

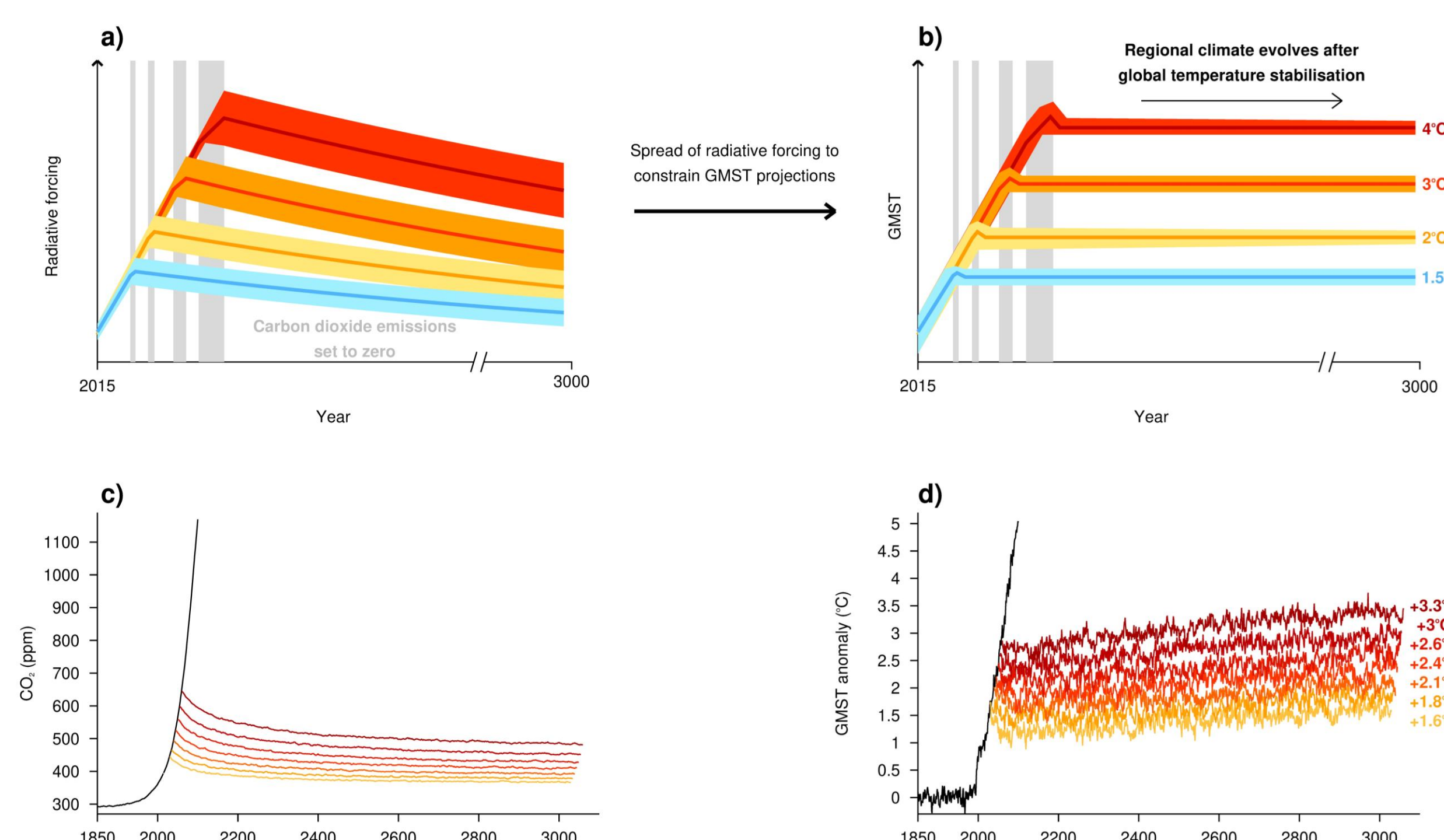
Understanding a post-net-zero world using ACCESS-ESM-1.5

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As governments aim to achieve net-zero emissions by the middle of this century it's important to work out the implications for future climate. How will the climate evolve if we achieve global net-zero and what does that mean for Australia. Here, we use ACCESS-ESM-1.5 to start to explore the future we may experience.

The experiments

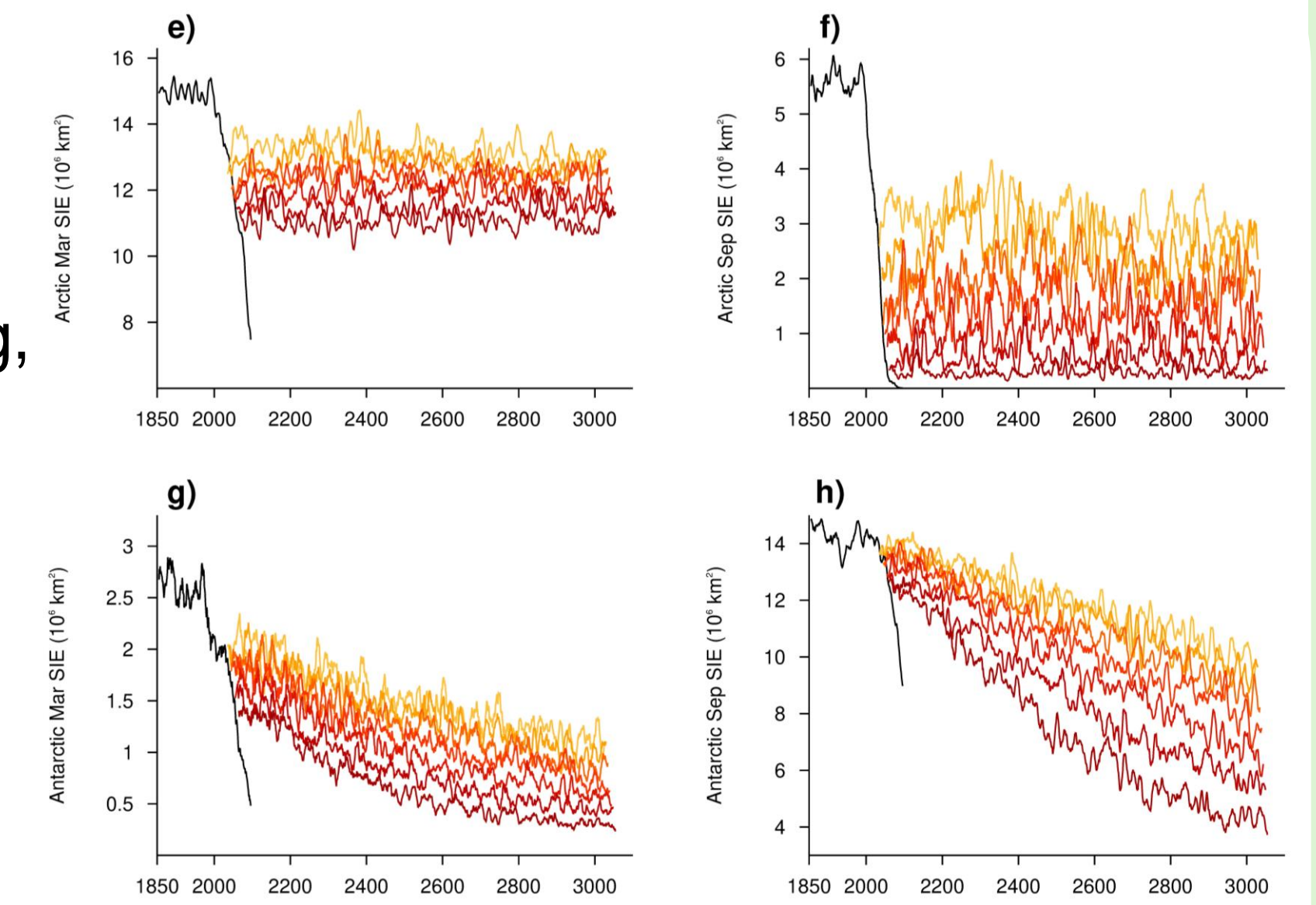
- ACCESS-ESM-1.5 was run for 1000 years under net-zero carbon dioxide emissions after branching from seven points on SSP5-8.5.
- This results in declining atmospheric carbon dioxide concentrations and near-stable global temperatures under net-zero carbon dioxide emissions.



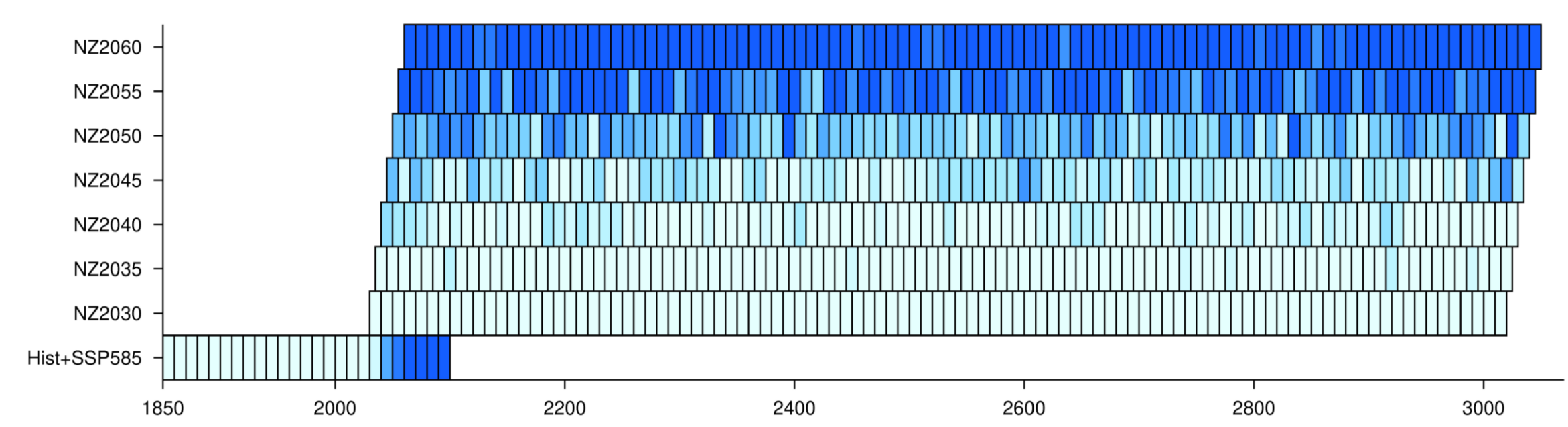
Antarctic sea ice decline continues

Beyond net-zero emissions, Arctic sea ice stops declining, although doesn't recover. Antarctic sea ice continues declining for centuries.

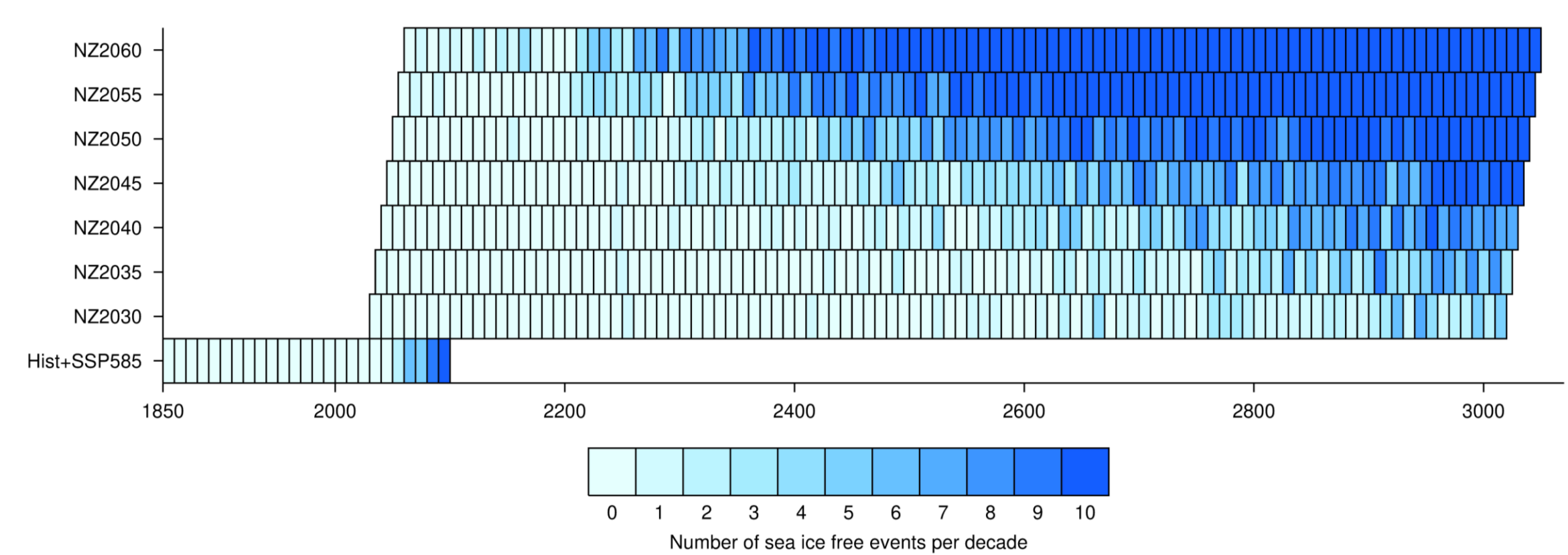
As a result, the likelihood of ice-free months increases in Antarctica but not in the Arctic.



a) Arctic sea ice free Septembers

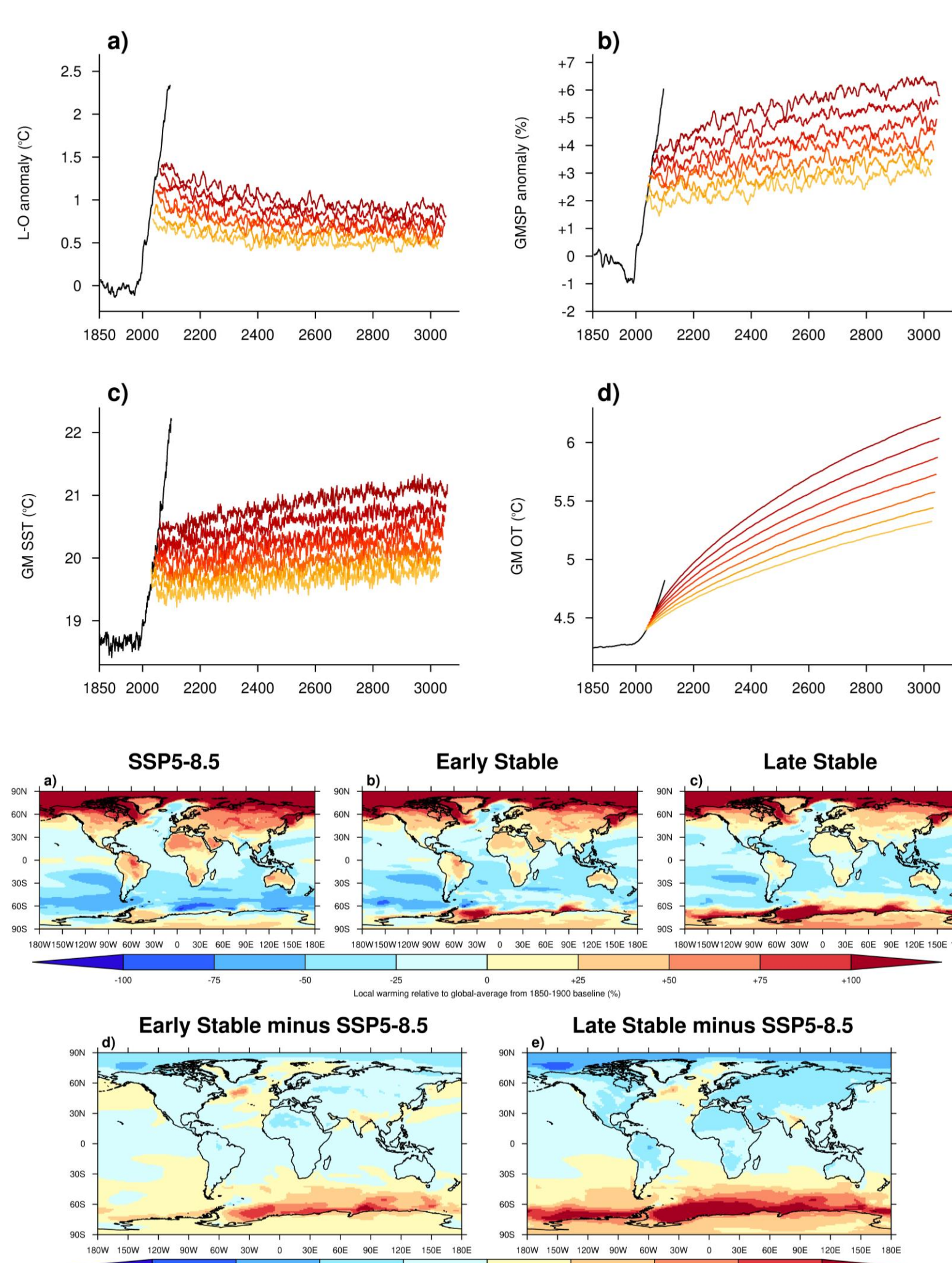


b) Antarctic sea ice free Marches



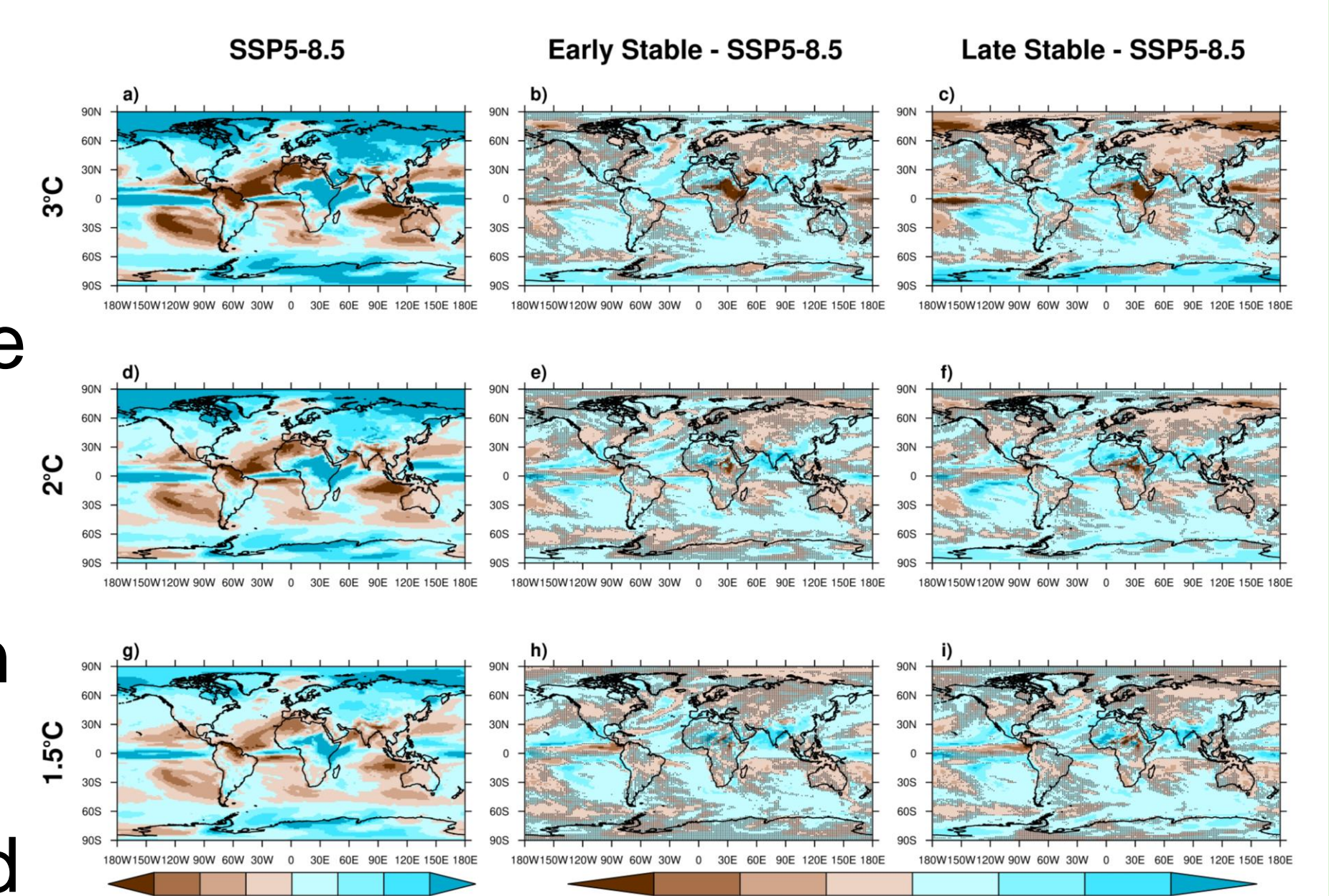
Land cools and oceans warm

While global temperatures show weak change beyond emissions cessation, we see a changing pattern with Southern Ocean warming and land cooling relative to fast-warming simulations. The deep ocean continues to warm strongly and global-average precipitation slowly increases.



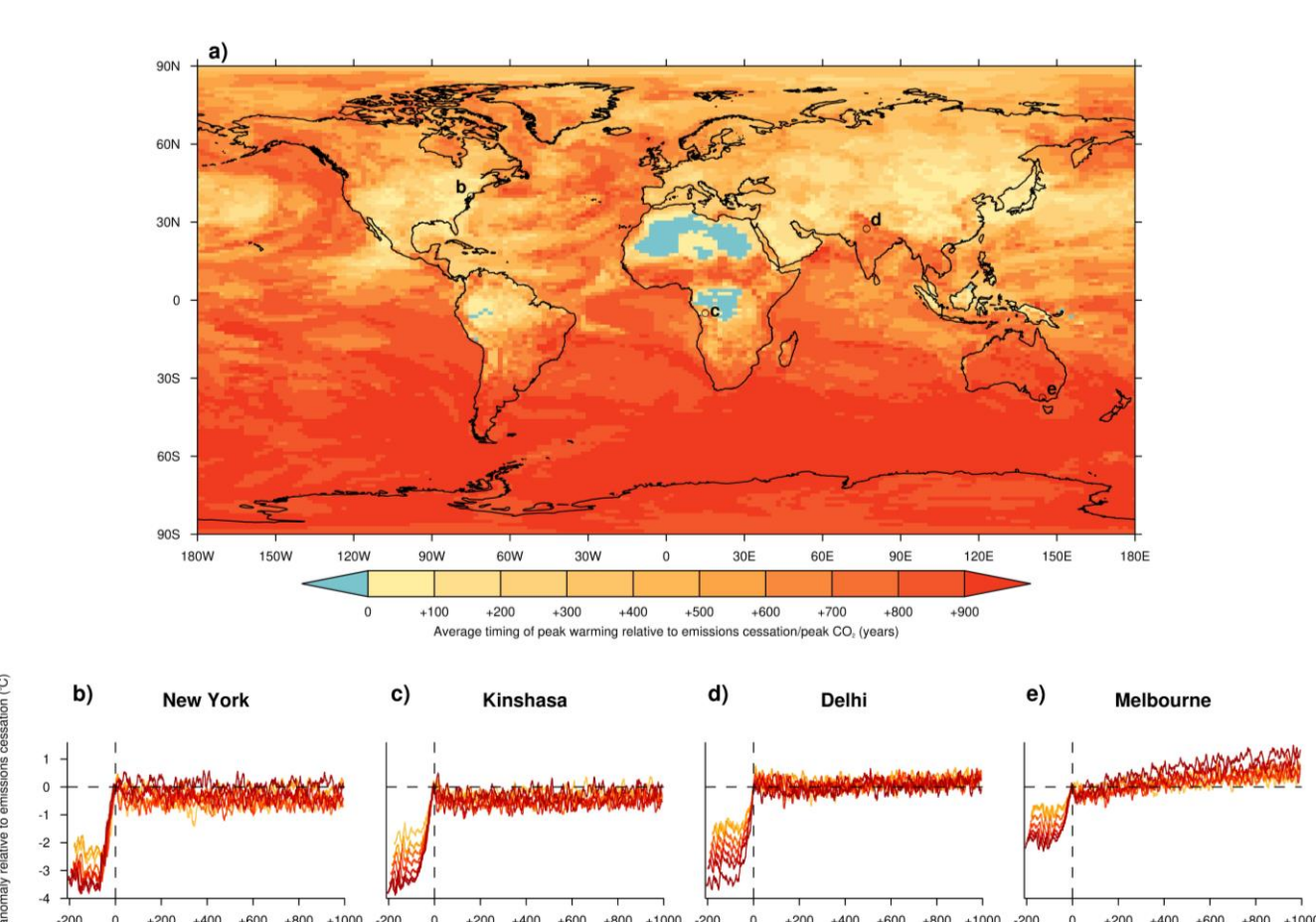
Precipitation changes begin to reverse

The pattern of precipitation change is very different beyond net-zero with increasing rain over many regions currently drying and vice versa.



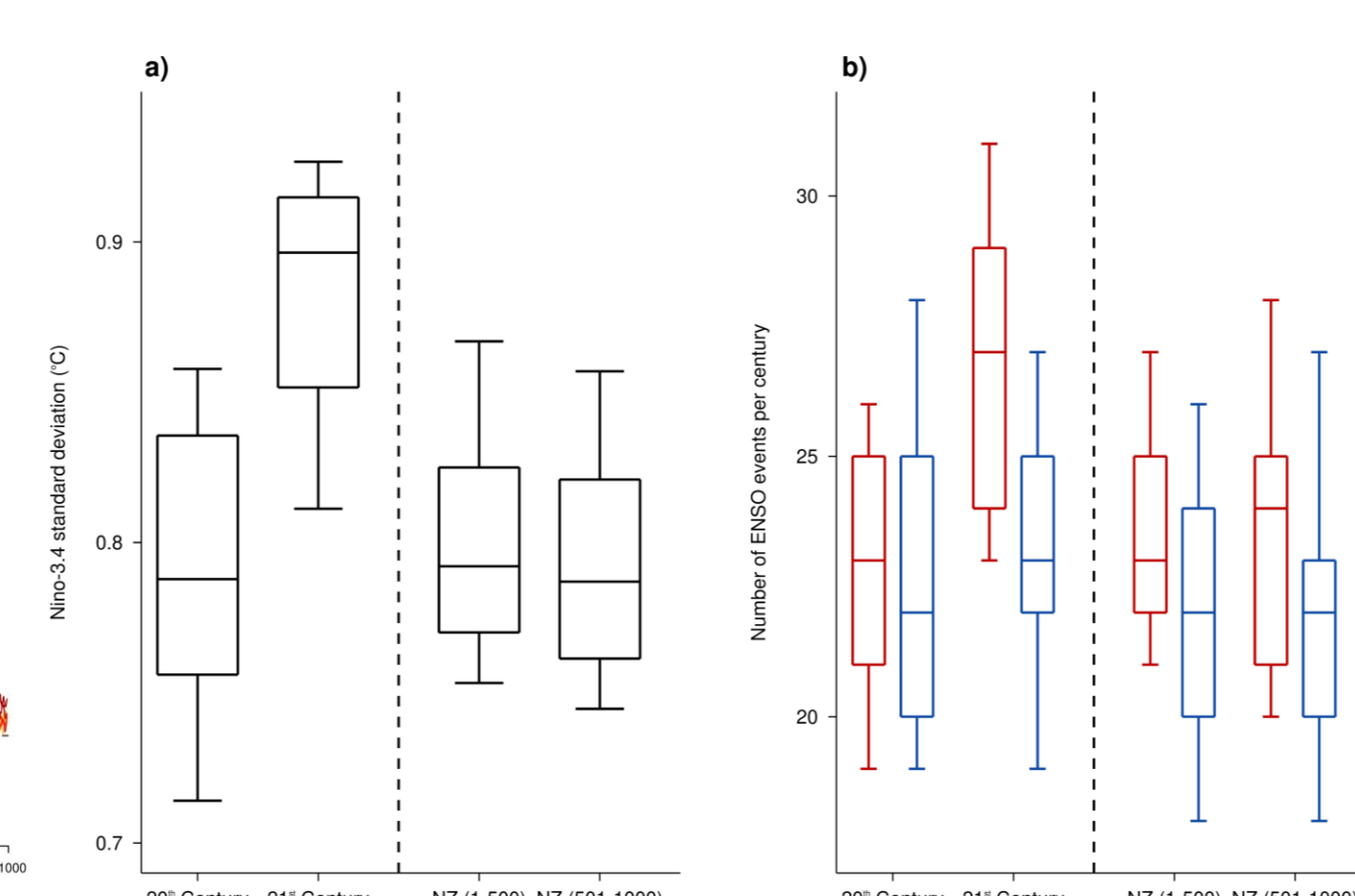
The Southern Hemisphere continues to warm

For much of the Southern Hemisphere, including southern Australia, temperatures don't peak until centuries after net-zero is achieved.

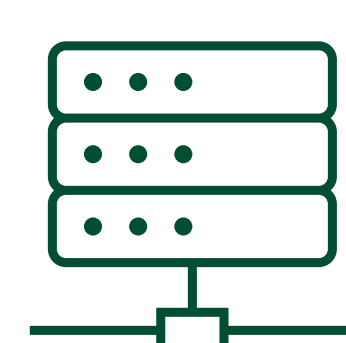


ENSO amplitude may decline

While ENSO amplitude is projected to increase under continued global warming scenarios, these simulations suggest that after net-zero emissions we may see a decrease in ENSO magnitude and fewer El Niño events.



Even though global warming nearly stops under net-zero, regional changes and slow processes continue. We will see some quick benefits after net-zero but other ongoing effects of our cumulative emissions.



There are many interesting studies that can be done with these simulations. I'd encourage you to take a look at the data on NCI and contact me or Tilo Ziehn if you think these simulations would be useful to you.



Further work to understand consequences of net-zero and net-negative emissions is needed using other scenarios and other models.