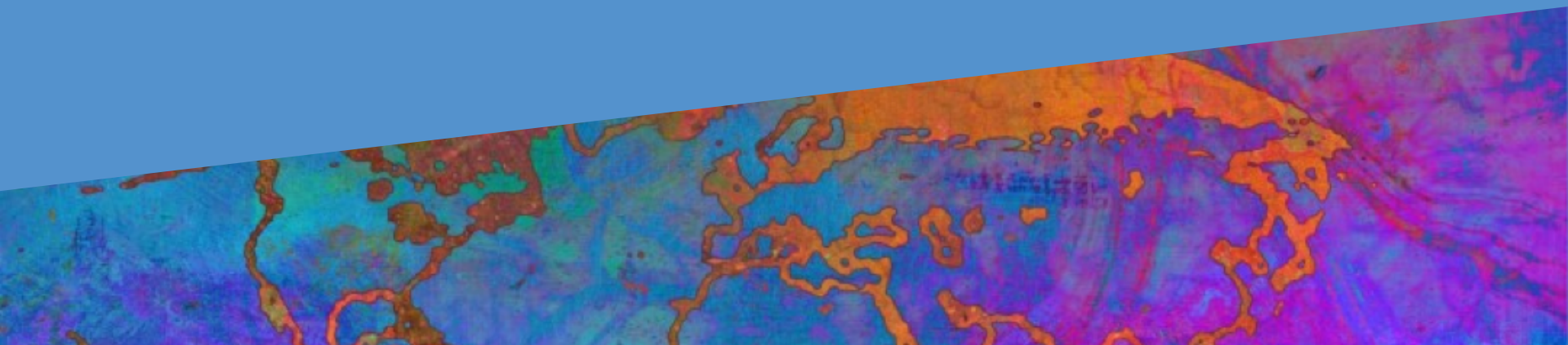
SIXTH ASSESSMENT REPORT
Working Group I – The Physical Science Basis

IPCC
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

IPCC AR6
Sea level projections

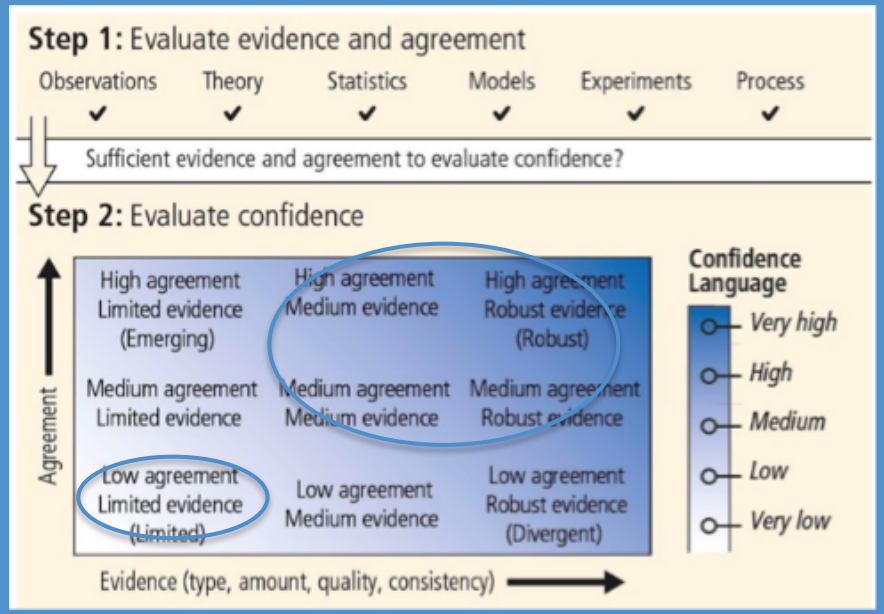
Helene Hewitt on behalf of AR6 WG1 Chapter 9

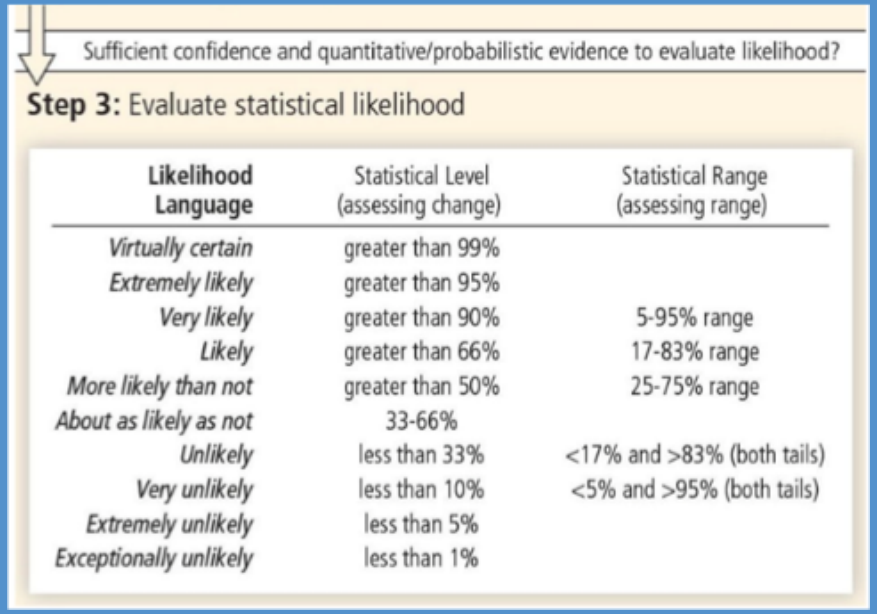


CHAPTER 9:
OCEAN, CRYOSPHERE & SEA LEVEL CHANGE

+5 chapter scientists (including Tim Hermans and Greg Garner) and 74 contributing authors

CALIBRATED UNCERTAINTY LANGUAGE





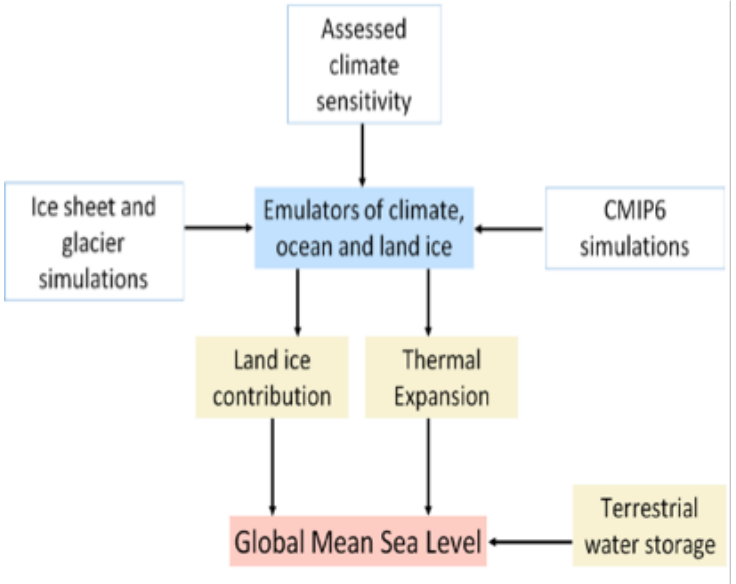
Likelihood Language	Statistical Level (assessing change)	Statistical Range (assessing range)
Virtually certain	greater than 99%	
Extremely likely	greater than 95%	
Very likely	greater than 90%	5-95% range
Likely	greater than 66%	17-83% range
More likely than not	greater than 50%	25-75% range
About as likely as not	33-66%	
Unlikely	less than 33%	<17% and >83% (both tails)
Very unlikely	less than 10%	<5% and >95% (both tails)
Extremely unlikely	less than 5%	
Exceptionally unlikely	less than 1%	

[Credit: Shari Gearheard | NSIDC]

> “There’s no going back from some changes in the climate system. However, some changes could be slowed and others could be stopped by limiting warming.

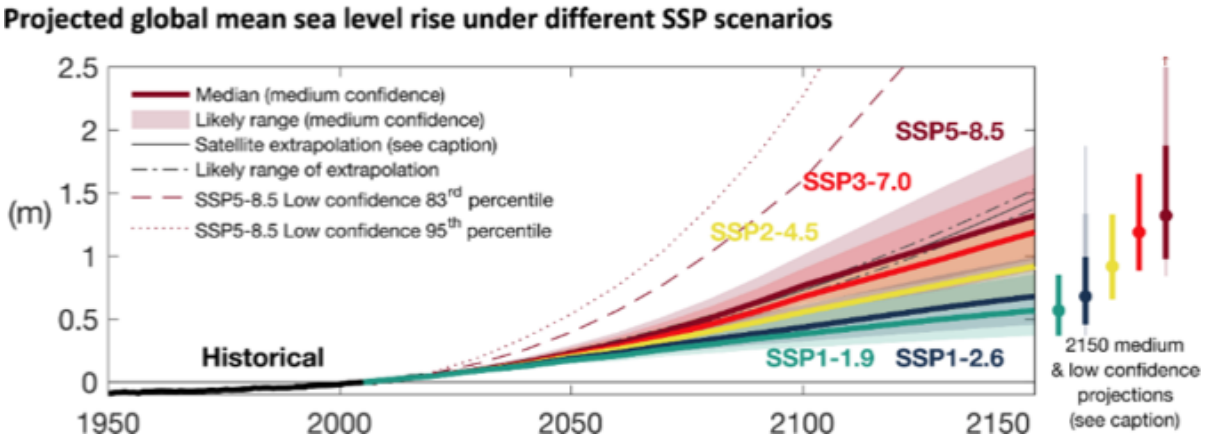
Sea level projections in AR6 are consistent with the assessment of Equilibrium Climate Sensitivity and Surface Temperature

- Methodology for producing sea level projections is updated relative to AR5 and SROCC
- Emulators are used with input from CMIP6, ice sheet and glacier simulations to give the *likely* range to 2100 based on processes in which there is at least *medium confidence*
- Deep uncertainty captured by *low confidence* ice sheet processes
- Sea level projections to 2300 are based on assessed literature of ice sheet response giving a *low confidence* range



Schematic based on 9.6.3.2; Table 9.7; 9.SM.4

Through 2050, projections show limited sensitivity to emissions scenario



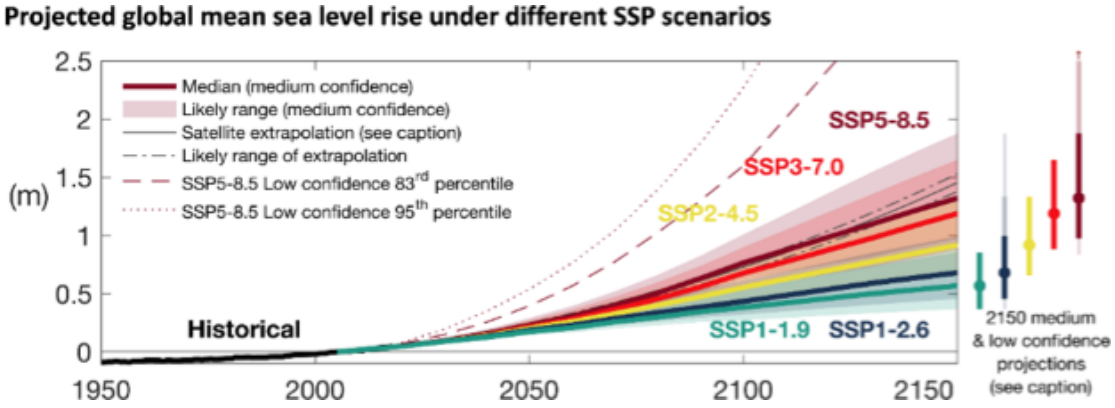
Relative to 1995-2014, the likely global mean sea level rise (*medium confidence*)

by 2050

0.16-0.25 m under the low GHG emissions scenario (SSP1-2.6)

0.18-0.27 m under the high GHG emissions scenario (SSP3-7.0)

Beyond 2050, projections are increasingly sensitive to emissions scenario, and it is *virtually certain* that sea level will continue to rise through 2100



Relative to 1995-2014, the likely global mean sea level rise (*medium confidence*):

by 2100:

0.32-0.62 m under the low GHG emissions scenario (SSP1-2.6)

0.55-0.90 m under the high GHG emissions scenario (SSP3-7.0)

Approaching 2m sea level rise cannot be excluded

by 2150:

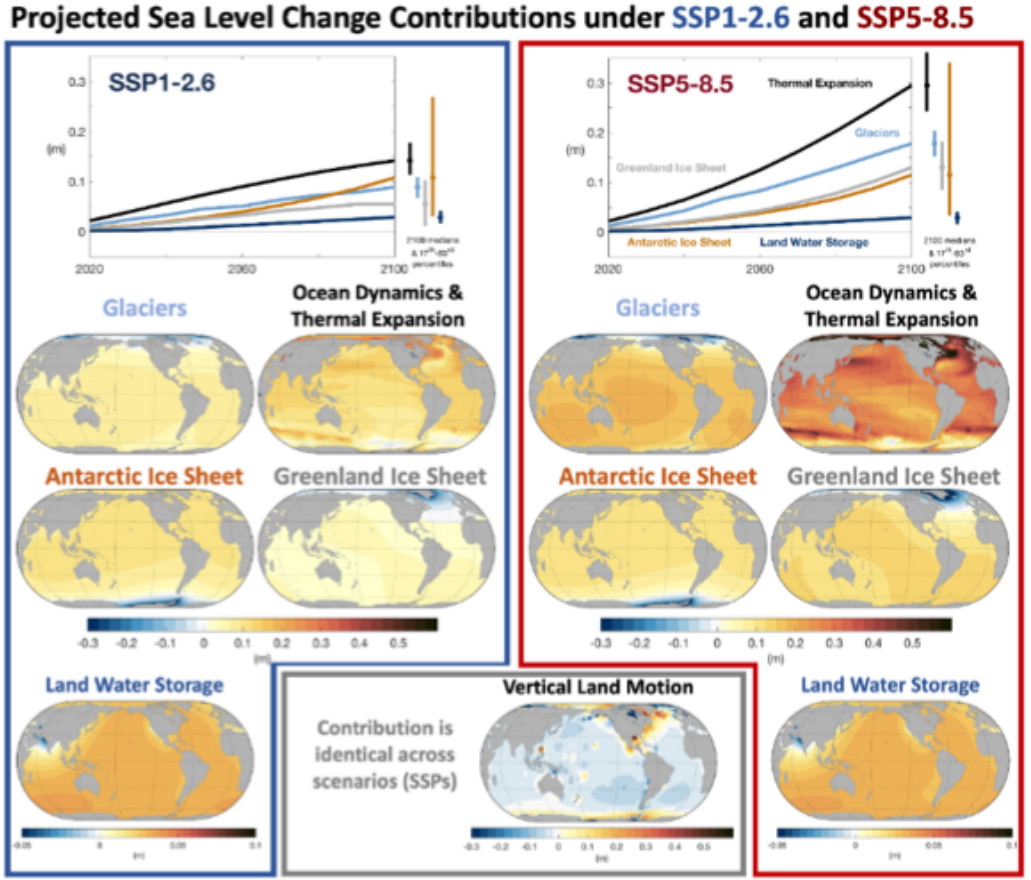
0.46-0.99 m under the low GHG emissions scenario (SSP1-2.6)

0.98-1.88 m under the high GHG emissions scenario (SSP3-7.0)

Regional differences in sea level arise from ocean dynamics, changes in Earth gravity, rotation and deformation in response to land-ice and land-water changes, and vertical land motion

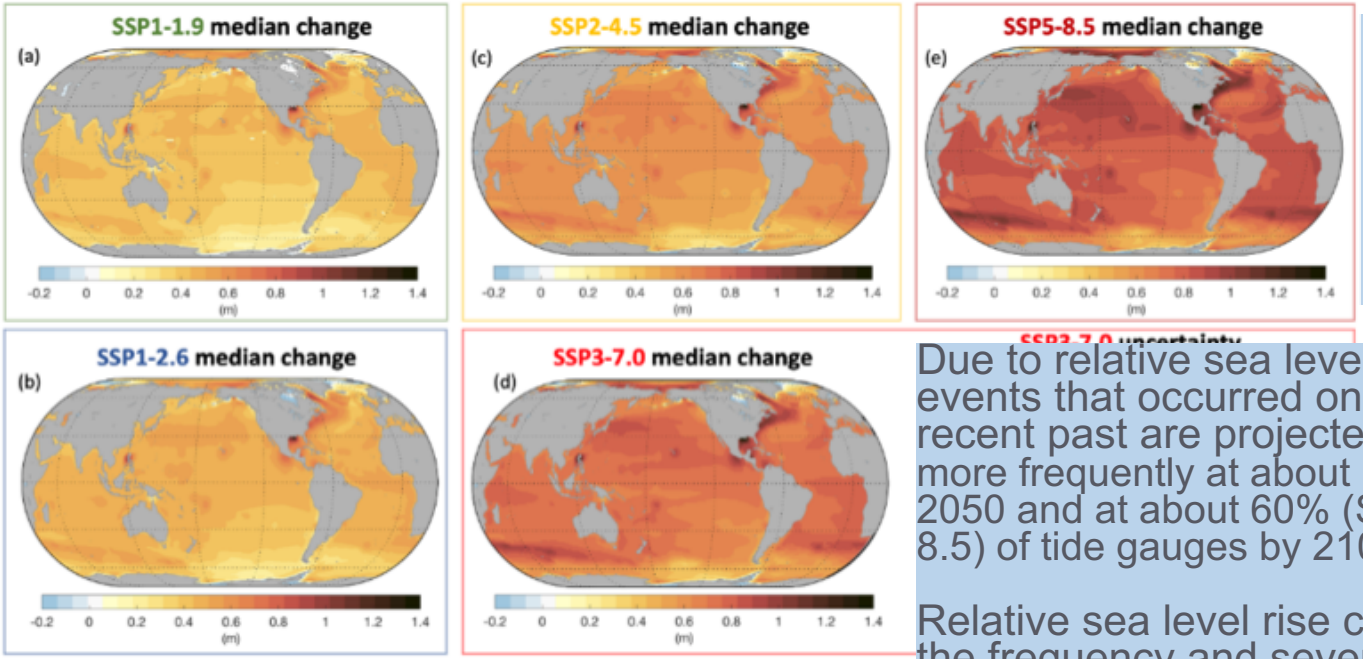
Temporal variability in ocean dynamics dominates regional patterns on annual to decadal time scales *(high confidence)*

The anthropogenic signal will emerge in most regions by 2100 *(medium confidence)*



It is *very likely* to *virtually certain* that regional mean relative sea level rise will continue throughout the 21st century, except in a few regions with substantial geologic land uplift rates.

Regional sea level change at 2100 for different scenarios (with respect to 1995-2014)



Approximately two-thirds of the global coastline has a projected regional relative sea level rise within ±20% of the global mean increase (*medium confidence*).

Due to relative sea level rise, extreme sea level events that occurred once per century in the recent past are projected to occur annually or more frequently at about 19–31% of tide gauges by 2050 and at about 60% (SSP1-2.6) to 82% (SSP5-8.5) of tide gauges by 2100 (*medium confidence*).

Relative sea level rise contributes to increases in the frequency and severity of coastal flooding in low-lying areas and to coastal erosion along

Beyond 2100, global mean sea level will continue to rise for centuries due to continuing deep ocean heat uptake and mass loss of the ice sheets *(high confidence)*

By 2300, GMSL will rise

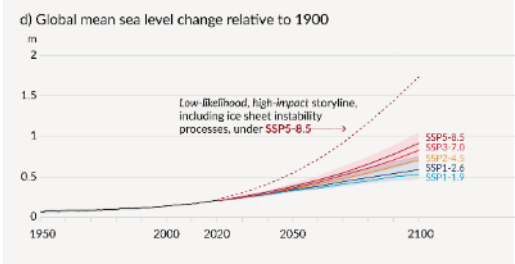
between 0.3 m and 3.1 m under SSP1-2.6

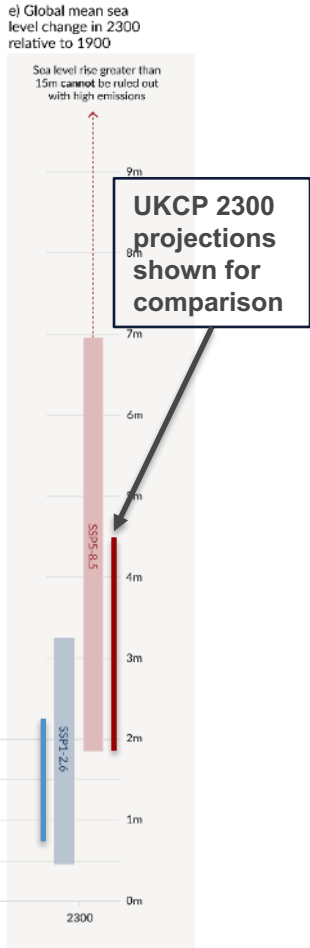
between 1.7 m and 6.8 m under SSP5-8.5 in the absence of Marine Ice Cliff Instability

and by up to 16 m under SSP5-8.5 considering Marine Ice Cliff Instability

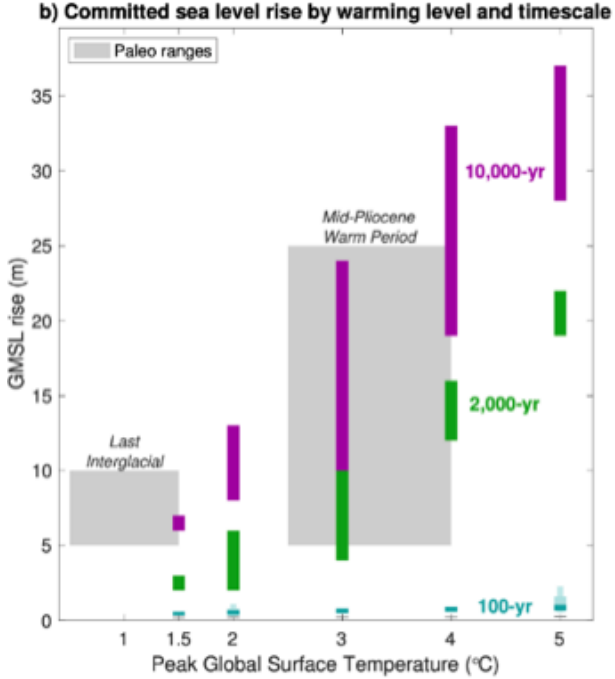
(*low confidence*)

Substantially higher values by 2300 than UKCP18





In the longer term, sea level is committed to rise for centuries to millennia and will remain elevated for thousands of years.



Over the next 2000 years, global mean sea level will rise by about
2 to 3 m if warming is limited to 1.5°C,
2 to 6 m if limited to 2°C and
19 to 22 m with 5°C of warming,
and it will continue to rise over subsequent millennia
(*low confidence*)

Projections of multi-millennial global mean sea level rise are consistent with reconstructed levels during past warm climate periods:
likely 5–10 m higher than today around 125,000 years ago, when global temperatures were *very likely* 0.5°C–1.5°C higher than 1850–1900;
and *very likely* 5–25 m higher roughly 3 million years ago, when global temperatures were 2.5°C–4°C higher (*medium confidence*).

AR6 take home messages

- It is *virtually certain* that sea level will continue to rise throughout the 21st century and beyond - deep and rapid cuts in emissions are the route to minimise sea level rise (particularly risk of large loss from Antarctic ice sheet)

- Sea level rise at 3C by 2100 is 62cm (50-81cm) (*medium confidence*) BUT

  1. extreme flooding events that happened once per century will occur annually in more locations at higher warming levels (60% versus 80%)
  2. higher levels by 2100 cannot be excluded due to ice sheet processes
  3. 3C warming would have significant implications for sea level rise post 2100

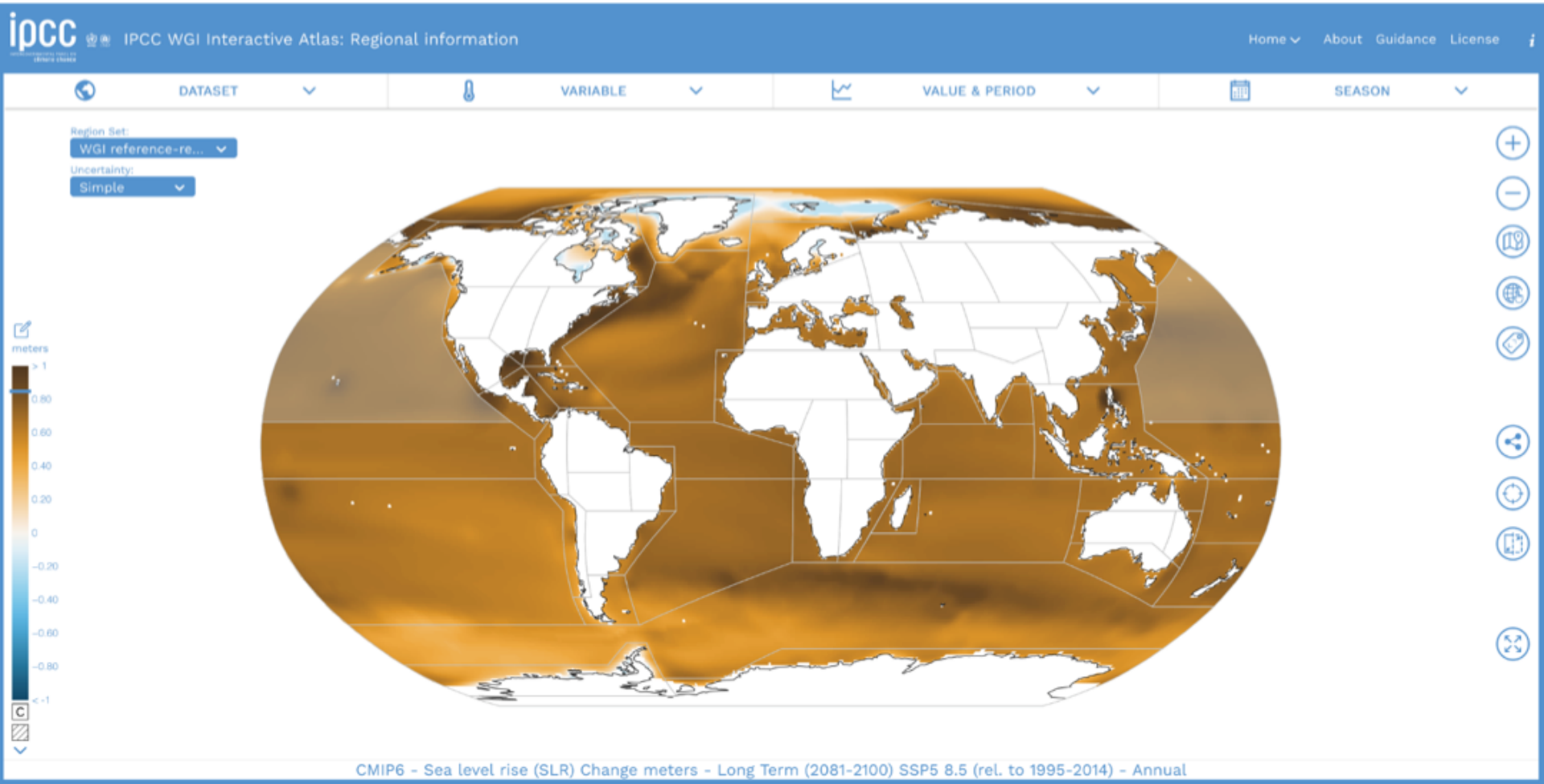
- Deep uncertainty is associated with ice sheet processes and this area would be one of my priorities to reduce uncertainty in the projections beyond AR6

[Credit: NASA]

ONLINE RESOURCES

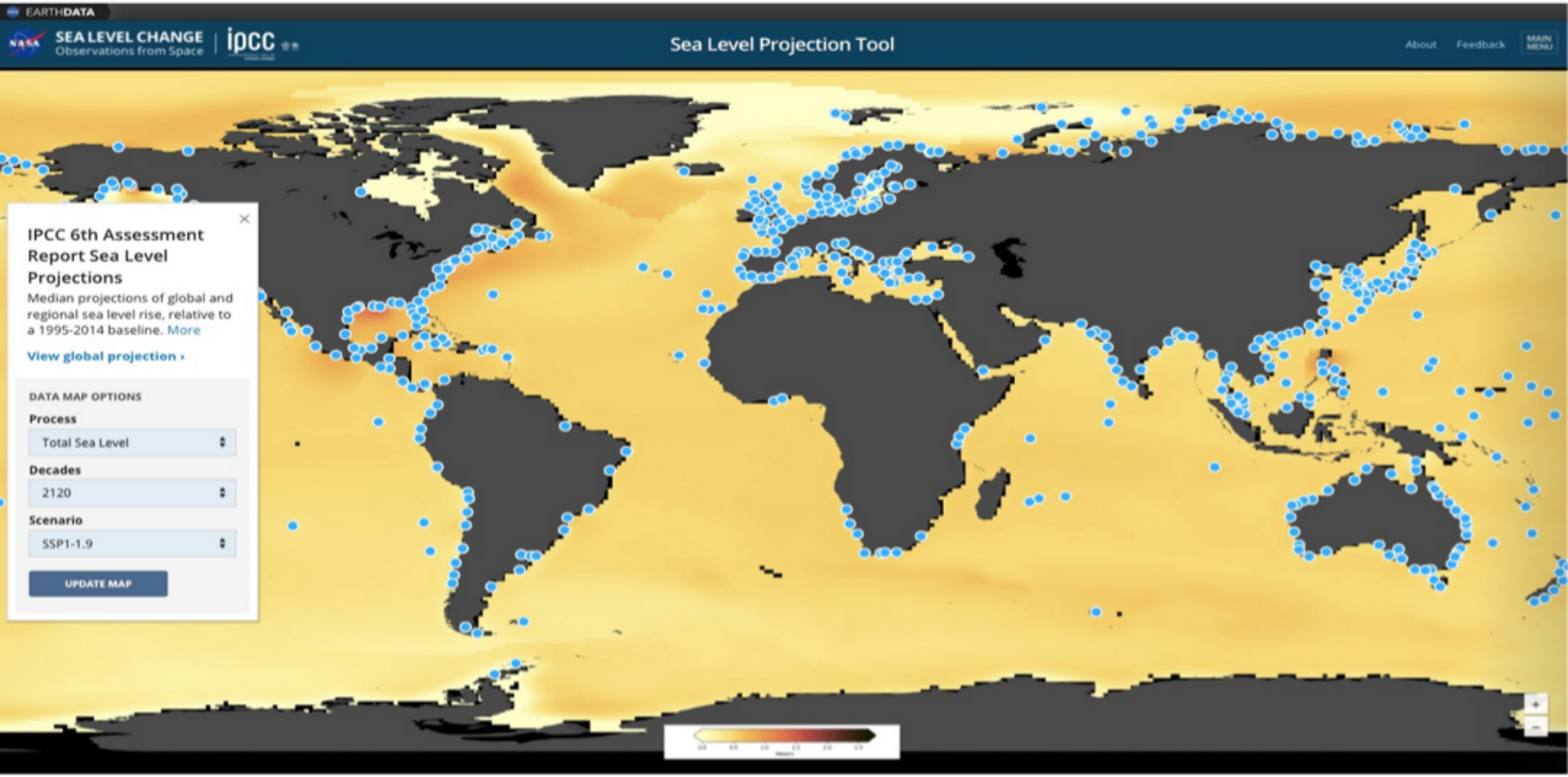
Interactive Atlas

interactive-atlas.ipcc.ch



NASA sea level tool

https://sealevel.nasa.gov/data_tools/17



Thank you.

More Information:

IPCC: www.ipcc.ch

Many thanks to:

Chapter scientists Gregory Garner & Tim Hermans

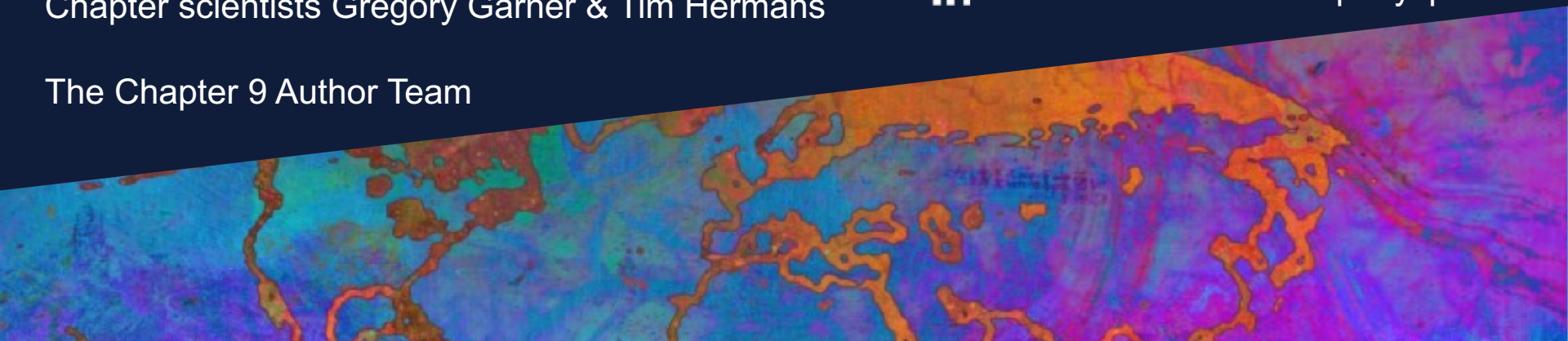
The Chapter 9 Author Team

Follow IPCC:

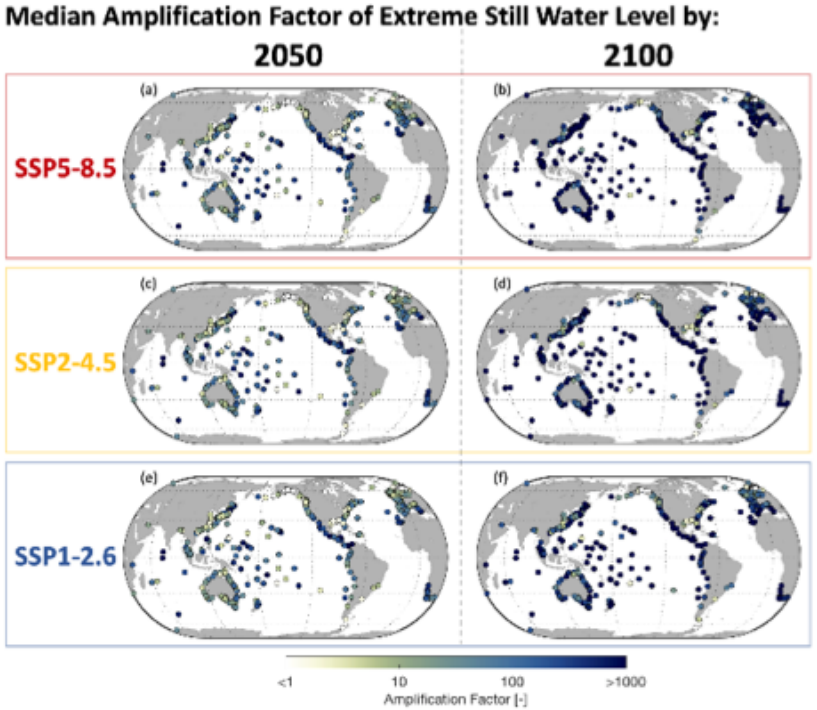
@IPCC

@IPCC_CH

linkedin.com/company/ipcc



Regional sea-level change will be the main driver of a substantial increase in the frequency of extreme still water levels over the next century *(medium confidence)*



Due to relative sea level rise, extreme sea level events that occurred once per century in the recent past are projected to occur annually or more frequently at about 19–31% of tide gauges by 2050 and at about 60% (SSP1-2.6) to 82% (SSP5-8.5) of tide gauges by 2100 (*medium confidence*).

Relative sea level rise contributes to increases in the frequency and severity of coastal flooding in low-lying areas and to coastal erosion along most sandy coasts (*high confidence*).