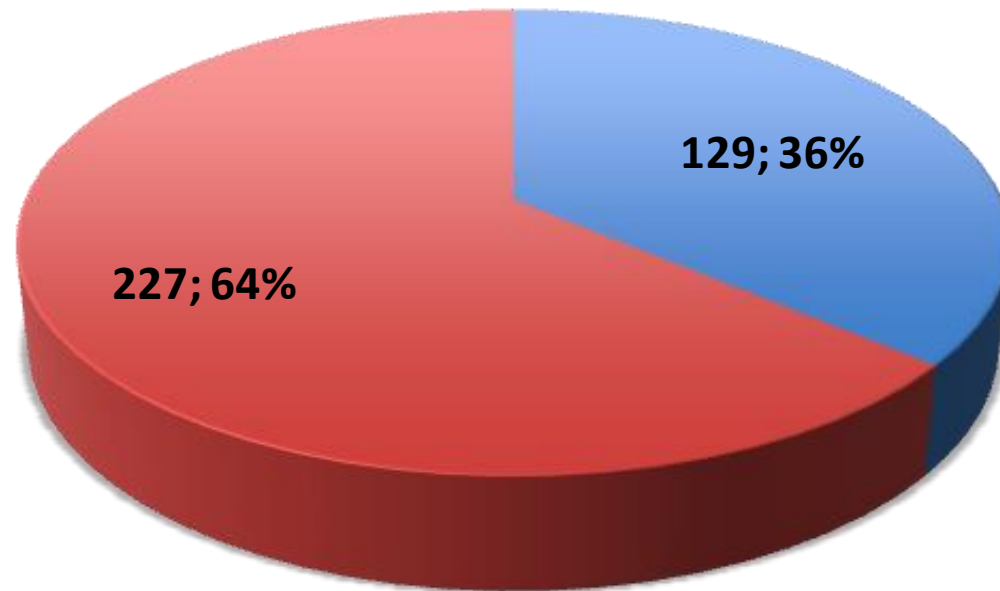


# **Wednesday Night Public Outreach Event**

- **It was an important experience;**
- **Every WCRP/IOC conference should have such an outreach component.**



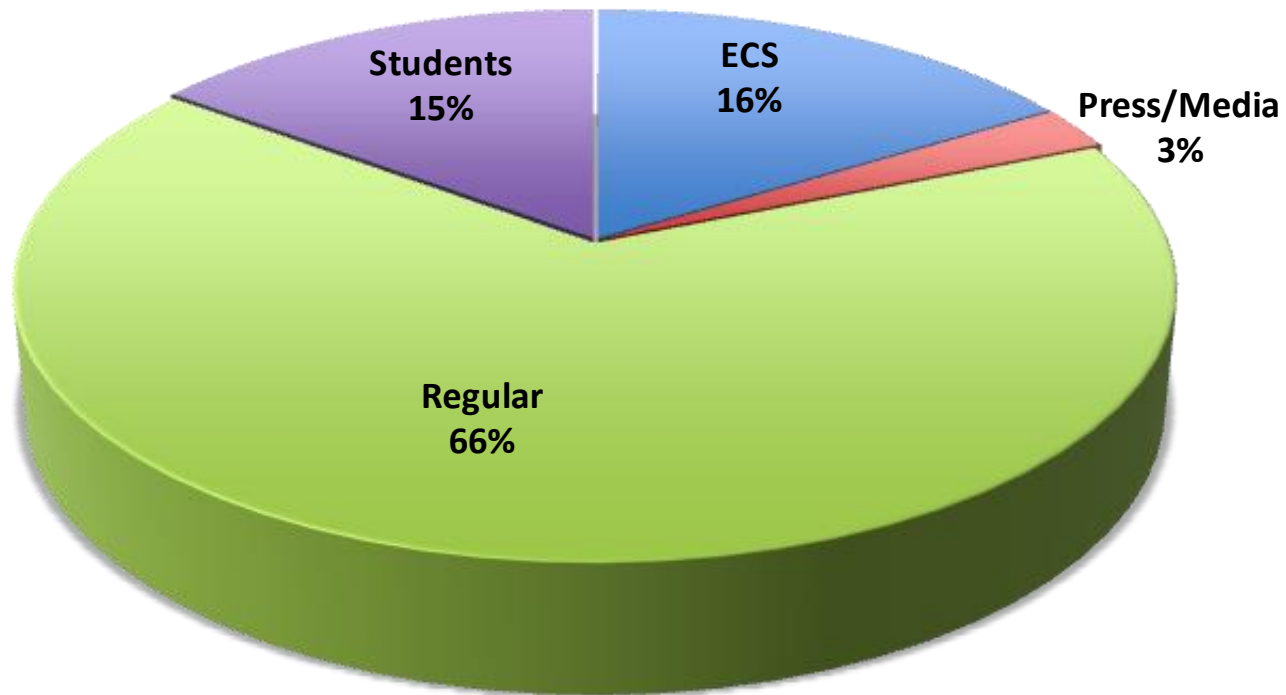
## 356 PARTICIPANTS




■ Female ■ Male



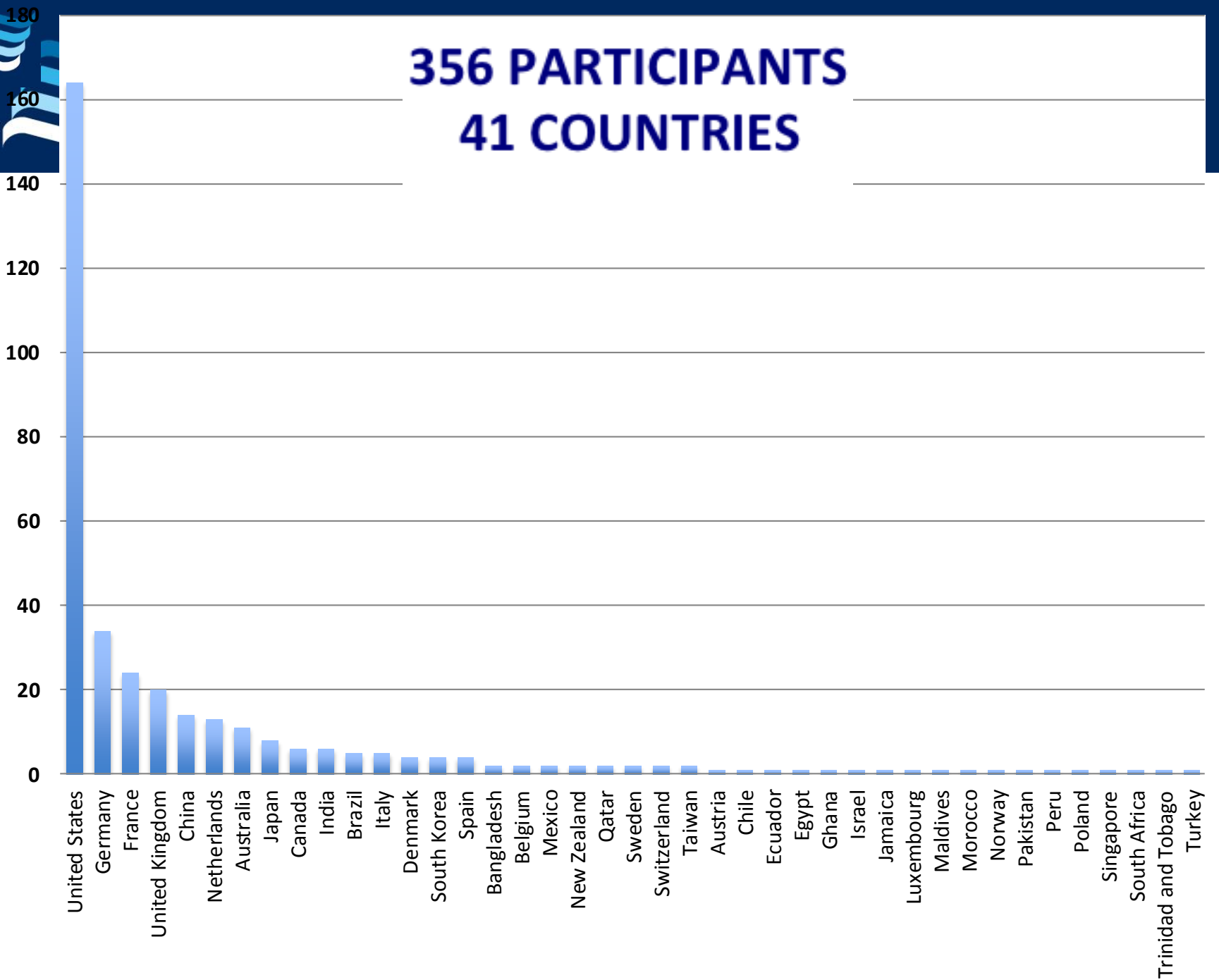
## 4 TYPES OF PARTICIPANTS



 ECS    Press/Media    Regular    Students



# 356 PARTICIPANTS 41 COUNTRIES







# INTERNATIONAL WCRP/IOC CONFERENCE 2017 Regional Sea Level Changes and Coastal Impacts

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## Workshop on High-End Sea Level Rise:

**Can we create useful high-end estimates of  
future sea-level rise?**

Detlef Stammer

The workshop was organized by the WCRP Grand Challenge on sea level with financial support by the German SPP1889 “SeaLevel”.

# Background

- Sea-level rise due to both climate change and non-climatic factors threatens coastal settlements, infrastructure, and ecosystems.
- Evolving science provides new information that can increase clarity about the nature of projected sea level rise.
- But also in many ways it increases uncertainty about how decision makers, planners, and engineers should adopt the latest science in adaptation efforts.
- Projections of mean global sea-level rise provide insufficient information to plan adaptive responses.
- Local decisions require local projections that accommodate different risk tolerances and time frames and that can be linked to storm surge projections.

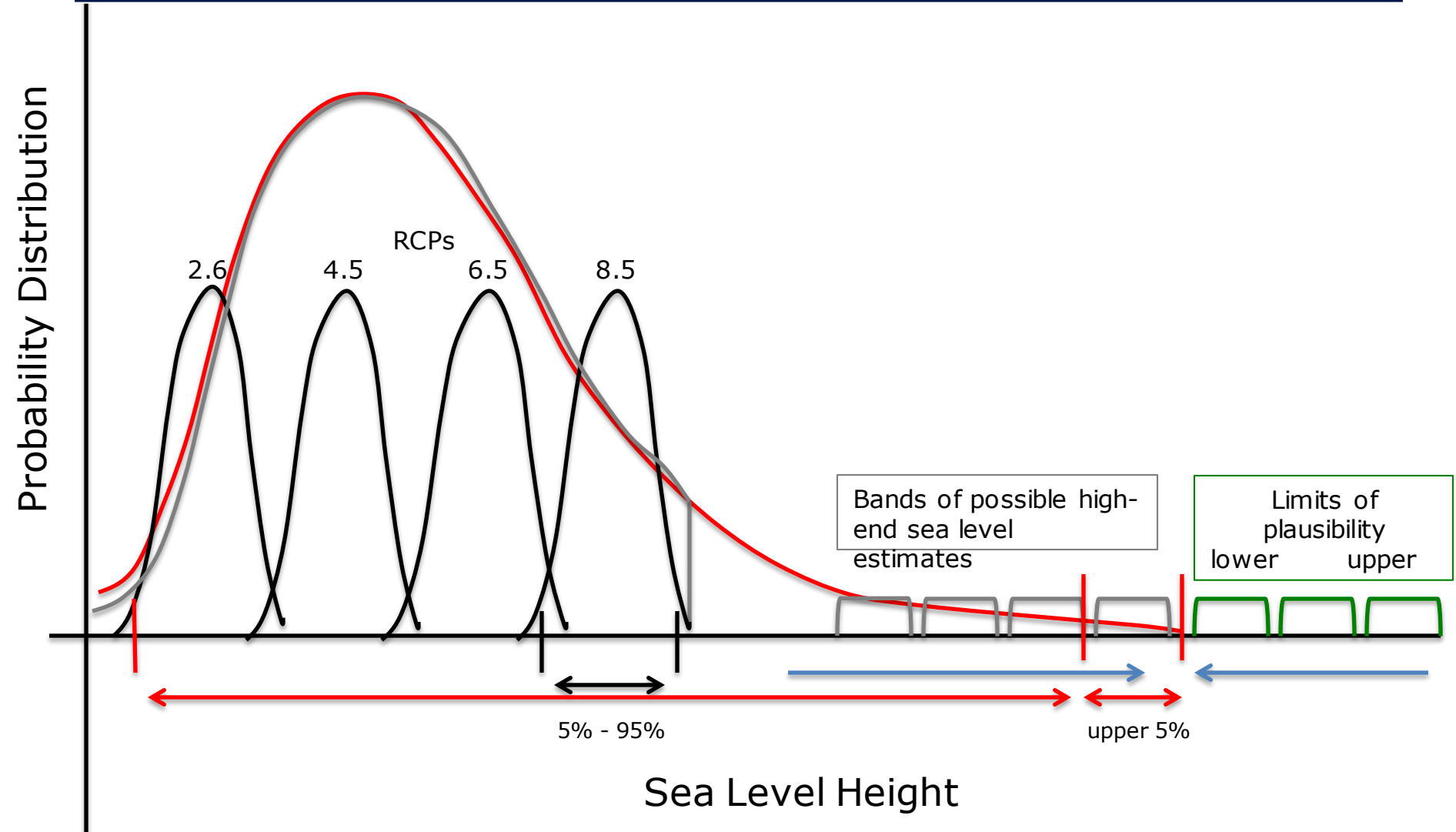
# Background

- High uncertainty exists about the magnitude of sea level rise through the 21<sup>st</sup> century and beyond, both globally and on regional scale.
- Physically, the rise will depend on emission scenarios, and the response of individual climate components to the respective temperature increase.
- **Stakeholders have the strong need for information on high-end or upper bound scenarios. However, different perspectives on high-end scenarios exist.**
- It needs to be reconciled which one provides the best scientific data in support of governments and coastal decision-makers.

# Goal of Workshop

- **Understand the different concepts on high-end sea level changes, agree on key concepts, definitions and terminology, including probabilistic approaches and upper bound concepts.**
- **Thrust of the discussion on the conceptual framework and feasibility of the possible approaches, rather than on the assessment of individual estimates.**
- The goal of the workshop was not to develop and agree on a number, nor is it an expert consultation.

# Different concepts of high-end sea level



# Results

- Global mean sea level rise for 2081–2100 relative to 1986–2005 will likely be in the ranges of 0.26 to 0.55 m for RCP2.6, ... 0.45 to 0.82 m for RCP8.5 (medium confidence). For RCP8.5, the rise by the year 2100 is 0.52 to 0.98 m, with a rate during 2081 to 2100 of 8 to 16 mm yr<sup>-1</sup> (medium confidence).
- Based on current understanding, only the collapse of marine-based sectors of the Antarctic ice sheet, if initiated, could cause global mean sea level to rise substantially above the likely range during the 21st century. However, there is medium confidence that this additional contribution would not exceed several tenths of a meter of sea level rise during the 21st century.

# Antarctic Ice Sheet

- The Greenland Ice sheet and its contribution to sea level seems to be understood.
- However, the Antarctic ice sheet constitutes a growing share of variance and uncertainties in GSL and LSL projections: In the global average and at many locations, it is the dominant source of variance in late 21st century projections.
- At some sites oceanographic processes contribute the largest share throughout the century.
- LSL rise dramatically reshapes flood risk, greatly increasing the expected number of “1-in-10” and “1-in-100” year events.



# Uncertainty factors

- In the high end we need to distinguish emissions scenarios, sea level response to emissions, risk-averseness according to different purposes.
- RCP8.5 may be economically “inconsistent”.
- **We do not know the climate dependence of rapid ice-sheet dynamical change, which is the biggest uncertainty.**
- Lack of correlation in projections between global warming and sub-ice-shelf warming. Incursion of CDW onto shelf in recent decades may not be anthropogenic, might be ozone-forced.

# Other ongoing and planned Activities

- OSM Session on sea level changes (WP3)
- Workshop at ISSI in March 2018 on interaction basin wide changes and coastal changes.
- Summer School, June 2018 in Qingdao
- Paper writing workshop at NCAR, 2018
  
- Papers:
  - Special issue from ISSI workshop
  - Terminology
  - High-end sea level
  - Review Coastal sea level
  - Review sea level science
  
- Reports:
  - Observational requirements
  - Modeling requirements

# Outlook

- 2018, Qingdao in collaboration with FIO: July: Sea



