

Tropical Pacific Decadal Variability Working Group

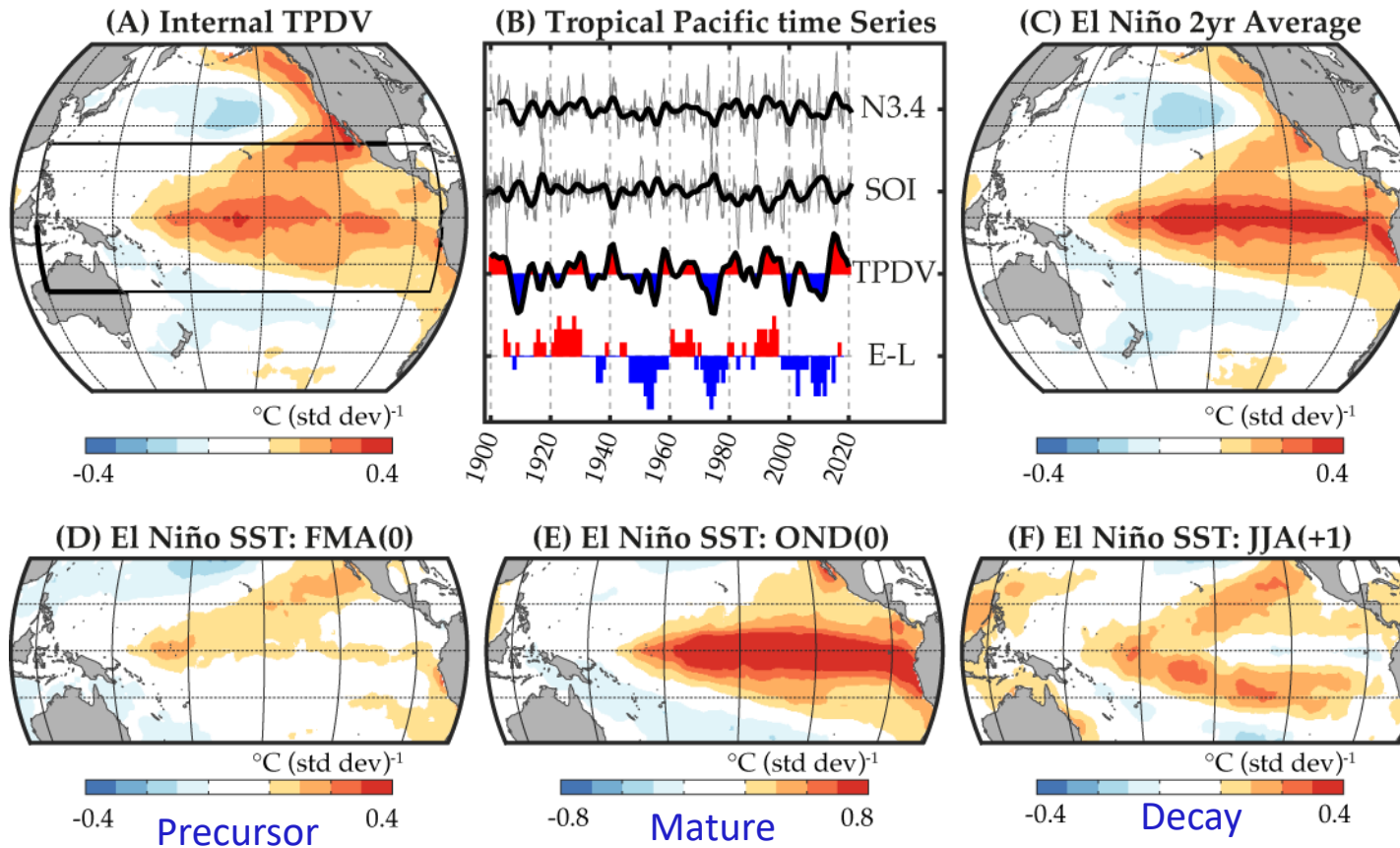
A PRP Initiative

Antonietta Capotondi, Sophie Cravatte, Riccardo Farneti, Giorgio Graffino, Neil Holbrook, Ryan Holmes, Shijian Hu, Yukiko Imada, Kris Karnauskas, Yu Kosaka, Fred Kucharski, Jing-Jia Luo, Nicola Maher, Michael Mayer, Shayne McGregor, Michael McPhaden, Bo Qiu, Sara Sanchez, Agus Santoso, Janet Sprintall, Samantha Stevenson, Malte Stuecker, Arnold Sullivan, Andrea Taschetto, Caroline Ummenhofer, Fan Wang, Matthias Zeller, Xuebin Zhang

The Working Group includes several past and present PRP members, and several Early Career Scientists

Is TPDV just an ENSO residual?

Internal TPDV: the null hypothesis

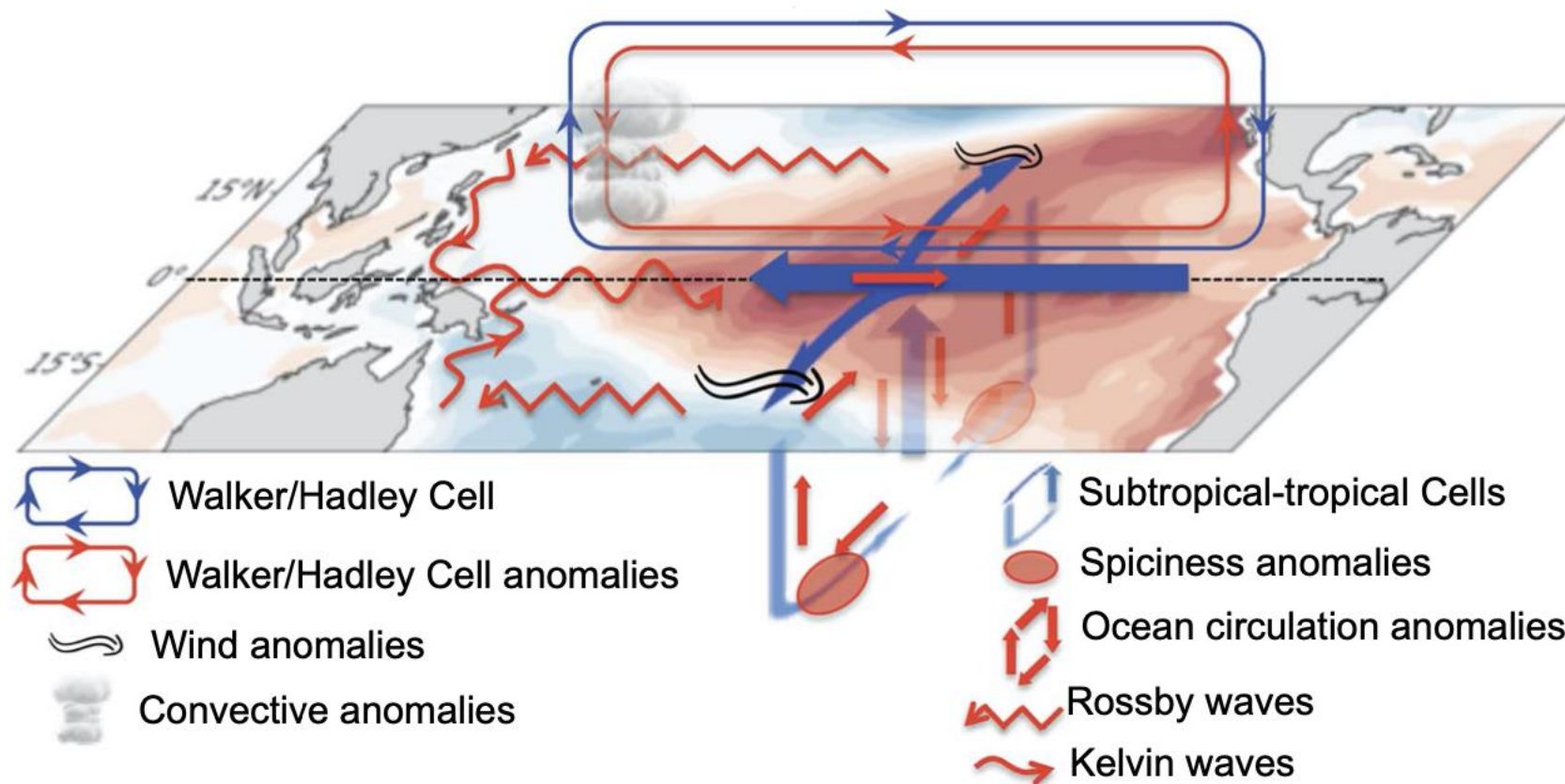


A previous paper organized by the PRP (Power et al., 2021) suggested that TPDV can originate as an ENSO residual, a “null hypothesis” that is difficult to disprove.

The positive TPDV pattern can be reconstructed as the residual of different evolutions of El Niño events from the precursor to decay El Niño phases.

If TPDV was only a residual of random differences in the ENSO evolution, there would be little prospect for skillful decadal predictions.

Oceanic/atmospheric Processes Contributing to Decadal Variations



Motivation

The TPDV Working Group was created to revisit oceanic and atmospheric processes proposed in the literature, and assess their effectiveness in producing decadal timescales.

Also, a better understanding of the leading processes of TPDV is critical for separating tropical Pacific forced trends from internal low-frequency variations

Terms of Reference

1. Review current state of knowledge of the role of the Subtropical Cells (STCs) in tropical Pacific decadal variability (including $v'\bar{T}$ and $\bar{v}T'$ mechanisms) in both observations/reanalysis and modelling studies (coupled and uncoupled).
2. Review current understanding of the interactions between Pacific and Indian Oceans at decadal timescales through the ITF.
3. Review current state of knowledge on atmospheric teleconnections from the extra-tropical Pacific, as well as Indian and Atlantic Oceans that can lead to TPDV.
4. Examine TPDV in paleo archive (characteristics, inter-basin linkages).
5. Assess the fidelity of state-of-the-art climate models in reproducing the properties of TPDV found in instrumental and paleoclimate archives.
6. Examine which changes may occur to TPDV under different warming scenarios.
7. Summarize the findings of the working group in one or more papers. Organize one or more conference sessions to stimulate discussions on TPDV and promote further research on the remaining open questions.

Activities

Quasi-monthly meetings starting to review different aspects of TPDV

May 18, 2021: Observations of decadal variability in the Pacific Subtropical Cells (**Mike McPhaden**)

June 28, 2021: Wind stress forcing and low-frequency variability of the Pacific Subtropical Cells (**Giorgio Graffino**)

July 28, 2021: Pacific Ocean Lower Latitude Western Boundary Currents (**Janet Sprintall**)

August 30, 2021:

- South Pacific variability and its connection with Tropical Pacific Decadal Variability (**Neil Holbrook**)
- Decadal sea level variability in the Pacific (**Xuebin Zhang**)

September 27, 2021

- Impacts of multi-decadal Pacific variability on the Indian Ocean (**Caroline Ummenhofer**)
- Indian Ocean impact on tropical Pacific through the ITF (**Michael Mayer**)

Activities

October 21, 2021:

- Importance of South Pacific $\bar{v}T'$ mechanism in TPDV and its impact on ENSO prediction - Case study: the termination of El Nino in 2014 (**Yukiko Imada**)
- Contribution of Spiciness Anomalies to Tropical Pacific Decadal Variability (**Mathias Zeller**)

November 23, 2021:

- Multi-Scaled Circulation Variability & Impact in the Western Tropical Pacific Ocean (**Bo Qiu**)
- Equatorial/Off-equatorial climate connectivity via coupled Hadley-STC-cloud feedback (**Malte Stuecker**)

December 14, 2021:

- Pacific low-frequency variability: tropical-extratropical interactions and subtropical cells (**Riccardo Farneti**)
- Atmospheric influences of Atlantic and Indian Oceans on TPDV: A biased point of view (**Fred Kucharski**)

February 2, 2022: Paleo Tropical Pacific Decadal Variability: What can paleoclimate offer? (**Sara Sanchez**)

September 22, 2022: Role of nonlinear dynamical heating in TPDV phase transitions (**Malte Stuecker**)

November 7, 2022

- Atlantic and Indian Ocean influences on TPDV (**Shayne McGregor**)
- Wind forcing of the STCs (**Antonietta Capotondi**)

Review Paper

A review paper was invited by Nature Reviews Earth & Environment in August 2022

The WG has been working on the review paper since November 2022.

The paper summarizes the body of knowledge collected during our meetings and associated discussions.

Paper will be finalized during this upcoming hybrid TPDV meeting

Submission deadline: March 15, 2023

Future activities (as joint research projects)

- Use the guidance of the review paper on the most TPDV-relevant oceanic/atmospheric processes to assess the fidelity of CMIP-type models (or their oceanic components) to represent those processes
- Assess possible TPDV changes in future climate projections