


University of
Massachusetts
Amherst

Analyzing climate justice implications of the Paris Agreement by combining future global climate and sea level modelling data with interdisciplinary research

Shahira Sedai

University of Massachusetts Amherst • sedai@climate.umass.edu • <https://www.climate.umass.edu/people/shahira-sedai>



Motivation, methods, and framing

My entry point? Several first Anterianian Sea Level (ASL) denormalizations provided a negative feedback on global mean sea level rise (GMSL) and thus could give the impression of these being "more time" to reach the Paris goals. However, it is also associated with sea level rise (SLR).

What are the climate justice implications of these responses in light of the Paris goal?

Methods

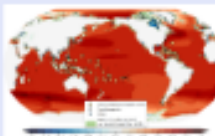
To integrate the conclusions of that work, a literature review was conducted across the

History of temperature targets

- 2C entered the conversation in the late 1980s since it was thought to be the equivalent climate sensitivity (ECS) value
- 1.5C-3.0C among different targets were proposed, such as maximum limited targets, or rates and magnitude of Earth system changes (see Image: Indefinite Sea Leveling & Flow, Climate Change 1001)
- 2C solidified in the 2000s driven in large part by European Union interests based on economic arguments, and despite objections of a majority of UNFCCC parties
- Paris goal of 2C/GMSL rise is intended as the realization of the UNFCCC goal of avoiding "dangerous anthropogenic interference" (DAI) – meaning changes is subjective

Sea level rise considerations

The Alliance of Small Island States (AOSIS) advocated early in the 1990s for maximum limited targets, and later for a 1.5C target. These targets (limitations chosen on top) are at approximately 100 km from SLR. Places where the Antarctic ice sheet is SLR is especially high (image below) meeting with these locations. Sea levels will rise for centuries even if GMSL is eventually reduced.

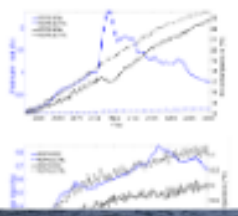


Looking for justice

Presented justice. A majority of nations, including small nations who pointed to SLR as a grave danger, were under low emissions, aligned to the case of 2C as a climate crisis. Do they request 2C as mentioned at the pre-Paris Simulated Rapid Change (SRC) panel to be inadequate as a crisis for 2C? No 2C can still show as the reinforcement of SLR, due to pressure from high emitting nations.

Distribution justice. GMSL projects spatial variability of impacts like SLR. ASL variability and the long thermal memory of the ocean make low and SLR inevitable on a continent, and possibly without notice. This exacerbates long term, and especially multigenerational, regional justice. This is accompanied by the alteration of migration pathways which have become a feature of temperature targets.

Negative feedbacks on temperature






Fig 2. Early proposals for climate targets as summarized in Velting & Rosen, 1991.




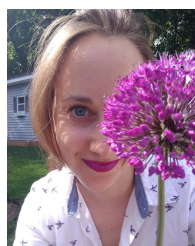
Fig 3. Sea level change projections for the 21st century under RCP8.5, with a color scale from 0 to 100 cm.

Conclusion

The adoption of global mean surface temperature (GMSL) as a target for climate action is associated with poor social, distributive, or anti-recognition justice issues. The complications presented by the entangled climate impacts of sea level rise and negative feedbacks on GMSL arising from Antarctic ice sheet denormalization exacerbate these climate justice issues.

ABSTRACT CONTACT AUTHOR PRINT GET POSTER

University of Massachusetts Amherst * srogstad@geo.umass.edu * @scienceshaina



AGU FALL MEETING
Online Everywhere | 1-17 December 2020

MOTIVATION, METHODS, AND FRAMING

My prior work (Sadai, 2020) found that Antarctic Ice Sheet (AIS) destabilization provides a negative feedback on global mean surface temperature (GMST) and thus could give the impression of there being “more time” to meet the Paris goals. However it is also associated with sea level rise (SLR).

What are the climate justice implications of these responses in light of the Paris goal?

Methods

To understand the justice implications a literature review was conducted across the fields of political economy, history, feminist studies, geography, political science, international relations, and legal studies along with a thematic analysis of the content of United Nations documents including treaties and negotiation summaries.

Introducing Justice Framing

Justice framing used was based on (Burnham, 2016) and has three components:

Procedural justice- equity and inequity in decision making processes

Distributive justice- accounting for spatial and temporal burdens and benefits

Recognition justice- relating to existence rights of cultural and social groups

Understanding why GMST became the target metric for the United Nations Framework Convention on Climate Change (UNFCCC) Article 2 goal of preventing "dangerous anthropogenic interference" (DAI) is key for understanding power and outcomes in negotiations. Variations in spatiotemporal impacts of climate change are given less prominence when conversations center around GMST. Modeling developments inform conversations about future climate impacts. Therefore we must take into considerations how model development and model data can impact policy, and how that impacts justice.

NEGATIVE FEEDBACKS ON TEMPERATURE

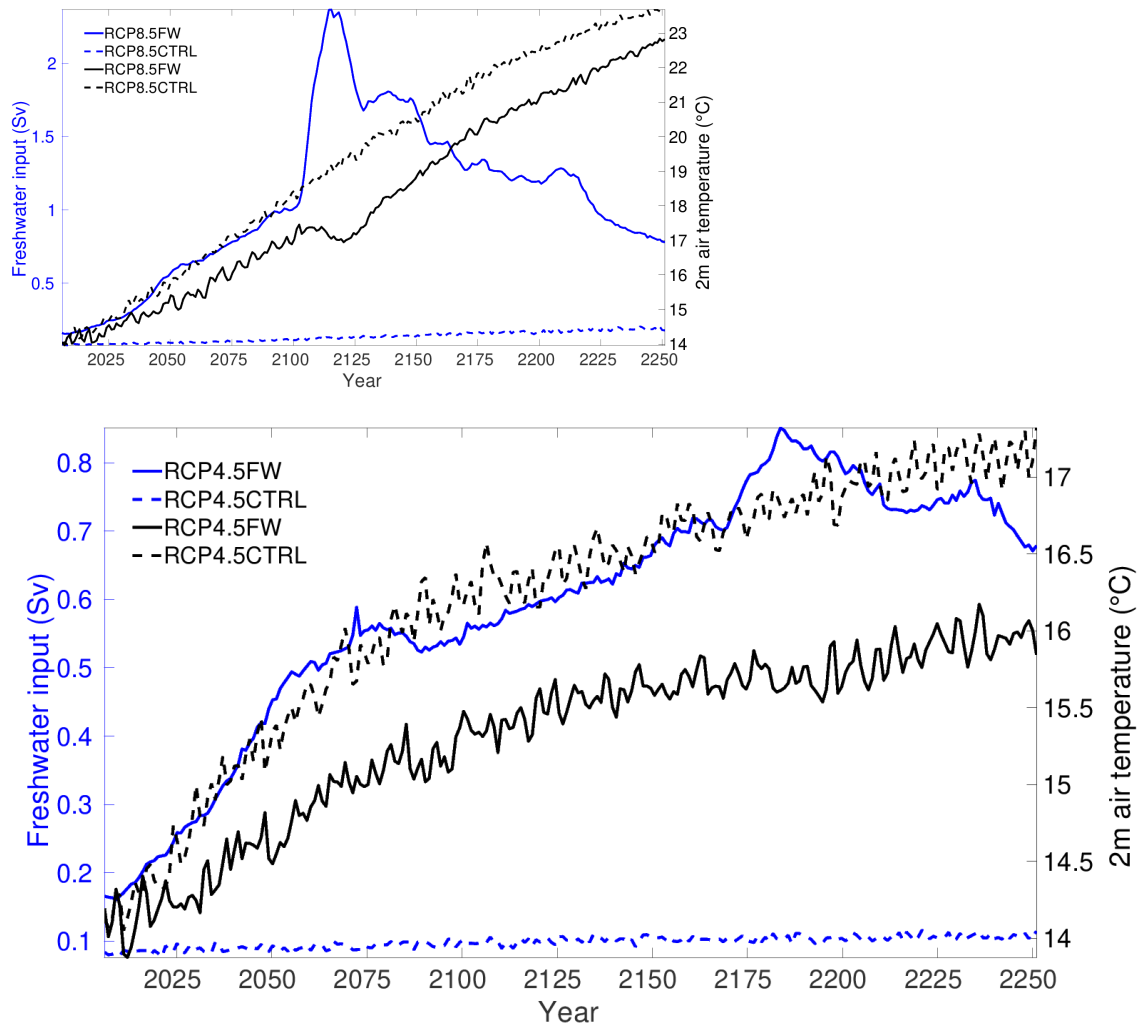


Fig 1- Freshwater runoff totals obtained from a regional ice sheet model (PSU model, DeConto & Pollard, 2016) and used to force a global climate model (CESM1.2) are shown in relation to the resulting global mean surface temperature in the climate model under RCP8.5 (top) and RCP4.5 (bottom).

The impact of freshwater has a negative feedback on global mean surface temperature.

Images via Sadai et al., 2020 (<https://advances.sciencemag.org/content/6/39/eaaz1169>).

HISTORY OF TEMPERATURE TARGETS

- **2C entered the conversation in the late 60s** since it was thought to be the equilibrium climate sensitivity (ECS) value (Manabe & Wetherald, 1967)
- **80s-90s many different targets were proposed** for UNFCCC metrics. Options included emissions based targets, or rates and magnitudes of Earth system changes including sea level rise and temperature (Rijsberman, 1990; see image below from Vellinga & Swart, Climatic Change 1991)
- **2C solidified in the 2000s** driven in large part by European Union interests based on economic arguments, and despite objections of a majority of UNFCCC parties (Randals, 2010)
- **Paris goal of 2C GMST rise** is intended as the realization of the UNFCCC goal of avoiding “dangerous anthropogenic interference”....except danger is subjective (Seager, 2009)



Fig 2- Early proposals for climate metrics as summarized in Vellinga & Swart, 1991 (<https://link.springer.com/article/10.1007/BF00142501>). There was a larger diversity in options for a target metric in the early days of negotiations.

SEA LEVEL RISE CONSIDERATIONS

The Alliance of Small Island States (AOSIS) advocated early in the 1990s for emissions based targets, and later for a 1.5C target (Hoad, 2015; Benjamin & Thomas, 2016). These nations (locations shown on top) are at disproportionate risk from SLR. Places where the Antarctic contribution to SLR is especially high (image bottom) overlap with these locations (Gomez, 2009). Sea levels will rise for centuries even if GMST is eventually reduced (SROCC, 2019).

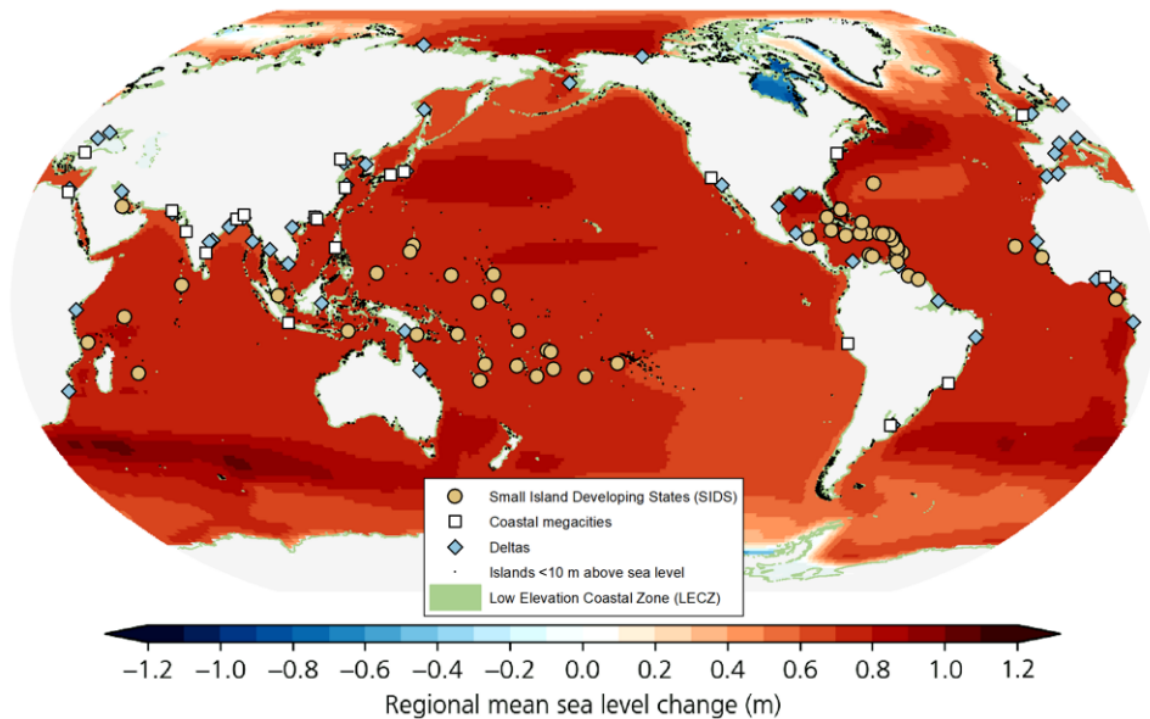


Fig 3- Sea level change projections for the end of the century under RCP8.5 with Small Island Developing States (members overlap with AOSIS) shown as stars and low lying coasts as black dots. Image CB9.1 from the IPCC SROCC (<https://www.ipcc.ch/srocc/>) report.

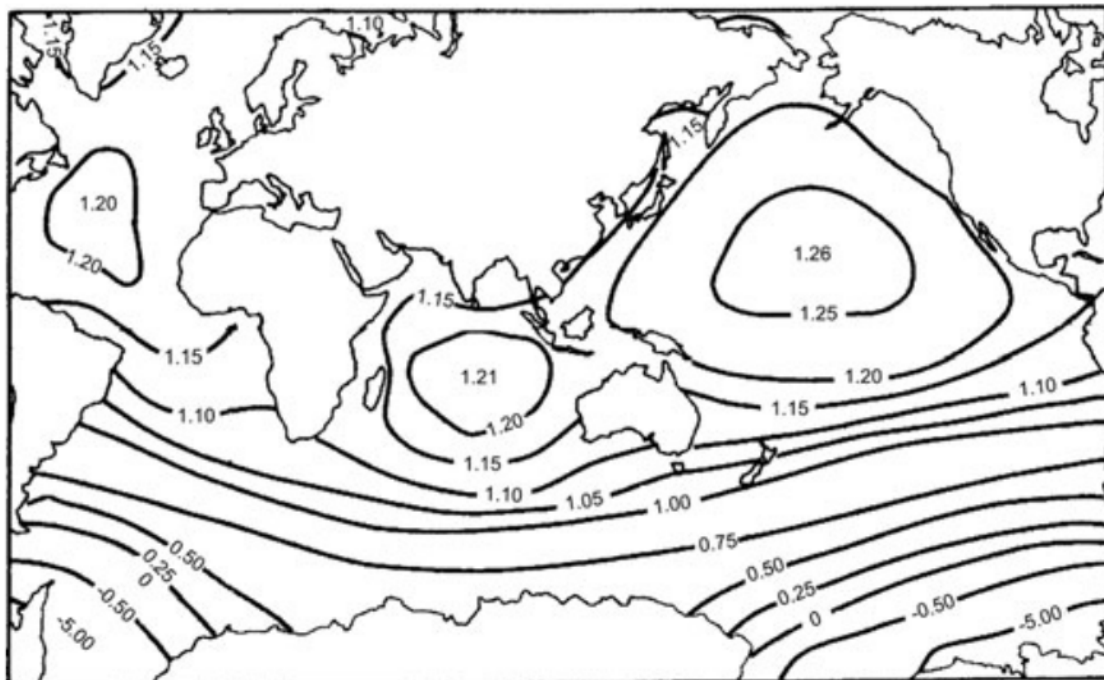


Fig 4- Sea level change in response to West Antarctic ice sheet thinning. Image via Gomez et al., 2010 (<https://academic.oup.com/gji/article/180/2/623/687369>) following methodology from Clark & Lingle, 1977.

LOOKING FOR JUSTICE

Procedural justice- A majority of nations- including island nations who pointed to SLR as a grave threat even under low emissions- objected to the use of 2C as a climate metric. On their request 2C was reviewed at the pre-Paris Structured Expert Dialogue. It was found to be inadequate as a metric for DAI (SED review, 2015). Yet 2C was still chosen as the embodiment of avoiding DAI, due to pressure from high emitting nations and capital interests.

Distributive justice- GMST neglects spatial variability of impacts like SLR. AIS instability and the long thermal memory of the ocean make ice loss and SLR irreversible on centennial, and possibly millennial, scales. This exacerbates long term, and especially multigenerational, temporal justice. This is compounded by the allowance of overshoot pathways which have become a feature of temperature targets.

Recognition justice- Near term emissions will lock in SLR, placing the continued existence of many island nations at risk. This also presents issues for continued involvement in UN proceedings as nation-states are currently defined (Montevideo Convention, 1933).

CONCLUSION

The adoption of global mean surface temperature (GMST) as a target for climate action is associated with procedural, distributive, and recognition justice issues. The complications presented by the entangled climate impacts of sea level rise and negative feedbacks on GMST arising from Antarctic Ice Sheet destabilization exacerbate these climate justice issues.

Modeling developments that more accurately simulate meltwater impacts on global climate will continue to bring negative feedbacks into the conversation, with ramifications for policy and justice.

This poster is a small snapshot of a much broader conceptual argument from a chapter of my dissertation. The chapter is in prep and will be submitted for peer review within the month.

ABSTRACT

The science linking anthropogenic greenhouse gas emissions with our changing climate, and the resulting impacts, has been well established for decades. During that time one of the focal points of international negotiations was to establish a common target for action to address climate change. These negotiations culminated in the Paris Agreement at COP21 in 2015 which seeks to limit the global mean surface temperature (GMST) rise to well below 2C above pre-industrial, and to pursue efforts to limit it to 1.5C. Our research seeks to assess the climate justice implications of using global mean surface temperature as a metric for climate action by combining data from ice sheet models and fully coupled global climate model simulations in conjunction with a literature review spanning fields including international relations, political economy, critical geography, and history. Considering the political and scientific history of the development of the temperature target alongside global impacts of climate change we gain a new understanding of spatial, temporal, and procedural aspects of climate justice.

REFERENCES

- Benjamin, L. & Thomas, A. 1.5 to stay alive? AOSIS and the long term temperature goal in the Paris Agreement. 17, 157–167., 2016.
- Burnham, M., Radel, C., Ma, Z. & Laudati, A. Extending a Geographic Lens Towards Climate Justice, Part 1: Climate Change Characterization and Impacts. *Geography Compass* vol. 7 239–248 (2013).
- Convention on Rights and Duties of States adopted by the Seventh International Conference of American States, 1933.
- Deconto, R. M. & Pollard, D. Contribution of Antarctica to past and future sea-level rise. *Nature* 531, (2016).
- Gomez, N., Mitrovica, J. X., Tamisiea, M. E. & Clark, P. U. A new projection of sea level change in response to collapse of marine sectors of the Antarctic Ice Sheet. *Geophys. J. Int* 180, 623–634 (2010).
- Hoad, D.. “Reflections on small island states and the international climate change negotiations (COP21, Paris, 2015).” (2015).
- IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegria, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. In press.
- Manabe S, Wetherald RT (May 1967). "Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity". *Journal of the Atmospheric Sciences*. 24 (3): 241–259. Bibcode:1967JAAtS...24..241M. doi:10.1175/1520-0469(1967)
- Randalls, S. History of the 2°C climate target. *Wiley Interdiscip. Rev. Clim. Chang.* 1, 598–605 (2010).
- Rijsberman, F. R., Swart, R. J. & Stockholm Environment Institute. Targets and indicators of climatic change. (Stockholm Environment Institute, 1990).
- Sadai, Condrón, DeConto, Pollard. Future climate response to Antarctic Ice Sheet melt caused by anthropogenic warming. *Science Advances* 23 Sep 2020: Vol. 6, no. 39, eaaz1169 DOI: 10.1126/sciadv.aaz1169
- Seager, J.. “Death by Degrees: Taking a Feminist Hard Look at the 2° Climate Policy.” (2009).
- The 2013-2015 review StructuredExpertDialogue.2015.1.SummaryReport.
- United Nations. FCCC/CP/2015/10/Add.1: Adoption of the Paris Agreement.
- UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE UNITED NATIONS. (1992).
- Vellinga, P. & Swart, R. THE GREENHOUSE MARATHON: A PROPOSAL FOR A GLOBAL STRATEGY A Guest Editorial.