APARC
Atmospheric Processes
And their Role in Climate

WCRP EPESC – LEADER Science Meeting
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Session D-1: The role of external forcings and internal variability on atmospheric temperature trends

WG 8 LEADER – ATC Activity
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A. Sweeney, F. Ladstädter, and the ATC Activity

WCRP
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The role of external forcings and internal variability on atmospheric temperature trends

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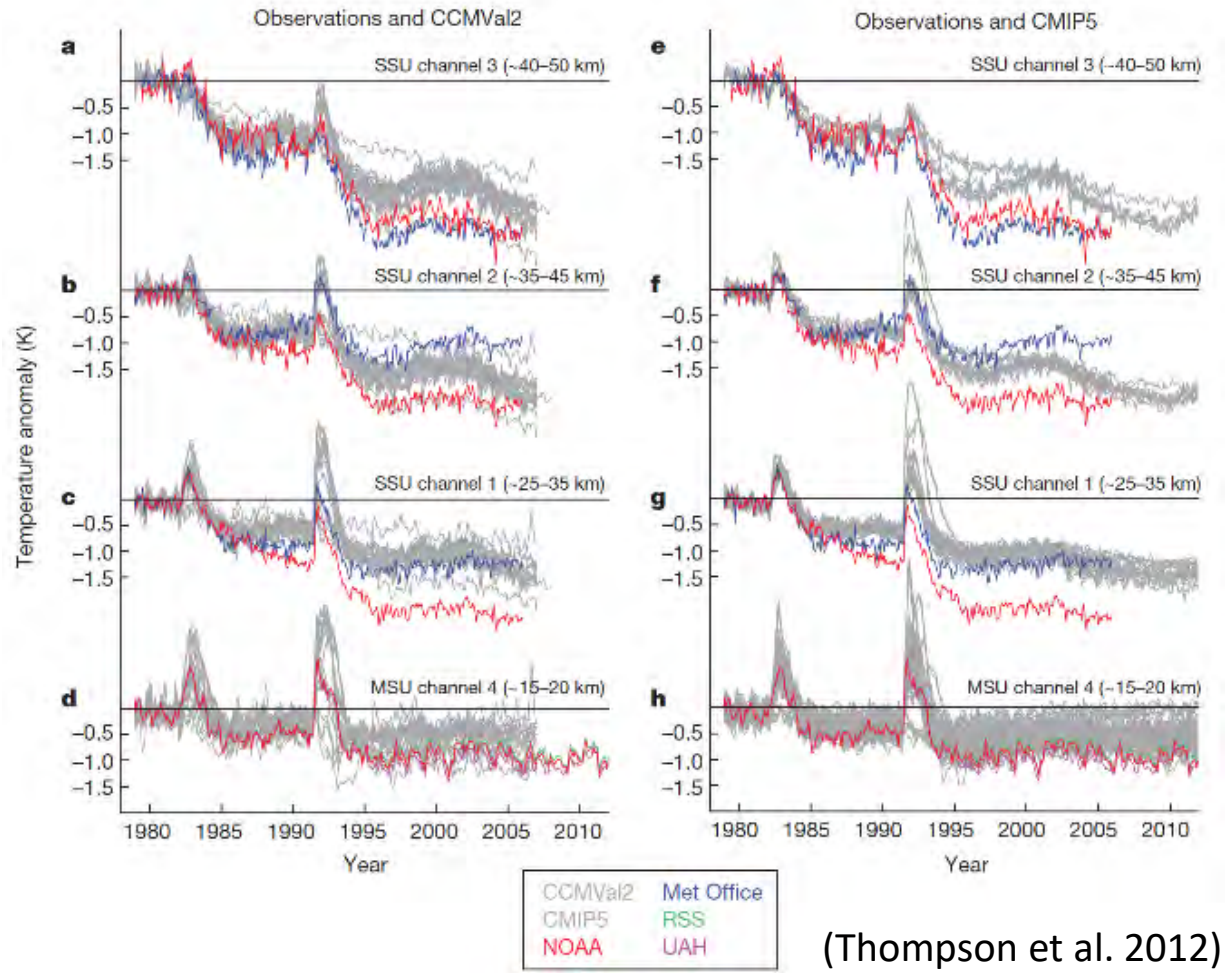
- Discrepancies in stratospheric temperature trends from models and observations
- Observations agree, but models have smaller trend
- Observations disagree, models lie in-between
- Observations disagree, models agree with Met Office
- Observations and models consistent



(Thompson et al. 2012)

The role of external forcings and internal variability on atmospheric temperature trends

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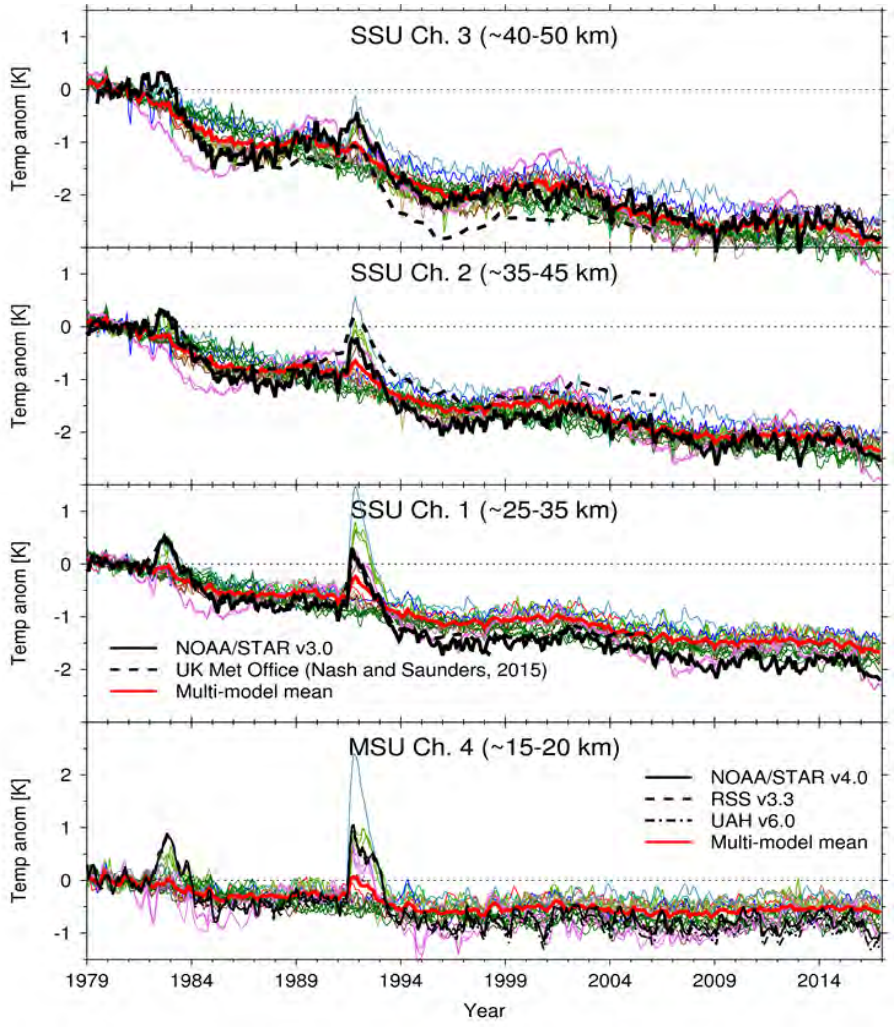
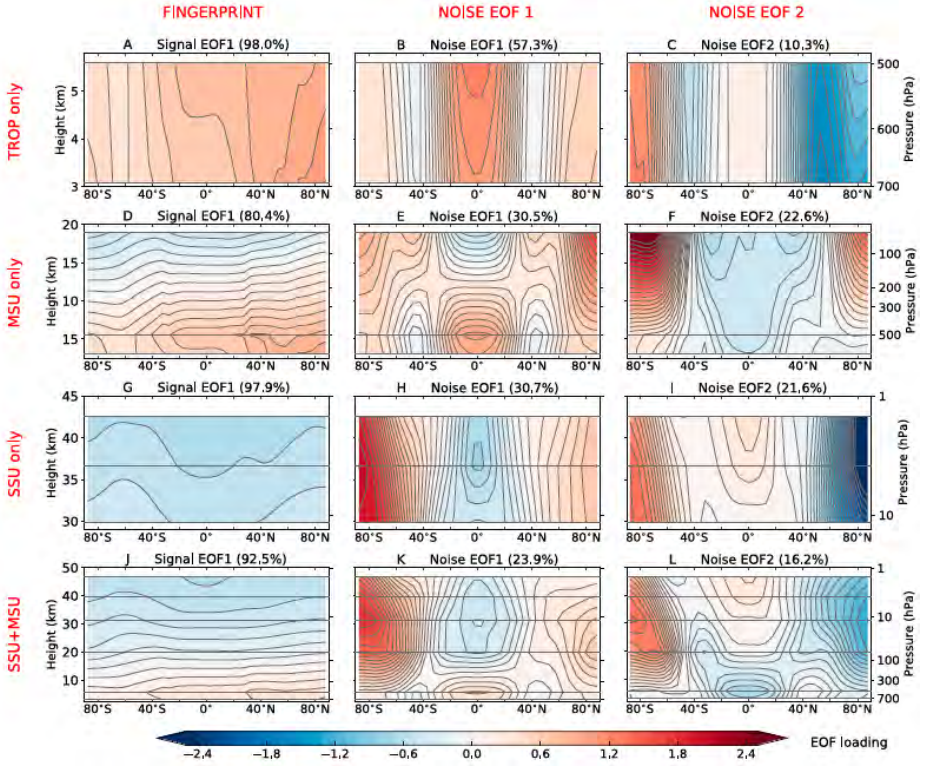
- Discrepancies in stratospheric temperature trends from models and observations
- lessened with **reprocessed satellite record**
- **Substantially better agreement** between observed and modeled stratospheric temperature trends than in former data version
- **Due to improved observations while models have not changed much**



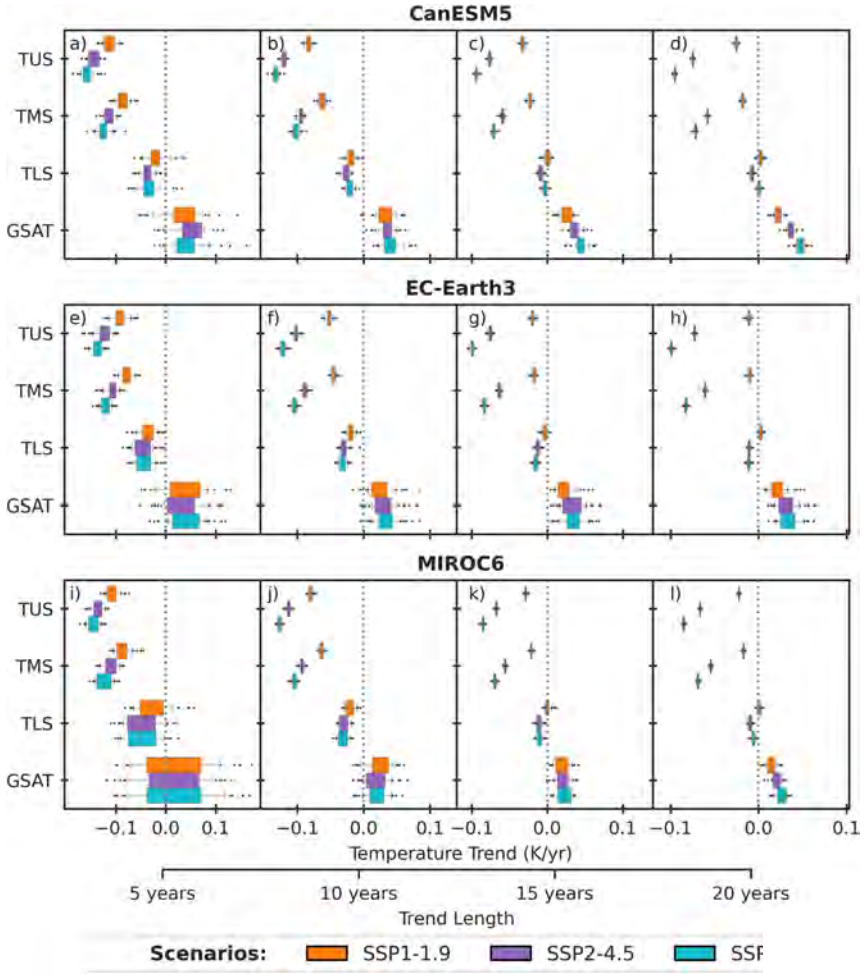
(Maycock et al. 2018)

The role of external forcings and internal variability on atmospheric temperature trends

- Stratospheric temperature trends have high signal-to-noise ratios
- Detection of human fingerprint
- Could be early indicators of mitigation effects



(Santer et al. 2023)



(Romanzini-Bezerra & Maycock 2024)

The role of external forcings and internal variability on atmospheric temperature trends

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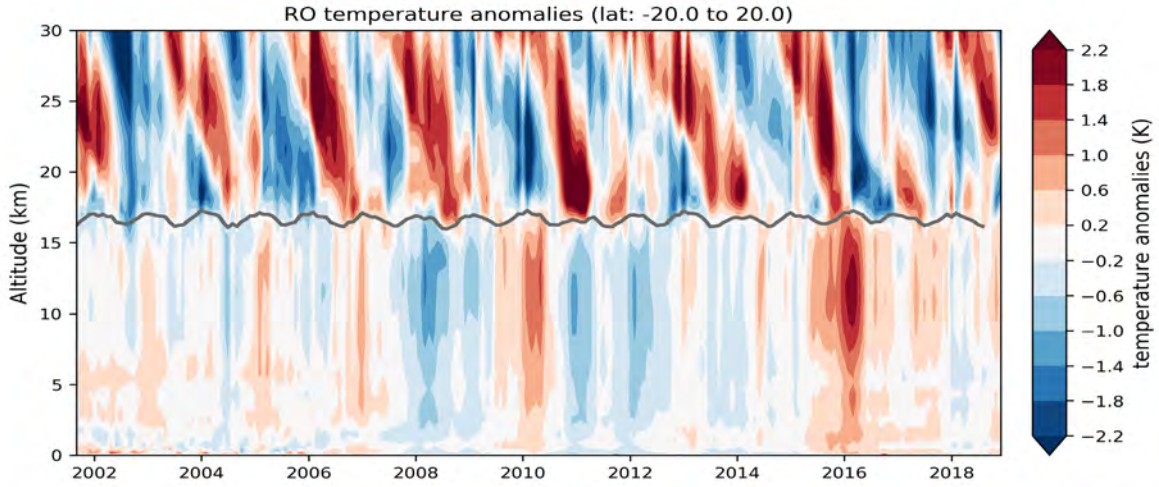
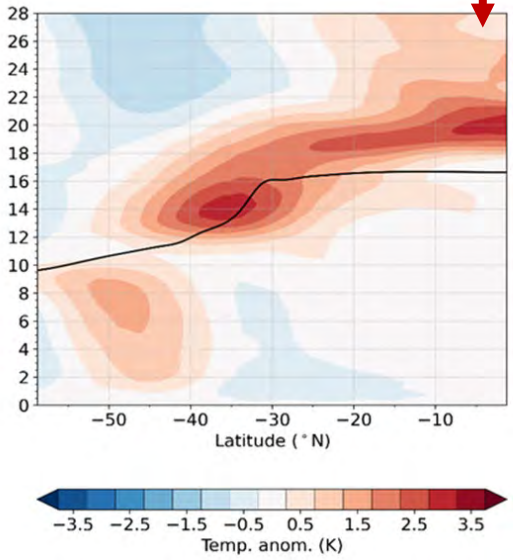
- Observations with high vertical resolution
- Climate trends in the UTLS
- Atmospheric variability
- Short-term signals from volcanoes
- Impacts from wildfires

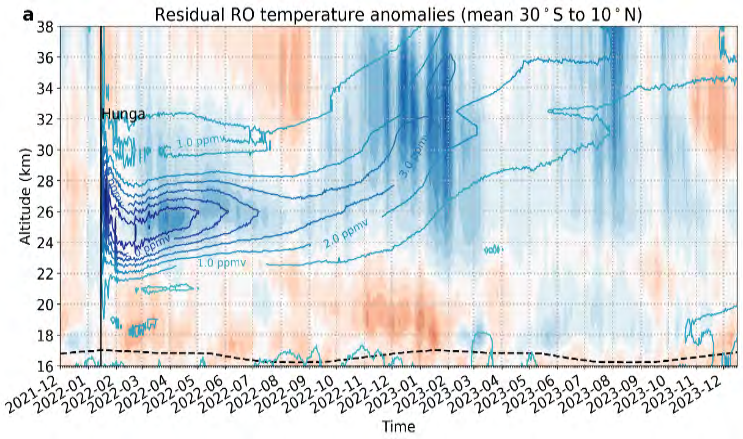
QBO and ENSO



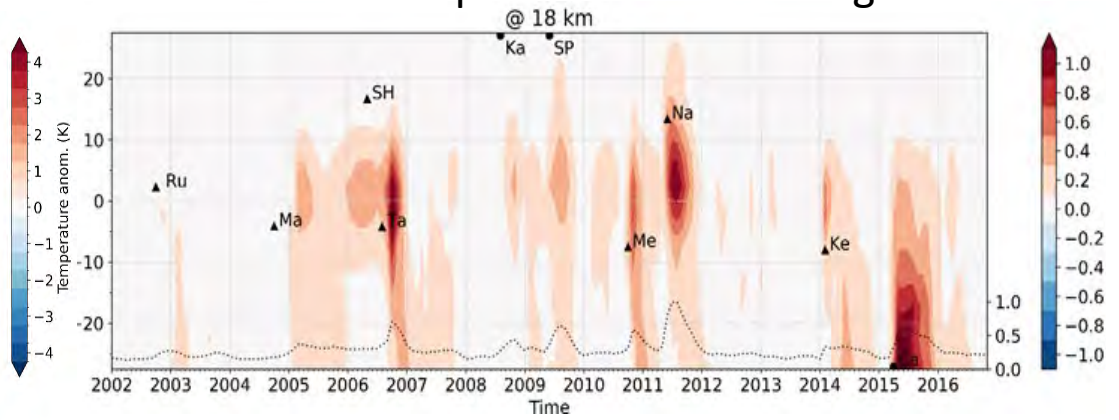
Australian wildfire



Hunga – Cooling



Volcanoes post-2000 – Warming



(Steiner et al. 2020; Ladstädter et al. 2023; Stocker et al. 2019; 2021)

SESSION D-1

The role of external forcings and internal variability on atmospheric temperature trends

WG8 LEADER – ATC Activity

- LESFMIP simulations for evaluation of atmospheric temperature trends
- How do model trends and observational trends compare? Are there discrepancies?
- Can discrepancies between observations and models be attributed to individual forcings or internal variability or observations?
- Can atmospheric temperature trends in different regions be attributed to individual forcings?

SESSION D-1

The role of external forcings and internal variability on atmospheric temperature trends

- **Benjamin Santer (virtual):** On Human fingerprints of climate change
- **Matthias Stocker (virtual):** Evaluating atmospheric temperature trends from LESFMIP simulations and observations
- **Sebastian Sippel (virtual):** Early-twentieth-century cold bias in ocean surface temperature observations & implications for constraints on future temperature projections
- **Erich Fischer:** On how the continued upward trend in temperature impacts hazard likelihoods (the increased likelihood of 5-sigma events)
- **Satyajit Singh Saini (virtual):** Aerosol transport and Polar Climate Extremes