

A unified approach to quantify uncertainties in sea level projections

Gonéri Le Cozannet, Jeremy Rohmer, Jean-Charles Manceau, Gaël Durand, Catherine Ritz, Angélique Melet, Benoit Meyssignac, David Salas y Mélia, Aimée B.A. Slangen, Jochen Hinkel, et al.

▶ **To cite this version:**

Gonéri Le Cozannet, Jeremy Rohmer, Jean-Charles Manceau, Gaël Durand, Catherine Ritz, et al.. A unified approach to quantify uncertainties in sea level projections. AGU Fall Meeting, Dec 2018, Washington, United States. hal-01885931

HAL Id: hal-01885931
https://brgm.hal.science/hal-01885931

Submitted on 2 Oct 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A unified approach to quantify uncertainties in sea level projections

Goneri Le Cozannet[1], Jeremy Rohmer[1], Jean-Charles Manceau[1], Gael Durand[2], Catherine Ritz[3], Angelique Melet[4], Benoit Meyssignac[5], David Salas y Mélia[6], Aimée Slangen[7], Jochen Hinkel[8], Roderik Vandewal[9], Mark L Carson[10] and Detlef Stammer[10], (1)BRGM, Orleans, France, (2)Institut des Géosciences de l'Environnement, CNRS/Univ. Grenoble Alpes/G-INP/IRD, Grenoble, France, (3)LGGE Laboratoire de Glaciologie et Géophysique de l'Environnement, Saint Martin d'Hères, France, (4)Mercator Ocean, Princeton, France, (5)Observatory Midi-Pyrenees, Toulouse, France, (6)Météo-France Toulouse, Toulouse, France, (7)NIOZ, Yerseke, Netherlands, (8)Global Change Forum, Berlin, Germany, (9)Utrecht University, Utrecht, Netherlands, (10)University of Hamburg, Hamburg, Germany

Abstract Text:

By 2100, between 0.2 and 4.6% of the global population is expected to be flooded annually. The uncertainties of this statement originate from climate change scenarios, coastal impact models as well as different sea level projections. In the most recent research, uncertainties in sea level projections have been provided in a probabilistic form, in resonance with the common practice in coastal engineering. However, because the physical processes affecting land-ice melting remain still incompletely understood today, different probabilistic projections can be provided. The co-existence of various credible physical mechanisms defines a higher level of uncertainty beyond probabilities, which is referred to as “ambiguity” in the literature. Here, we build on extra-probabilistic theories of uncertainties to provide a unified approach to quantify ambiguity in sea level projections. We show that the knowledge gained regarding ice sheets melting since the AR5 allows to quantify the relationship between ambiguity in sea level projections and greenhouse gas emissions scenarios, both globally and regionally: limiting climate change to RCP 4.5 instead of RCP 8.5 reduces ambiguity by 40% globally, and even 70% for RCP 2.6. Europe and Northern America benefit the most from a policy limiting climate change to RCP 2.6 instead of RCP 4.5. For adaptation planning, this means that mitigation of climate change strongly reduces the risks of high-impact high end scenarios along most of the coasts. Our results provide a baseline to select regional high end scenarios, whose probability is difficult to quantify, but which are associated with high risks of impacts and are therefore particularly relevant for adaptation planning.

Plain-Language Summary:
Over the coming century, sea level will continue rising to an amount which remains highly uncertain. This is summarized by the AR5 IPCC report using a likely range between 30cm and 1m depending on future greenhouse gas emissions. Probability, though a powerful tool for uncertainty treatment, remains however a poor descriptor of this situation, which encompasses lack of knowledge and of consensus in the scientific community on numerous physical processes with different kinematics, and particularly its ice melting component. Consequently, a unique probability model can hardly and unambiguously be provided to represent the uncertainties of future sea level rise. In this contribution, we show how this level of uncertainties, which is termed ambiguity in the literature, can be understood, quantified, and communicated with extra-probabilistic theories of uncertainties.

Session Selection:
Quantifying and Decreasing Uncertainty in Projections of Future Sea Level Change

Submitter's E-mail Address:
g.lecozannet@brgm.fr
Abstract Title:
A unified approach to quantify uncertainties in sea level projections
Requested Presentation Type:
Assigned by Program Committee (oral or Poster)
Previously Published?:
No
AGU On-Demand:
Yes
Abstract Payment:

Paid (agu-fm18-373793-0214-4799-1112-7902)

For non-students only: I am interested in receiving information on the AGU mentoring program.

First Presenting Author
Presenting Author
Goneri Le Cozannet

Primary Email: G.LeCozannet@brgm.fr
Phone: ARRAY(0xf428314)

Affiliation(s):

BRGM
Orleans 45060 (France)

Second Author
Jeremy Rohmer

Primary Email: j.rohmer@brgm.fr

Affiliation(s):

BRGM
Orleans 45060 (France)

Third Author
Jean-Charles Manceau

Primary Email: jc.manceau@brgm.fr
Phone: ARRAY(0xf428314)

Affiliation(s):

BRGM
Orleans 45060 (France)

Fourth Author
Gael Durand

Primary Email: gael.durand@univ-grenoble-alpes.fr

Affiliation(s):

Institut des Géosciences de l'Environnement, CNRS/Univ. Grenoble Alpes/G-INP/IRD
Grenoble (France)

Fifth Author
Catherine Ritz

Primary Email: catherine.ritz@lgge.obs.ujf-grenoble.fr

Affiliation(s):

LGGE Laboratoire de Glaciologie et Géophysique de l’Environnement
Saint Martin d'Hères (France)

Sixth Author
Angelique Melet

Primary Email: angelique.melet@mercator-ocean.fr

Affiliation(s):

Mercator Ocean
Princeton (France)

Seventh Author
Benoit Meyssignac

Primary Email: benoit.meyssignac@legos.obs-mip.fr

Affiliation(s):

Observatory Midi-Pyrenees
Toulouse (France)

Eighth Author
David Salas y Mélia

Primary Email: david.salas@meteo.fr

Affiliation(s):

Météo-France Toulouse
Toulouse (France)

Ninth Author
Aimée Slangen

Primary Email: Aimee.Slangen@nioz.nl

Affiliation(s):

NIOZ
Yerseke (Netherlands)

Tenth Author
Jochen Hinkel

Primary Email: hinkel@globalclimateforum.org

Affiliation(s):

Global Change Forum
Berlin (Germany)

Eleventh Author
Roderik Vandewal

Primary Email: r.s.w.vandewal@uu.nl

Affiliation(s):

Utrecht University
Utrecht 3512 JE (Netherlands)

Twelfth Author
Mark L Carson

Primary Email: mark.carson@uni-hamburg.de

Affiliation(s):

University of Hamburg
Hamburg (Germany)

Thirteenth Author
Detlef Stammer

Primary Email: detlef.stammer@uni-hamburg.de

Affiliation(s):

University of Hamburg
Hamburg (Germany)