Taking Science to Action Seriously:
An Actionable Science Perspective on Land Ice and Sea Level Rise Projections

David Behar
Climate Program Director, San Francisco Public Utilities Commission
Chair, Practitioner Exchange for Effective Response to Sea Level Rise

Land Ice Working Group
30th Annual CESM Workshop
June 9, 2025

Collaborative Climate Science: A User's Perspective on Need, Communication, and Adaptation

David Behar

San Francisco Public Utilities Commission

Water Utility Climate Alliance

Community Climate System Model Annual Workshop

June 28, 2010

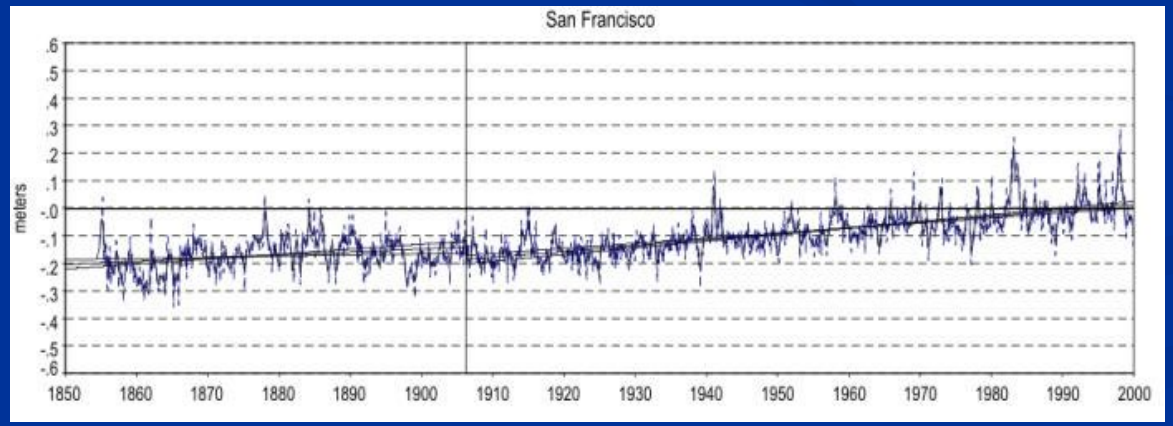
Symbiosis

Water Utility Climate Alliance contribution (2009)

"Actionable Science"

A Working Definition:

Data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.



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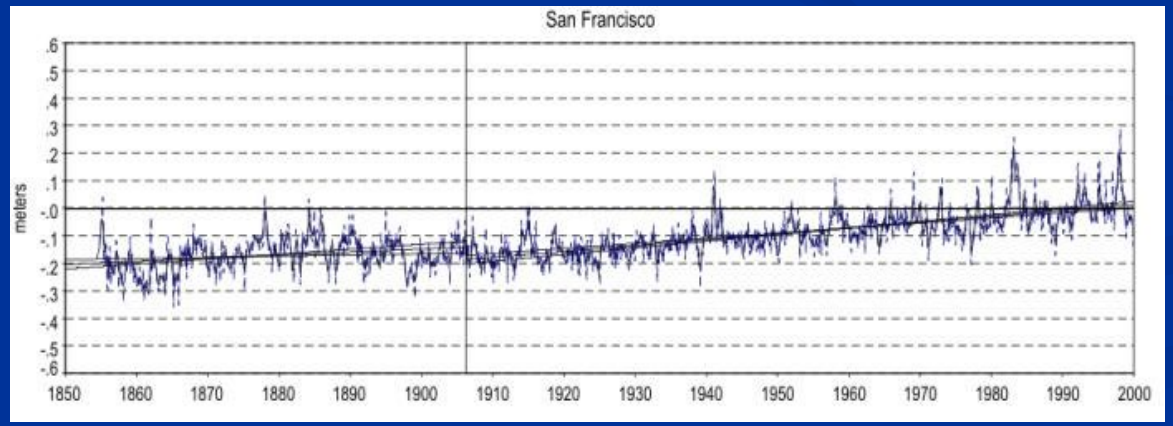
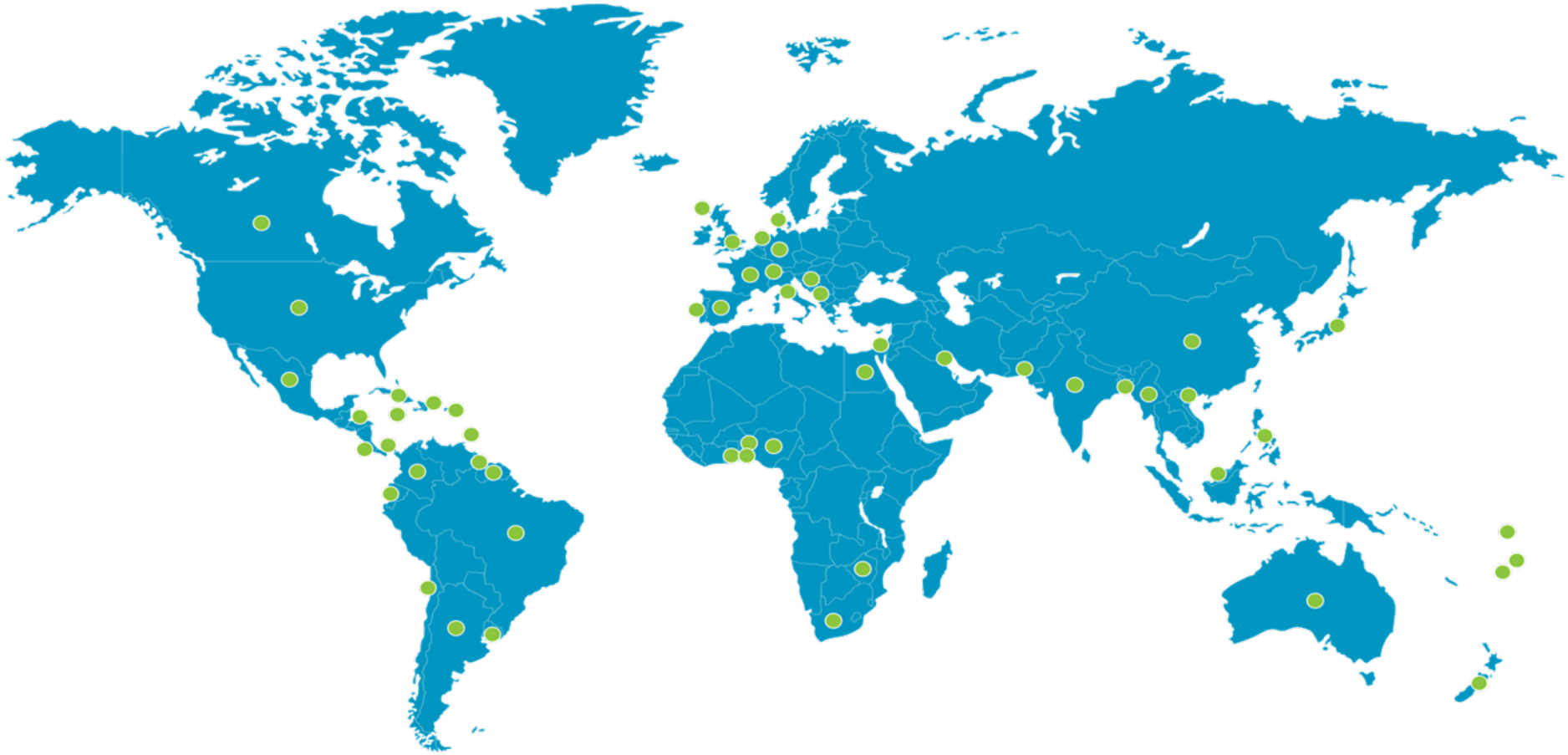


Practitioner Exchange for Effective Response to Sea Level Rise (PEERS)

Over 600 Members in 60 Countries



PEERS

Lipscomb, Behar, Morrison 2025

EGU European Geosciences Union

The Cryosphere

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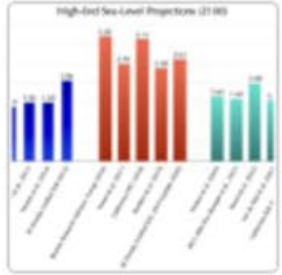
21 Feb 2025

Brief communication: Sea-level projections, adaptation planning, and actionable science

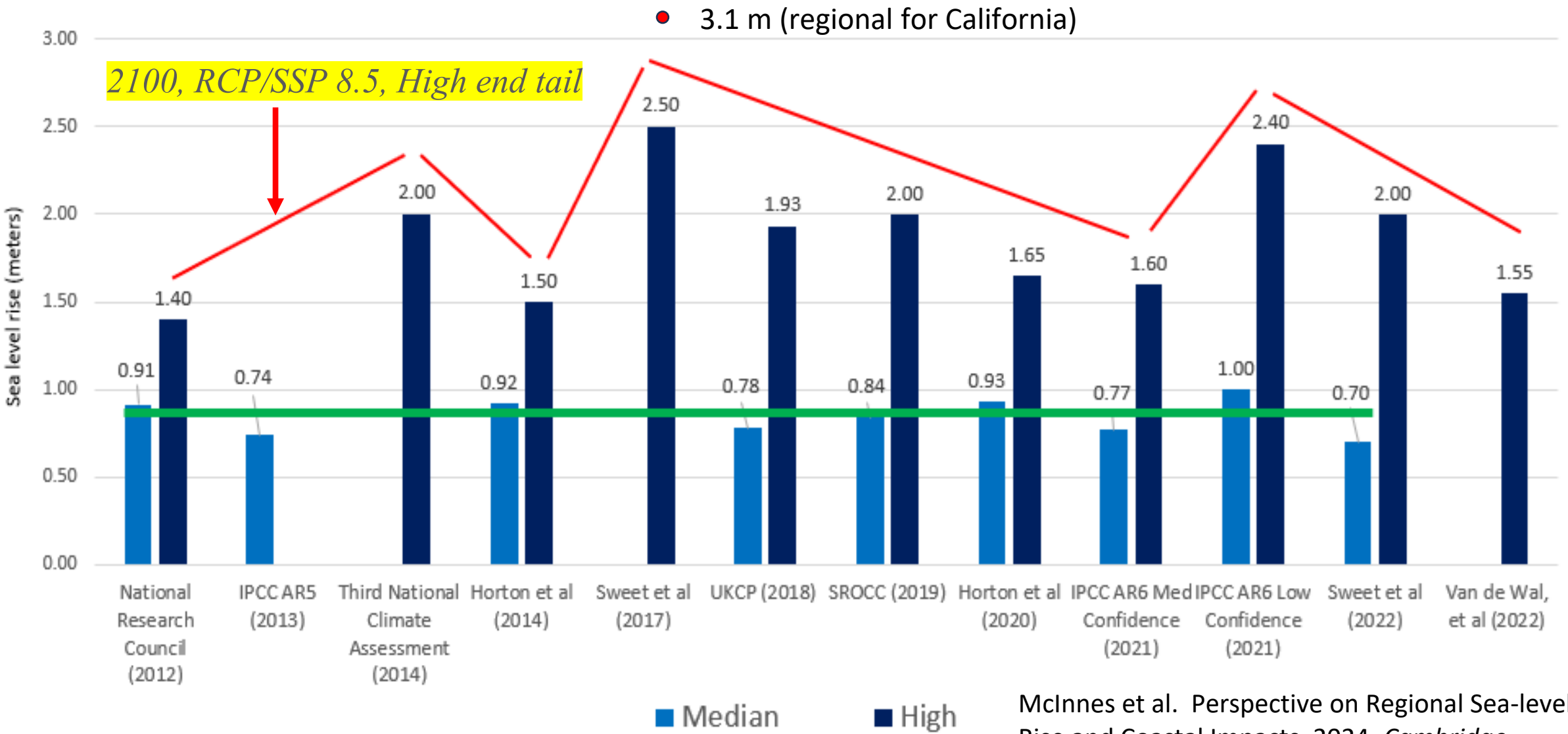
William H. Lipscomb, David Behar, and Monica Ainhorn Morrison



Abstract

As climate scientists seek to deliver actionable science for adaptation planning, there are risks in using novel results to inform

High End and Median, 2012-2022



McInnes et al. Perspective on Regional Sea-level Rise and Coastal Impacts. 2024. *Cambridge Prisms: Coastal Futures*.

The Whiplash Effect

Climate Experts Tussle Over Details. Public Gets Whiplash.

By Andrew Revkin, July 29, 2008, New York Times

Scientists . . . sometimes fail to carefully discriminate between what is well understood and what remains uncertain.

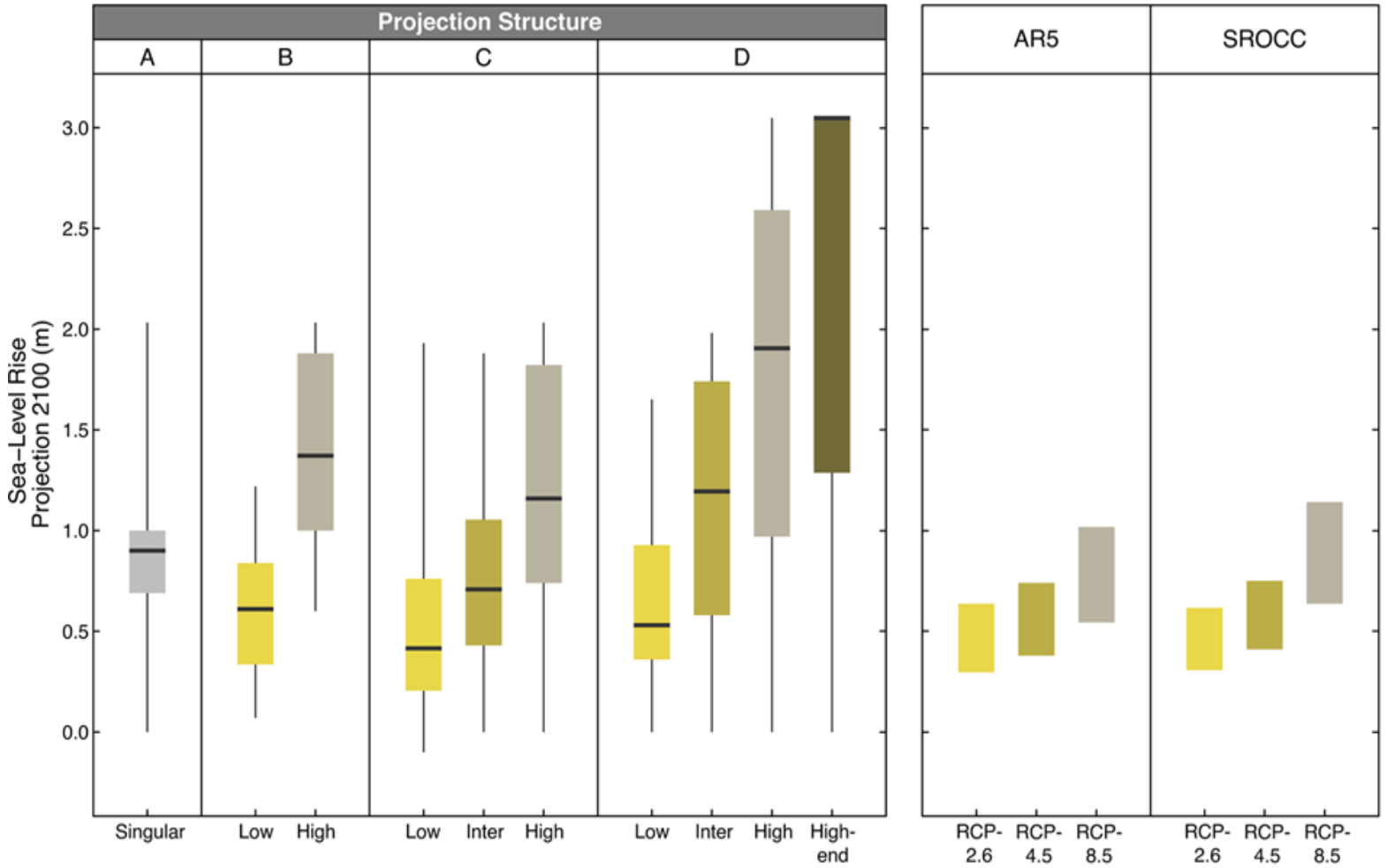
Kimberly Thompson
Associate professor of risk analysis and decision science at Harvard (paraphrased)

(Subject of article: Land ice melt)

First ever global survey of coastal adaptation practitioners reveals chaotic science translation

Among 253 respondents from every inhabited continent:

- 28% report they are not using sea level rise projections, with lower resourced regions less frequently accessing projections
- Of those using projections in planning, 53% report they use a single projection, counter to leading practice
- High end projections adopted for 2100 range from below 1 m. to over 3 m.



Hirschfeld, D., Behar, D., Nicholls, R.J. *et al.* Global survey shows planners use widely varying sea-level rise projections for coastal adaptation. *Commun Earth Environ* **4**, 102 (2023).

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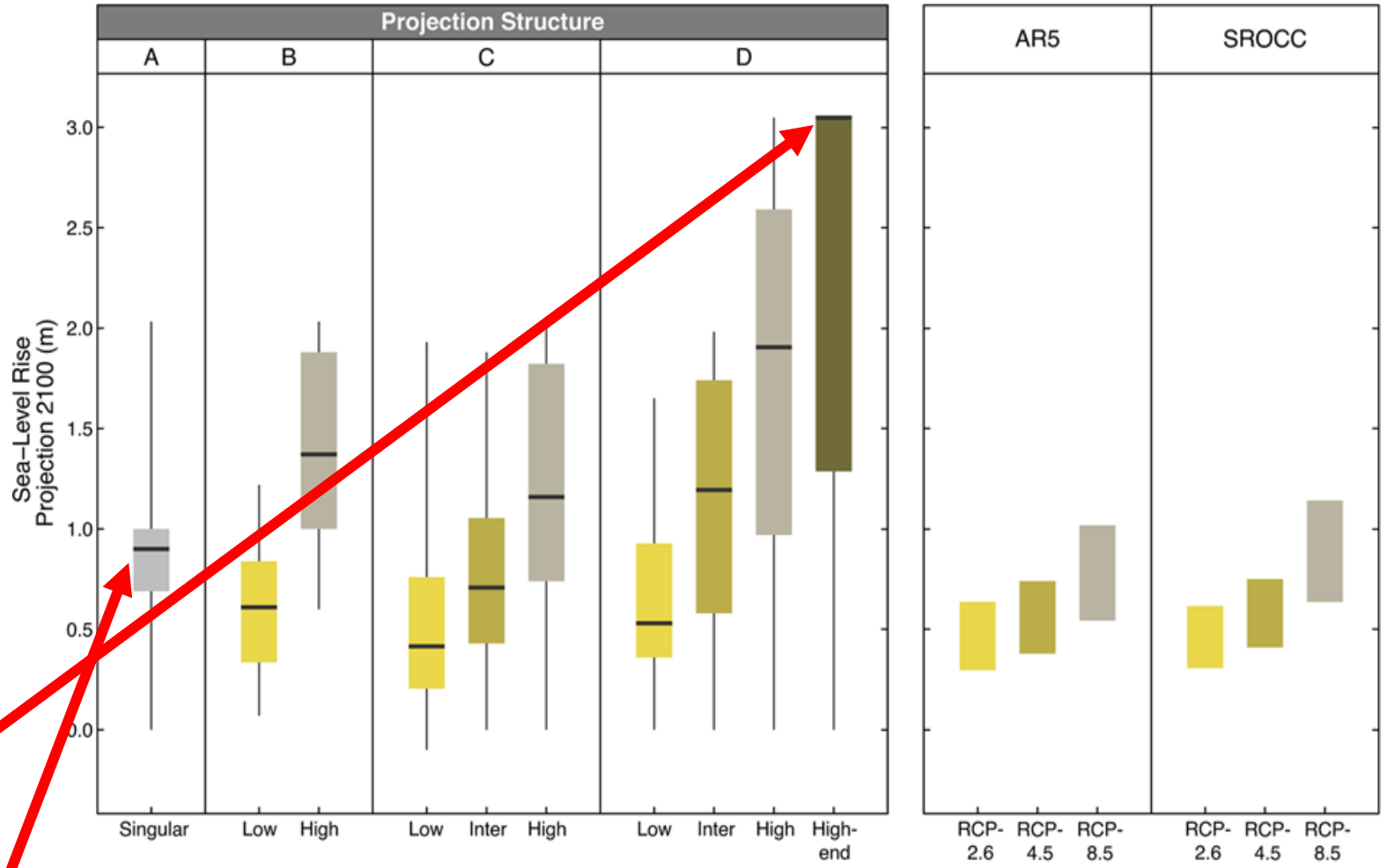


Hirschfeld, D., Behar, D., Nicholls, R.J. *et al.* Global survey shows planners use widely varying sea-level rise projections for coastal adaptation. *Commun Earth Environ* **4**, 102 (2023).

It’s clear there is a problem…

so what’s the solution?

“Actionable Science”

2009

Water Utility Climate Alliance

Data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.

Framework for High End Estimates for Applications

Earth's Future

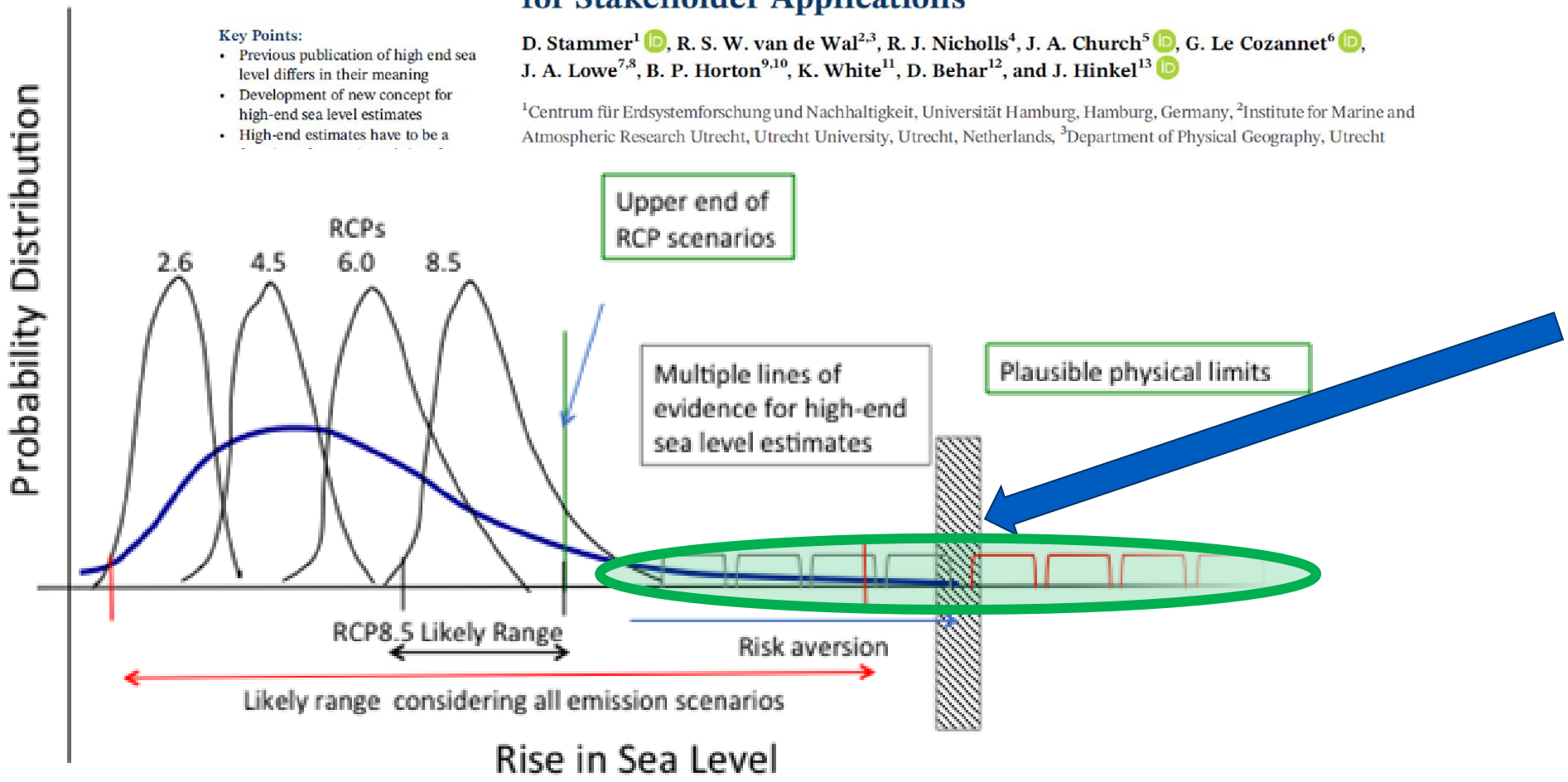
RESEARCH ARTICLE
10.1029/2019EF001163

Framework for High-End Estimates of Sea Level Rise for Stakeholder Applications

Key Points:
- Previous publication of high end sea level differs in their meaning
- Development of new concept for high-end sea level estimates
- High-end estimates have to be a

D. Stammer[1], R. S. W. van de Wal[2,3], R. J. Nicholls[4], J. A. Church[5], G. Le Cozannet[6], J. A. Lowe[7,8], B. P. Horton[9,10], K. White[11], D. Behar[12], and J. Hinkel[13]

[1]Centrum für Erdsystemforschung und Nachhaltigkeit, Universität Hamburg, Hamburg, Germany, [2]Institute for Marine and Atmospheric Research Utrecht, Utrecht University, Utrecht, Netherlands, [3]Department of Physical Geography, Utrecht



Actionable Science: Where is this line?

Building on the High End Framework

Earth's Future

RESEARCH ARTICLE
10.1029/2022EF002751

Key Points:

- A high-end estimate of sea level rise in 2100 and 2300
- Decisionmaker/practitioner

A High-End Estimate of Sea Level Rise for Practitioners

R. S. W. van de Wal[1,2], R. J. Nicholls[3], D. Behar[4], K. McInnes[5], D. Stammer[6], J. A. Lowe[7,8], J. A. Church[5,9], R. DeConto[10], X. Fettweis[11], H. Goelzer[12], M. Haasnoot[13], I. D. Haigh[14], J. Hinkel[15], B. P. Horton[16,17], T. S. James[18], A. Jenkins[19], G. LeCozannet[20], A. Levermann[21,22,23], W. H. Lipscomb[24], B. Marzeion[25], F. Pattyn[26], A. J. Payne[27], W. T. Pfeffer[28], S. F. Price[29], H. Seroussi[30], S. Sun[20], W. Veatch[31], and K. White[32]

✓ Multiple lines of evidence (rather than single sources)

✓ Strong confidence in scientific community (rather than weak confidence)

✓ Plausible high-end (rather than worst imaginable)

Lipscomb et al 2025 contribution

2009

Water Utility Climate Alliance

Data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.

2024

Lipscomb, Behar, Morrison, 2025, *The Cryosphere*

A scientific claim is sufficiently accepted to justify adaptation action (i.e., near-term physical measures and financial investments) when it is supported by multiple, consistent independent lines of high-quality evidence leading to high or medium confidence, as determined by a diverse group of experts in an open, transparent process.

Whiplash in action (Lipscomb et al)

ARTICLE
doi:10.1038/nature17145

Contribution of Antarctica to past and future sea-level rise

Robert M. DeConto[1] & David Pollard[2]

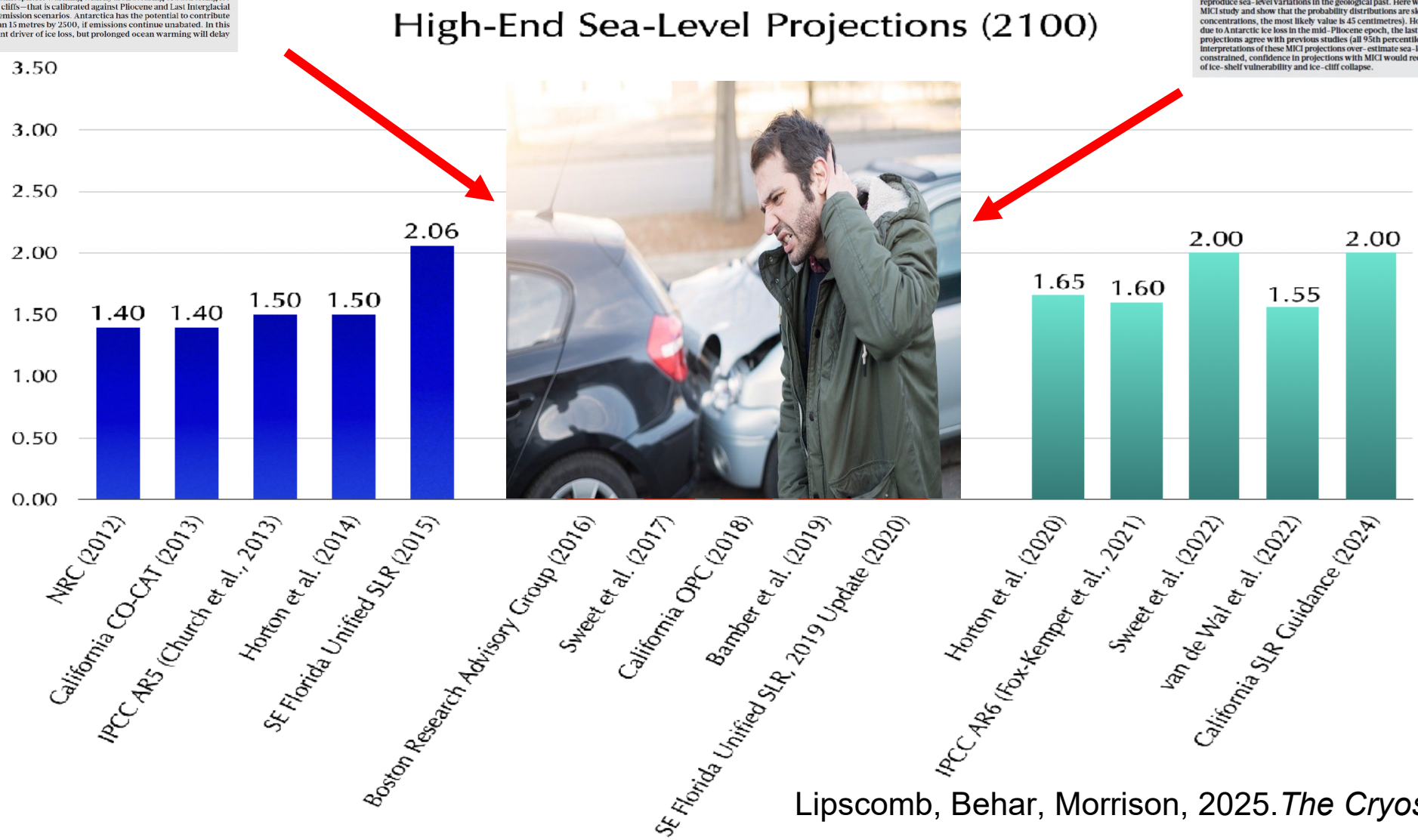
Polar temperatures over the last several million years have, at times, been slightly warmer than today, yet global mean sea level has been 6–9 metres higher as recently as the Last Interglacial (130,000 to 115,000 years ago) and possibly higher during the Pliocene epoch (about three million years ago). In both cases the Antarctic ice sheet has been implicated as the primary contributor, hinting at its future vulnerability. Here we use a model coupling ice sheet and climate dynamics—including previously underappreciated processes linking atmospheric warming with hydrofracturing of buttressing ice shelves and structural collapse of marine-terminating ice cliffs—that is calibrated against Pliocene and Last Interglacial sea-level estimates and applied to future greenhouse gas emission scenarios. Antarctica has the potential to contribute more than a metre of sea-level rise by 2100 and more than 15 metres by 2500, if emissions continue unabated. In this case atmospheric warming will soon become the dominant driver of ice loss, but prolonged ocean warming will delay its recovery for thousands of years.

ARTICLE
https://doi.org/10.1038/s41586-019-0901-4

Revisiting Antarctic ice loss due to marine ice-cliff instability

Tamsin L. Edwards[1*], Mark A. Brandon[2], Gael Durand[3], Neil R. Edwards[2], Nicholas R. Golledge[4,5], Philip B. Holden[2], Isabel J. Nias[6], Antony J. Payne[6], Catherine Ritz[3] & Andreas Wernecke[3]

Predictions for sea-level rise this century due to melt from Antarctica range from zero to more than one metre. The highest predictions are driven by the controversial marine ice-cliff instability (MICI) hypothesis, which assumes that coastal ice cliffs can rapidly collapse after ice shelves disintegrate, as a result of surface and sub-shelf melting caused by global warming. But MICI has not been observed in the modern era and it remains unclear whether it is required to reproduce sea-level variations in the geological past. Here we quantify ice-sheet modelling uncertainties for the original MICI study and show that the probability distributions are skewed towards lower values (under very high greenhouse gas concentrations, the most likely value is 45 centimetres). However, MICI is not required to reproduce sea-level changes due to Antarctic ice loss in the mid-Pliocene epoch, the last interglacial period or 1992–2017; without it we find that the projections agree with previous studies (all 95th percentiles are less than 43 centimetres). We conclude that previous interpretations of these MICI projections over-estimate sea-level rise this century; because the MICI hypothesis is not well constrained, confidence in projections with MICI would require a greater range of observationally constrained models of ice-shelf vulnerability and ice-cliff collapse.



Lipscomb, Behar, Morrison, 2025. *The Cryosphere.*

Recommendations

- **Practitioners**: *View novel peer-reviewed claims with caution; do not treat as actionable until thorough community review*

- **Practitioners**: *If incorporating low-confidence claims into planning, use approaches that allow a wait and see approach before investing*

- **Scientists**: *present new results in context of well-established science and acknowledge uncertainty*

Scientists + Practitioners: *work together across the boundary between science and practice to advance a holistic view of what we know (and don't yet know) to support adaptation planning and action*

- **Journalists**: *Don't just report the practical lesson but provide breadth in language of what we recognize one paper rarely reshapes understanding; seek range of opinions about what remains unsettled*

Lipscomb, Behar, Morrison, 2025. *The Cryosphere.*

If YOU are interested, YOU are invited. . .

- PEERS is standing up an **Actionable Science Working Group** – consider volunteering.
- Familiarize yourself with **van de Wal et al 2022** and **Lipscomb et al 2025,** co-produced scientist/practitioner outputs – and other viewpoints
- ASWG:
  - Members: Scientists + Practitioners
  - Goals:
    - Translate today's science and emissions landscape to support adaptation planning
    - Track evolving observations and modeling to inform adaptation planning
    - **High end subgroup to translate today's land ice science to better inform adaptation practice. White paper output. Topics likely to include:**
      - **Antarctica**
      - **Greenland**
      - **ISMIP6 and 7 ensembles**
      - **Confidence levels**
      - **Modeling and observations**

PEERS

Thank you

PEERS

David Behar, Chair
dbehar@sfwater.org

peerscoastal.org

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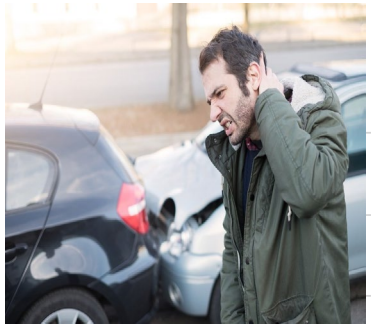

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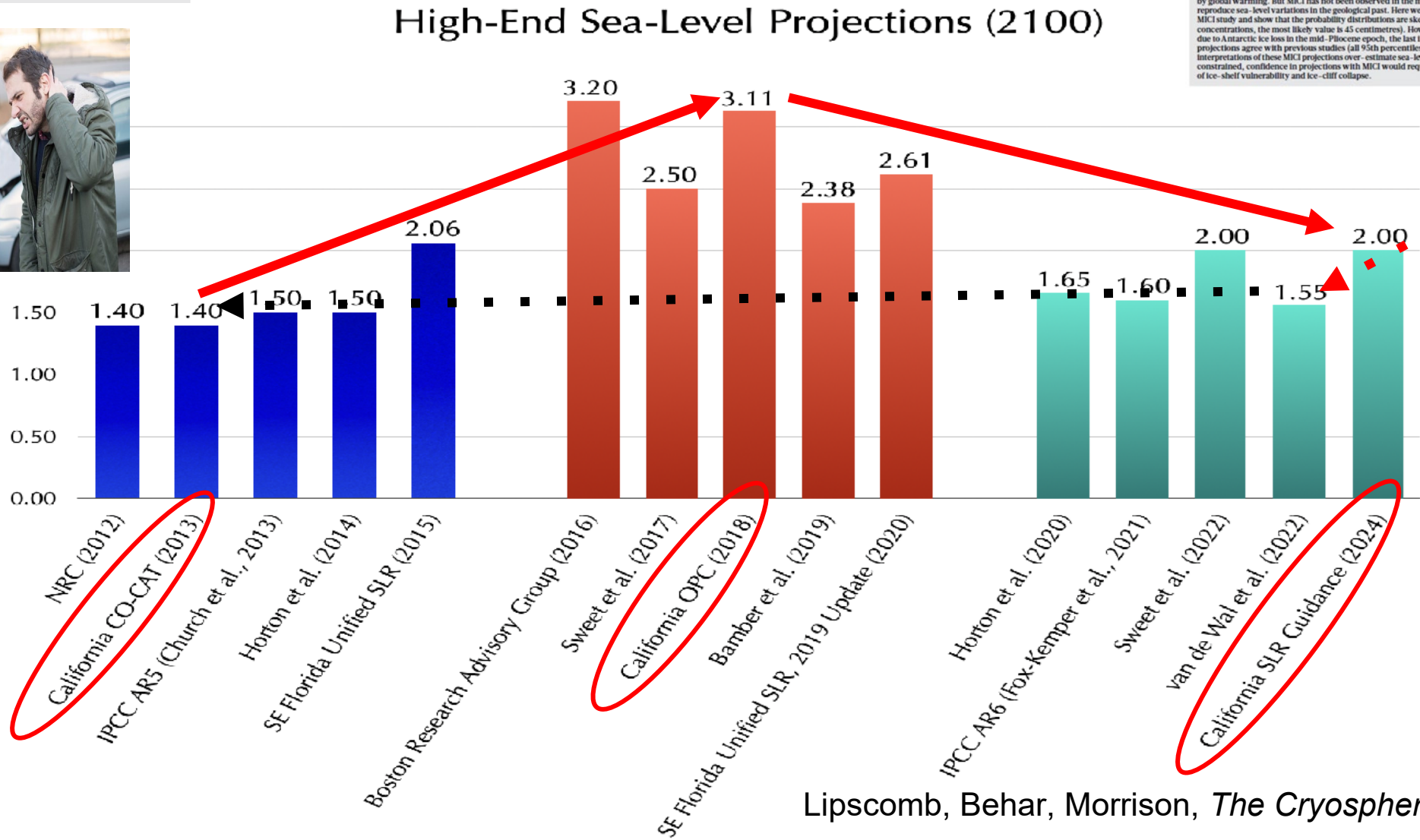

Lipscomb, Behar, Morrison, *The Cryosphere* (in review)

“Actionable Science” (or information, or knowledge…)

- The **National Global Change Research Plan 2012-2021** (2012) – “actionable knowledge,” “actionable information”
- **Presidents Climate Action Plan**, June 2013 – “actionable climate science”
- **Executive Order – Preparing the United States for the Impacts of Climate Change**, Nov 2013 – “actionable information.”
- **USACE, Climate Change and Adaptation Plan** 2011 – “actionable climate science and climate change information”
- **Global Framework for Climate Services**, 2011– “actionable climate information”
- **Biden-Harris Administration Fifth National Climate Assessment Press Release** 2023. “authoritative and actionable climate change information.”
- **WCRP Strategic Plan 2019-2028: Engaging with society, “**actionable climate information”