



APARC

Atmospheric Processes
And their Role in Climate

46th meeting of the Joint Steering Committee, WCRP

APARC

Atmospheric Processes And their Role in Climate

Co-chairs: Amanda Maycock, Olaf Morgenstern, Karen Rosenlof

IPO: Rolf Müller, Ines Tritscher, Moha Diallo, Lars Hoffmann, Olaf Stein

With many
thanks for IPO
support to



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A. C. Maycock, O. Morgenstern

10 May 2025, Paris



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Reflecting on the first year of APARC



- Our project is now firmly established as APARC.
- ‘Seamless’ transition and positive community response.
- New logo routinely used.
- New website under construction.
- Promotional video being finalised.



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SSG and co-chair succession

- Karen Rosenlof to retire as co-chair. We have suggested a successor.
- Several SSG members will rotate off this year. Nominations for 6 new members are being considered by the JSC.
- SSG members appointed in 2025:



Dr Suvarna Fadnavis
IITM, Pune, India

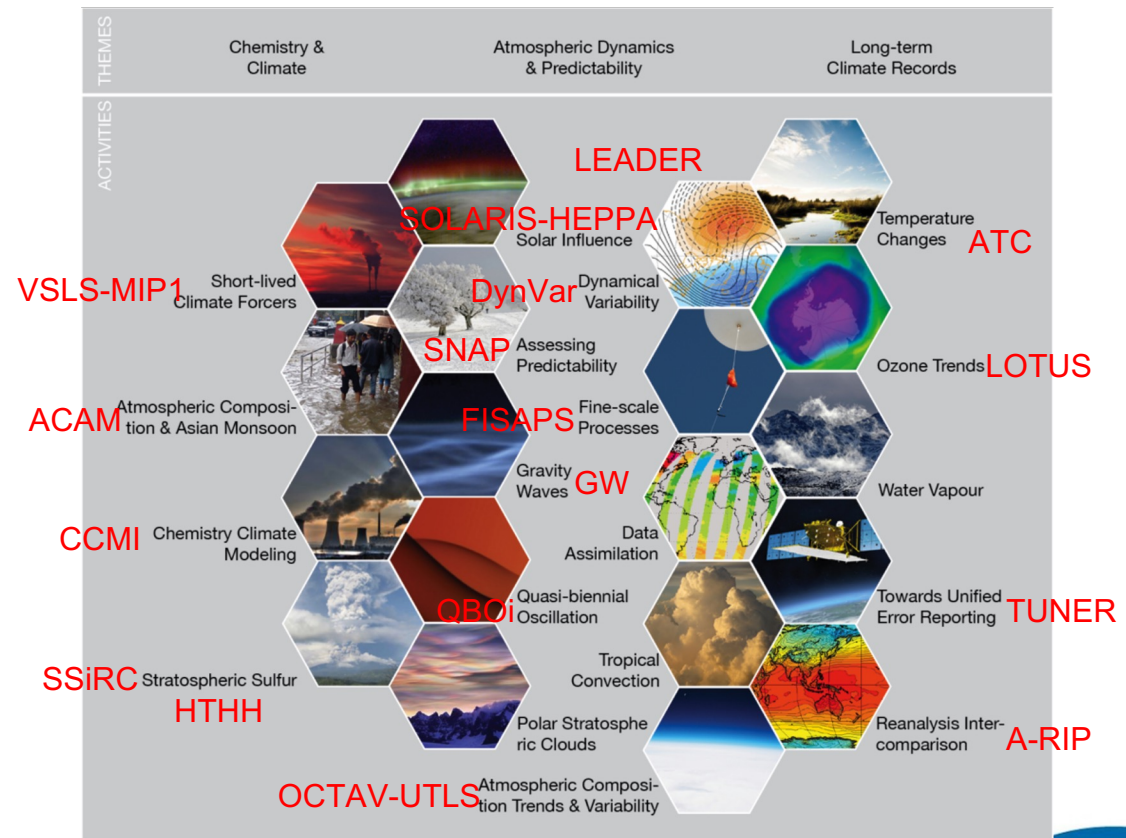


Dr Victor Ongoma
Mohammed VI Polytechnic U.
Marrakesh, Morocco

APARC activities

APARC themes and activities (red).

All are addressing current research priorities and/or serve operational purposes for IPCC Reports or WMO Ozone Assessments.



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Highlights for Joint Scientific Committee

- Hunga Tonga-Hunga Ha’apai stratospheric impacts (HTHH) Activity - Assessment Report forthcoming in 2025, will inform 2026 WMO/UNEP Ozone Assessment. >70 authors and reviewers involved.
- Large Ensembles for Attribution of Dynamically-driven ExtRemes (LEADER) – joint activity with EPESC, work is progressing well towards several community publications analysing Large Ensemble Single Forcing MIP results.
- A-RIP and LOTUS side meetings before and after the Quadrennial Ozone Symposium in Boulder (15-19 July 2024), A-RIP meeting included an ECR Networking Event
- APARC supported ECRs to attend STIPMEX workshop in Pune, June 2024.

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Highlights for Joint Scientific Committee

- March 2025: Workshop on atmospheric predictability (SNAPSI, QBOi, and QUOCA APARC Activities) – Cambridge, UK. 90 in person participants.



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Highlights for Joint Scientific Committee

Upcoming APARC connected meetings:

- June 2025: ACAM Workshop & Training School in Bali, Indonesia (8–13 June 2025).
- APARC supporting Storm Tracks workshop, Norway, June 2025.
- International Gravity Wave symposium, Seoul, South Korea, June 2025.

The following projects received additional support in 2024 from ISSI and are meeting in Bern, Switzerland:

- QBOi-CCMi/QUOCA WG: INFO-QBO: INvestigating the Feedback from Ozone in the Quasi-Biennial Oscillation (C Orbe, A Ming)
- CCMi: Satellite-Based Evaluation of Stratospheric Transport in Chemistry-Climate Models (M Abalos)
- A-RIP, HTHH, CCMi: Climate Impacts of Stratospheric Water Vapour (Plöger F, Rolf C)

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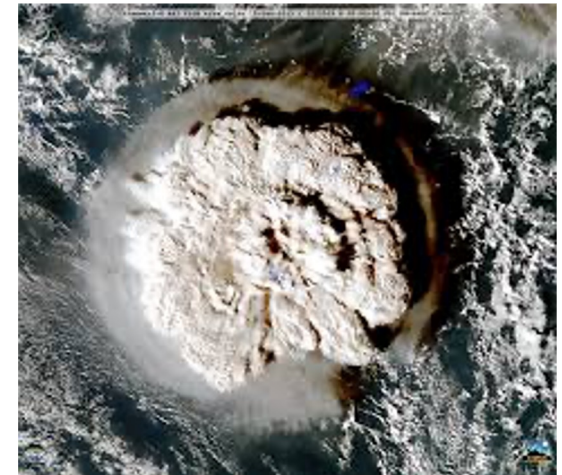
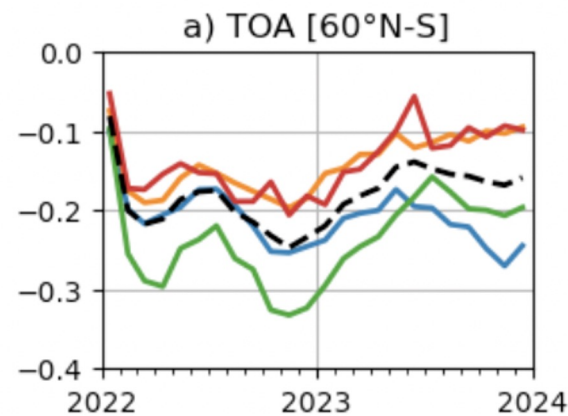
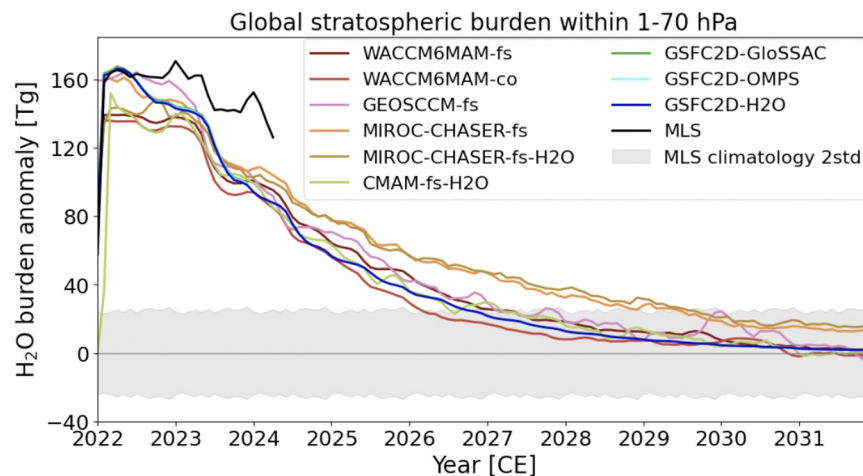
Highlights for Joint Scientific Committee

15 January 2022

Hunga Tonga-Hunga Ha'apai stratospheric impacts (HTHH)

Leadership: Yunqian Zhu, Graham Mann, Paul A. Newman, William Randel

Aim: Assess the impacts of the eruption on the atmosphere and climate



HTHH Report,
in preparation

Highlights for Joint Scientific Committee

Impact of chlorinated very-short-lived substances on stratospheric ozone (VSLS)

Leadership: Ryan Hossaini, Lucy Carpenter, Martyn Chipperfield, Doug Kinnison and Susann Tegtmeier

- Aim: Understand impact of uncontrolled chlorinated VSLS on the ozone layer; determine ozone depleting potentials of gases
 - 8 models: UKESM, TOMCAT, WACCM, SOCOL, EMAC (tbc), MIROC-CHASER, CCSRNIES-MIROC3.2 and GSFC.
 - **CMIP7** forcing data so experiments are 'up-to-date'.
 - Simulations: (1) early 2000s to 2023 to examine the impacts of Cl-VSLS on stratospheric ozone and other aspects of stratospheric composition (e.g. HCl trends). (2) runs for ODP and SODP quantification.
 - 5 main industrially emitted Cl-VSLS species: CH_2Cl_2 , CHCl_3 , C_2Cl_4 , $\text{CH}_2\text{ClCH}_2\text{Cl}$ and C_2HCl_3 .
 - Goal to publish first results ahead of 2026 Ozone Assessment.

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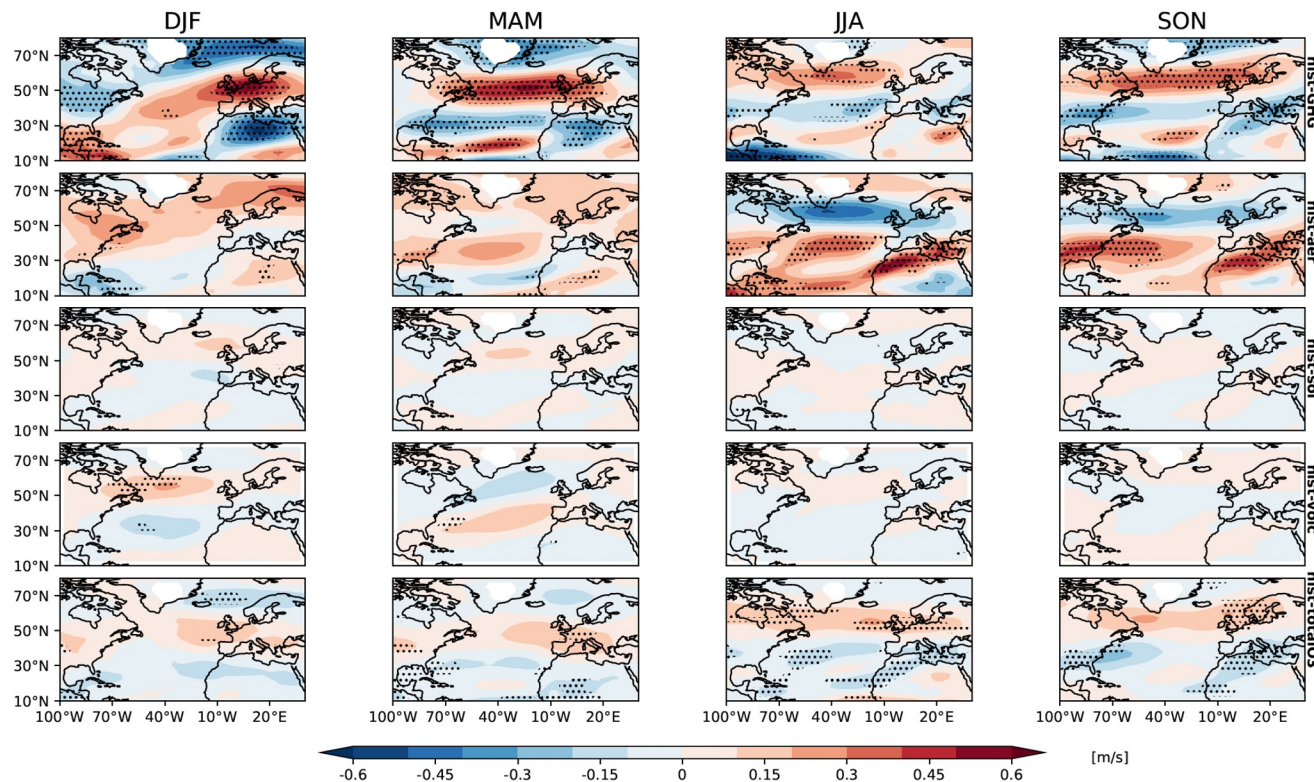


Large Ensembles for Attribution of Dynamically-driven ExtRemes (LEADER)

Leadership: Chaim I. Garfinkel and Scott Osprey (also co-chairs EPESC WG2)

Aim: Quantify the contribution of anthropogenic and natural forcings to historical climate trends

Multi-Model Mean of U-wind700 response, 1990-2014 vs. 1851-1920

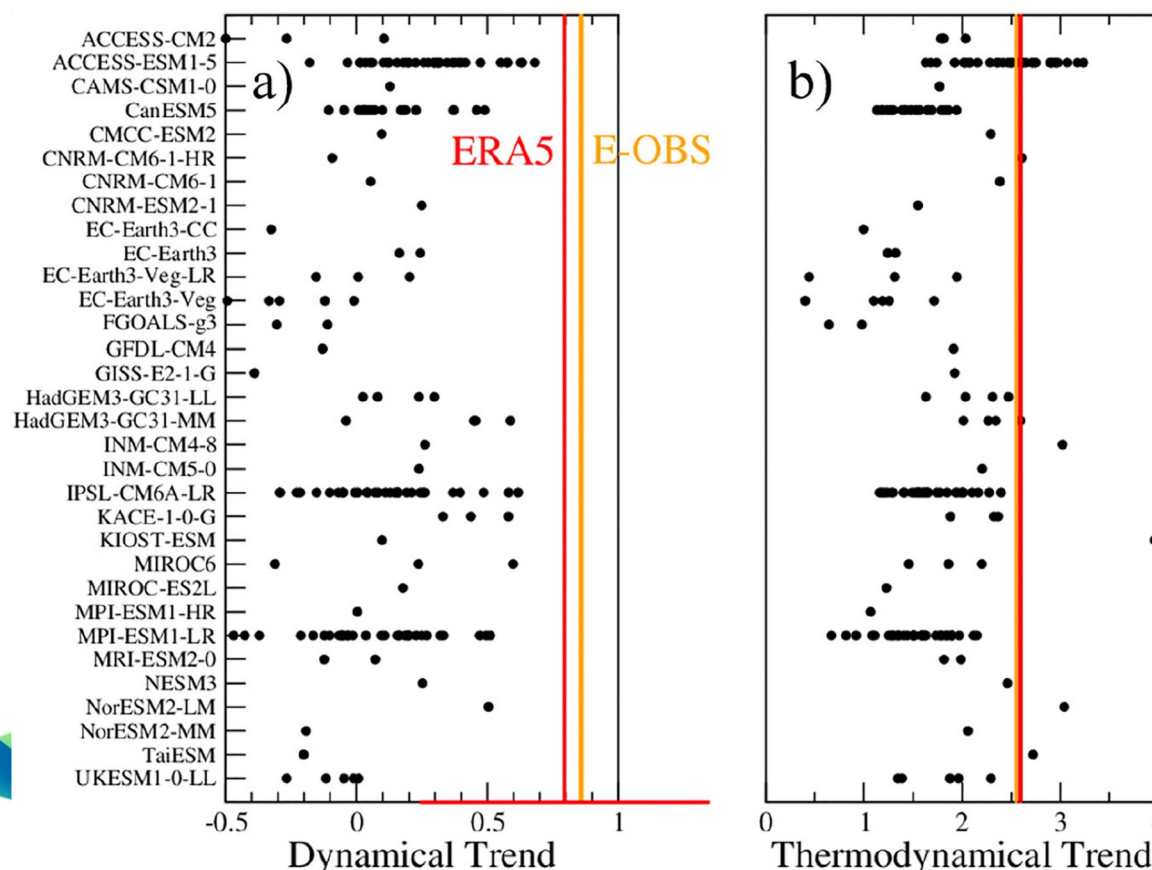


- **2 joint LEADER-EPESC working groups** – North Atlantic and Southern hemisphere climate trends
- 8 working groups covering different topics
- Hybrid workshop to take place in July 2025.

Figure courtesy:
David Avisar and
Chaim Garfinkel

Highlights for Joint Scientific Committee

Emerging Climate Change Signals in Atmospheric Circulation, Shaw et al 2024: Perspective paper based on outcomes of DynVar/SNAP 2023 workshop



From Vautard et al.
2023

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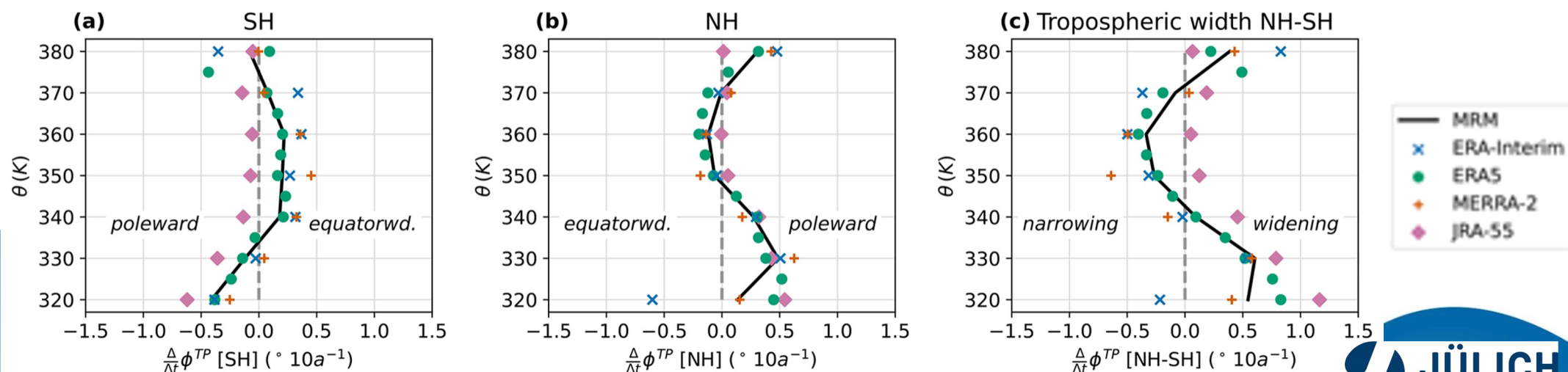
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Highlights for Joint Scientific Committee

Special Issues:

- *Stratospheric impacts on climate variability and predictability in nudging experiments: (SNAP, QBOi; WCD/GMD)*
- *The SPARC Reanalysis Intercomparison Project (S-RIP) Phase 2 (ACP/WCD inter-journal SI)*

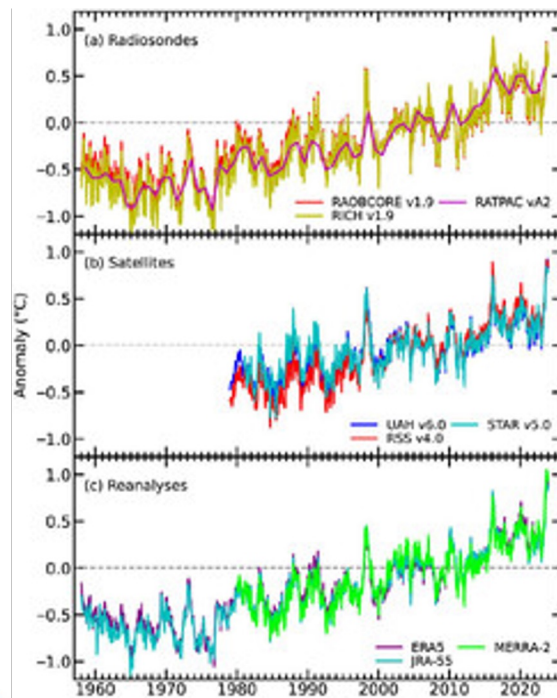
1980–2017 trends of PVG tropopause latitude ϕ^{TP}



Highlights for Joint Scientific Committee

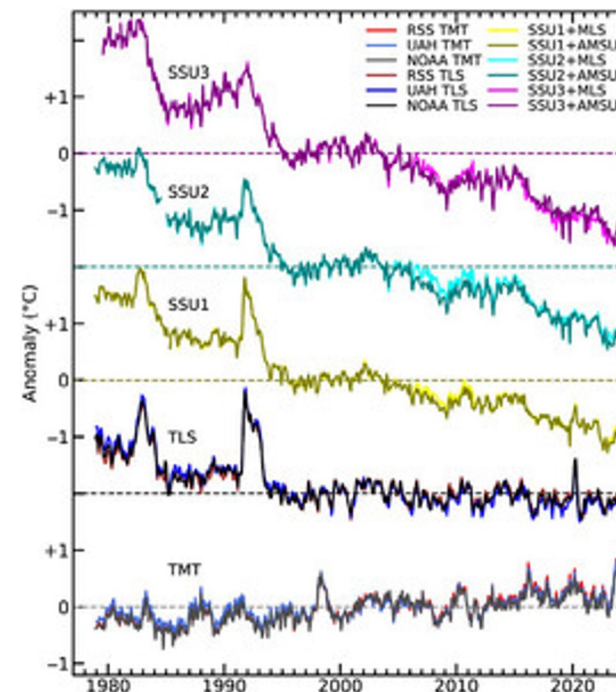
State of the Climate 2023 – Atmospheric temperature changes and their drivers Activity

Tropospheric warming



Po-Chedley et al., 2024

Stratospheric cooling



Randel et al., 2024

Workshop “**Climate Data Analysis and AI in the Global South (AI4Climate)**”

❖ **Follow-on from Training School on AI for Climate Science (U. Rwanda, 2023)**

❖ **24-28 November 2025, University Cheikh Anta Diop, Dakar, Senegal (Profs. A. Gaye and C. Fall)**

- State-Of-Art of Weather & Climate Research in Africa
- Predictability & Regional Attribution in Africa
- Climate Services for Resilience in Africa
- Climate-Water-Energy-Food nexus in Africa
- *Actionable climate knowledge to build resilience communities, and how to best foster an ECR training program on AI for climate and weather research.*

❖ **Sponsorship/Partnerships: **APARC, WCRP LHA, WWRP, ICMA & IRD.****

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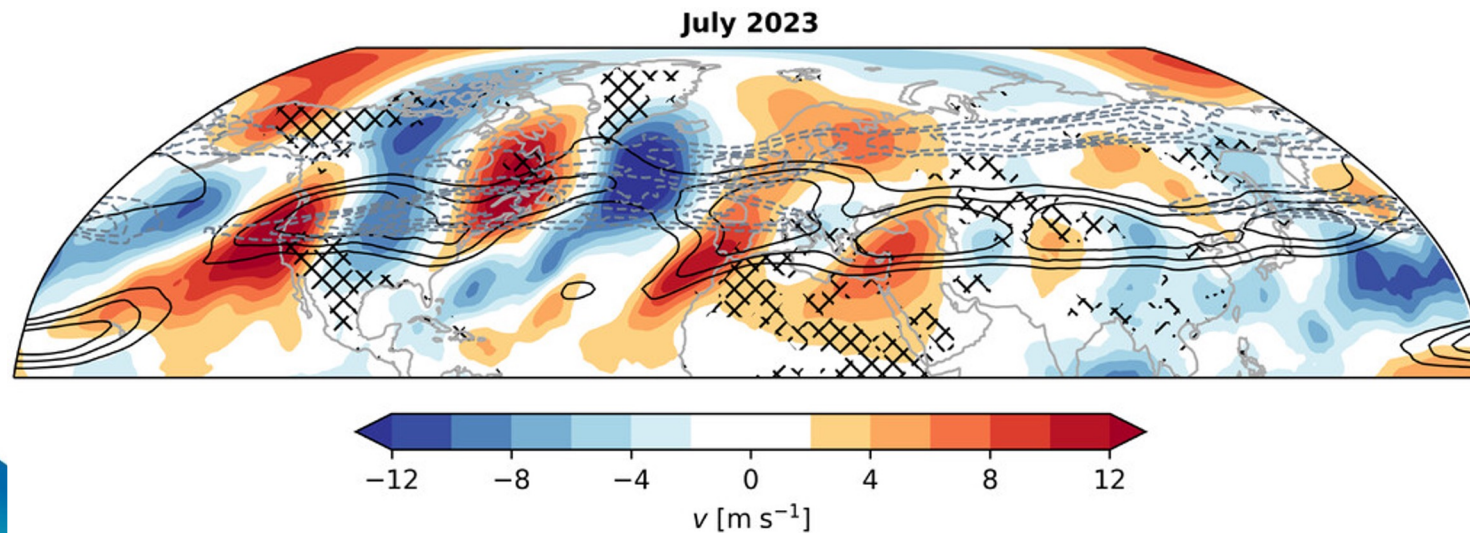
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Strategic priorities 2026: Rossby waves workshop

- Rossby Waves workshop planned for January 2026, Amsterdam – co-organised with DynVar Activity with APARC support.
- Part of APARC strategic goal to grow connection with tropospheric atmospheric dynamics communities



Lembo et al., 2024

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Strategic priorities 2026: APARC General Assembly

- Quadrennial meeting of entire APARC community.
- Last General Assembly in 2022: > 400 participants across three hubs.
- **Planned next GA: Indian Institute for Tropical Meteorology, Pune, 12 - 16 October 2026**
- Local organizing committee and scientific organizing committee are being recruited.
- Will include a hybrid option.
- Proposed financial support by WCRP is gratefully acknowledged.



Planned products, high-level assessments or other key outputs/publications

- APARC 2025 Special Report on the HTHH eruption ahead of the 2026 WMO/UNEP Ozone Assessment Report
- APARC 2026 Special Report assessing the impact of industry-related emissions of chlorinated VSLs on stratospheric ozone
- CCMi is working with the CMIP7 Forcing Task Force to produce an ozone forcing dataset for CMIP7 (to appear May 2025)
- LOTUS will contribute to the 2026 WMO/UNEP Ozone Assessment Report by updating observed vertically-resolved ozone trends.
- LEADER to produce community publications that will support EPESC WG2 and IPCC AR7.

Linkages with other WCRP activities

- Hunga Tonga Activity is strongly aligned with **VoIMIP** from CMIP.
- LEADER will directly contribute to the **EPESC** LHA Working Group 2 on Integrated Attribution, Prediction and Projection.
- **CMIP**, **Safe Landing Climates**, **ESMO**, and **My Climate Risk** have expressed support for the APARC Training School in Dakar. Additional funding has been requested from **International Commission on the Middle Atmosphere (ICMA)**. We will work with the Academy to promote the workshop.
- SSiRC in contact with **LHA “Research on Climate Intervention”** (Daniele Vioni is co-lead) can contribute expertise on stratospheric aerosols to the SRM/SAI. APARC co-chair Karen Rosenlof is part of the steering committee for the Climate Intervention LHA.
- SOLARIS-HEPPA activity lead Bernd Funke and Michaela Hegglin (CCMi) are members of the WCRP **Climate forcing Task Team**.
- Amanda Maycock sits on **CLIVAR** Climate Dynamics panel. Opportunity for APARC to co-organize a CDP Annual Workshop – to be discussed at Pan-CLIVAR meeting in Sept.

Linkages with other WCRP activities

- APARC is continuing efforts to connect to the **GEWEX/CLIVAR Monsoon Panel**. Area of mutual interest: role of composition in driving variability and trends in monsoon circulation.
- Gravity Waves has common interest with **GEWEX** on the role of gravity waves relative to clouds. New high resolution global modelling offers opportunities to collaborate e.g., Digital Earth's Hackathon.
- Synergies between APARC and **ESMO** through modelling activities:
 - QBOi aims to improve QBO modelling
 - SNAP through continued S2S activities (WGSIP)
 - Masatomo Fujiwara is A-RIP liaison with the WCRP TIRA, which is within ESMO.
- ATC contributed to the **WCRP-GCOS** Task Team on Earth's Energy and Budget Cycles Task Force and Workshops.

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Partnerships with entities outside of WCRP

- APARC activities continue close collaborations with the *International Global Atmospheric Chemistry* (IGAC) project:
 - ACAM collaboration with IGAC activities including *Monsoon Asia and Oceania Networking Group* (MANGO) and *Monitoring, Analysis, and Prediction of Air Quality* (MAP-AQ)
 - CCMi collaborate with the *Role of STE in the Earth System* (ROSTEES) working group under the *Tropospheric Ozone Assessment Report* (TOAR) activity of IGAC
 - LOTUS collaborates with the *IGAC TOAR* activity to interpret changes in tropospheric ozone that contribute to the total ozone changes.
 - OCTAV UTLS attend IGAC TOAR-2 meetings.
- ACAM collaborate with *Asian Summer Monsoon Chemical & Climate Impact Project* (ACCLIP) on the regional and global impact of the Asian summer monsoon and with the NASA ASIA-AQ field experiment in 2026

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Partnerships with entities outside of WCRP

- LOTUS & OCTAV UTLS collaborate with **GAW** and **NDACC** on using ground-based ozone records for trend analyses.
- LOTUS also collaborates with **NASA, ESA, NOAA, and EUMETSAT** that provide combined satellite ozone records.
- SOLARIS HEPPA is strongly interacting with the *Scientific Committee on Solar Terrestrial Physics* (SCOSTEP) within its *Predictability of the Variable Solar-Terrestrial Coupling* (PRESTO) programme.
- SSiRC collaborates with **Carbonyl sulfide (COS) as A NOVeI trAcer** (COSANOVA; <https://www.cosanova.org/>) using measurements of carbonyl sulfide in ecosystem science.
- APARC continues to cooperate well with the UK *Centre for Environmental Data Analysis* (CEDA) on data storage and provision.

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Suggestions, issues or challenges

- Mismatch of 17 APARC activities and the proposed budget (CHF 15k excl. GA and training school).
- Alternative sources of funding?
- Priority for operational activities (e.g. LOTUS, needed for the 2026 Ozone Assessment)
- Comments on the way forward would be appreciated.

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Thank You

