

WCRP Grand Challenge on Regional Sea Level Change and Coastal Impacts

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RF overview

The “Regional Sea Level Change and Coastal Impacts” (GCSL for short hereafter) is one of the WCRP Grand Challenges, managed by CLIVAR. The decision to develop this GC occurred during the 19th session of CLIVAR SSG in 2012, in line with one of the WCRP grand challenge topics “Regional Sea Level Change” agreed by WCRP JSC. Over an 8-year period (Jan 2015 - Dec 2022), the program is to address the following imperatives, which are being approached via six parallel, but strongly interconnected, working groups:

1. An integrated approach to historic sea level estimates (paleo time scale)
2. Quantifying the contribution of land ice to near-future sea level rise
3. 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

Achievements for 2020-2021

The activities of the GCSL during the 2020-2021 time period have focused on three activities agreed upon at the workshop on coastal climate services held in Orleans, in October 2019. These were to

- Develop a special issue in *Frontiers in Marine Science* titled, “Climate Services for adaptation to sea-level rise”:
- Undertake a study of practitioner needs for sea-level science
- Develop a manuscript on a high-end estimate of sea-level rise for practitioners that builds off the framework for high-end estimates outlined in Stammer et al, 2019

The special issue for climate services for adaptation so far has 12 papers accepted (listed below) with two still under review (see <https://www.frontiersin.org/research-topics/13632/climate-services-for-adaptation-to-sea-level-rise#articles>).

The project to understand practitioner needs from sea level science, led by David Behar commenced in 2020. Coastal practitioner contacts were sought worldwide to contribute to a survey developed by Dr Daniella Hirschfeld, Utah State University. The broad research goals of this work are:

- Create a database that captures the sea level rise numbers or scenarios being used in decision making by local and regional planners across the globe;
- Identify the similarities and the differences between the numbers, the planning timeframes and the context of their development; and
- Explore the causes and implications of the similarities and differences between locations. Specifically, we are looking to draw conclusions on leading practices to improve coastal climate services’ ability to support local decision making.

These goals will be achieved by:

- Learning from local decision makers about the development and use of sea level rise projections in the local planning context
- Understanding how planning agencies develop or select sea level rise projections
- Surveying what sea level rise projections planning agencies use
- Gaining knowledge of what non-climate change-related factors (e.g., land subsidence ocean currents, etc.) are included in planning agencies' sea level rise projections, and
- Gathering information on how planning agencies use sea level rise projections.

In 2020, a total of 667 surveys were sent to practitioners in 50 countries. 250 completed surveys have been received and these indicate that 70% of respondents are using sea level rise in their planning process. Analysis of the surveys is underway.

The project to develop a high-end estimate of sea level rise commenced with a workshop in September 2020 involving relevant members of the work packages and invited experts in ice sheets and glaciers to promote a community effort. During 2021, a manuscript has been developed and is close to submission.

The final major activity by the GCSL has been the planning of a sea-level conference in Singapore aimed at July 12-16, 2022 as a follow-up activity to the New York Conference in 2017 and as a sunset event for the GCSL. This meeting will be held over five days with four days focused on the science of the six work packages, and a day dedicated to practitioners needs to enhance the science-practitioner interface. For more information see: <https://www.clivar.org/events/wcrp-international-conference-2022-singapore-regional-sea-level-change-and-coastal-impacts>

Plans for 2022 and beyond

- January 2022, submission of a community-led manuscript on high-end sea level estimates for practitioners.
- February 2022, a virtual practitioner workshop will be held. This workshop is aimed to bring together participants in the practitioner survey and sea-level scientists to progress the learnings from the survey to better target sea-level rise information in decision-making. This workshop will also provide learnings that will be used to inform the detailed structure of the practitioner day at the Singapore conference in July.
- Planning for the Singapore conference which will be ongoing to July 2022.
- Preparing a manuscript on Practitioner needs from sea-level science for decision making

Articles published in 2020/21 as part of RF activities (if any)

1. Sweet WV, Genz AS, Obeysekera J and Marra JJ (2020) A Regional Frequency Analysis of Tide Gauges to Assess Pacific Coast Flood Risk. *Front. Mar. Sci.* 7:581769. doi: 10.3389/fmars.2020.581769
2. Su J, Andrée E, Nielsen JW, Olsen SM and Madsen KS (2021) Sea Level Projections From IPCC Special Report on the Ocean and Cryosphere Call for a New Climate

- Adaptation Strategy in the Skagerrak-Kattegat Seas. *Front. Mar. Sci.* 8:629470. doi: 10.3389/fmars.2021.629470
3. Mitchell M, Isdell RE, Herman J and Tombleson C (2021) Impact Assessment and Management Challenges of Key Rural Human Health Infrastructure Under Sea Level Rise. *Front. Mar. Sci.* 8:631757. doi: 10.3389/fmars.2021.631757
 4. Amores A, Marcos M, Pedreros R, Le Cozannet G, Lecacheux S, Rohmer J, Hinkel J, Gussmann G, van der Pol T, Shareef A and Khaleel Z (2021) Coastal Flooding in the Maldives Induced by Mean Sea-Level Rise and Wind-Waves: From Global to Local Coastal Modelling. *Front. Mar. Sci.* 8:665672. doi: 10.3389/fmars.2021.665672
 5. Melville-Rea H, Eayrs C, Anwahi N, Burt JA, Holland D, Samara F, Paparella F, Al Murshidi AH, Al-Shehhi MR and Holland DM (2021) A Roadmap for Policy-Relevant Sea-Level Rise Research in the United Arab Emirates. *Front. Mar. Sci.* 8:670089. doi: 10.3389/fmars.2021.670089
 6. Luque P, Gómez-Pujol L, Marcos M and Orfila A (2021) Coastal Flooding in the Balearic Islands During the Twenty-First Century Caused by Sea-Level Rise and Extreme Events. *Front. Mar. Sci.* 8:676452. doi: 10.3389/fmars.2021.676452
 7. Toimil A, Camus P, Losada IJ and Alvarez-Cuesta M (2021) Visualising the Uncertainty Cascade in Multi-Ensemble Probabilistic Coastal Erosion Projections. *Front. Mar. Sci.* 8:683535. doi: 10.3389/fmars.2021.683535
 8. Melet A, Buontempo C, Mattiuzzi M, Salamon P, Bahurel P, Breyiannis G, Burgess S, Crosnier L, Le Traon P-Y, Mentaschi L, Nicolas J, Solari L, Vamborg F and Voukouvalas E (2021) European Copernicus Services to Inform on Sea-Level Rise Adaptation: Current Status and Perspectives. *Front. Mar. Sci.* 8:703425. doi: 10.3389/fmars.2021.703425
 9. Lawrence J, Stephens S, Blackett P, Bell RG and Priestley R (2021) Climate Services Transformed: Decision-Making Practice for the Coast in a Changing Climate. *Front. Mar. Sci.* 8:703902. doi: 10.3389/fmars.2021.703902
 10. Legeais J-F, Meyssignac B, Faugère Y, Guerou A, Ablain M, Pujol M-I, Dufau C and Dibarboure G (2021) Copernicus Sea Level Space Observations: A Basis for Assessing Mitigation and Developing Adaptation Strategies to Sea Level Rise. *Front. Mar. Sci.* 8:704721. doi: 10.3389/fmars.2021.704721
 11. Simm J, Gouldby B, Lumbroso D and Matthewson T (2021) Effective Coastal Climate Services—An End-User Perspective for Resilient Infrastructure. *Front. Mar. Sci.* 8:706048. doi: 10.3389/fmars.2021.706048
 12. Nicholls RJ, Beaven RP, Stringfellow A, Monfort D, Le Cozannet G, Wahl T, Gebert J, Wadey M, Arns A, Spencer KL, Reinhart D, Heimovaara T, Santos VM, Enríquez AR and Cope S (2021) Coastal Landfills and Rising Sea Levels: A Challenge for the 21st Century. *Front. Mar. Sci.* 8:710342. doi: 10.3389/fmars.2021.710342

Budget and other needs for 2022 (in CHF)

Due to the ongoing on-line nature of interactions, there have been no costs for continuing the work of the SL GC. However, a request of \$20K CHF has been requested for the preparations for the Singapore SLR conference in 2022.

Annex A

Proforma for CLIVAR Research Focus requests for SSG approval for meetings

Note: If your group has approved funds in 2021 that were not used because of Covid19 and any other unexpected issues, and you propose to use them in 2022, they should be included again in this request, in addition to any new request.

1. RF name:
2. Title of meeting or workshop:
3. Proposed venue (or indicate if online):
4. Proposed dates:
5. Proposed attendees, including likely number:
6. Rationale, motivation and justification, including: relevance to CLIVAR science & WCRP Strategic Plan and Lighthouse Activities, and any cross-panel/research foci links and interactions involved:
7. Specific objectives and key agenda items:
8. Anticipated outcomes (deliverables):
9. Format:
10. Science Organizing Committee (if relevant)
11. Local Organizing Committee (if relevant)
12. Proposed funding sources and anticipated funding requested from WCRP: