

46th Session of the WCRP Joint Scientific Committee (JSC)

Date: 12-16 May 2025

DEADLINE: 15 Feb 2025

Instructions

Overarching content/goal: To provide an update on progress made during the last year, and to identify issues etc. in advance of the JSC meeting. This will allow more discussion and less reporting at the JSC meeting itself. The outcomes from this report will also feed into a highlights brochure planned for the first quarter of the year. The Secretariat will arrange calls prior to the JSC meeting with JSC liaisons (as appropriate) to discuss the input and any issues to the JSC meeting itself. Please work with the WCRP secretariat responsible for your activity, in the preparation of the report.

Please keep the information as focused as possible and provide links to websites where more details can be accessed.

Update report for the WCRP Joint Scientific Committee

APARC

1. High-level publications (in particular strategic publications/assessments that are direct outcomes of your activity)

- **Special issues led by APARC activities:**
 - Atmospheric ozone and related species in the early 2020s: latest results and trends (ACP/AMT inter-journal SI):
https://acp.copernicus.org/articles/special_issue1194.html
34 published papers (Feb 2025)
 - The SPARC Reanalysis Intercomparison Project (S-RIP) Phase 2 (ACP/WCD inter-journal SI):
https://acp.copernicus.org/articles/special_issue1242.html
9 published papers (Feb 2025)
 - Chemistry and Climate Impacts of the Asian Summer Monsoon (ACAM; GRL/JGR-Atmos):
<https://agupubs.onlinelibrary.wiley.com/hub/journal/19448007/homepage/call-for-papers/si-2023-001027>
 - Stratospheric impacts on climate variability and predictability in nudging experiments: (SNAP, QBOi; WCD/GMD inter-journal SI):
https://wcd.copernicus.org/articles/special_issue1297.html

- CMIP7 solar forcing roadmap review paper:
 - Funke, B., Dudok de Wit, T., Ermolli, I., Haberreiter, M., Kinnison, D., Marsh, D., Nesse, H., Seppälä, A., Sinnhuber, M., and Usoskin, I.: Towards the definition of a solar forcing dataset for CMIP7, *Geosci. Model Dev.*, 17, 1217–1227, <https://doi.org/10.5194/gmd-17-1217-2024>, 2024.
- ACAM-related high-level publication:
 - Laura Pan et al.: East Asian summer monsoon delivers large abundances of very short-lived organic chlorine substances to the lower stratosphere, *PNAS* 121; <https://doi.org/10.1073/pnas.2318716121>, 2024.

Publications underpinning Scientific Assessment Reports:

- APARC Hunga-Tonga Eruption Assessment:
 - Zhou, X., Dhomse, S. S., Feng, W., Mann, G., Heddell, S., Pumphrey, H., et al.: Antarctic vortex dehydration in 2023 as a substantial removal pathway for Hunga Tonga-Hunga Ha'apai water vapor. *Geophysical Research Letters*, 51, e2023GL107630. <https://doi.org/10.1029/2023GL107630>, 2024.
 - Schoeberl, M. R., Wang, Y., Ueyama, R., Dessler, A., Taha, G., & Yu, W.: The estimated climate impact of the Hunga Tonga-Hunga Ha'apai eruption plume. *Geophysical Research Letters*, 50, e2023GL104634. <https://doi.org/10.1029/2023GL104634>, 2023.
 - Schoeberl, M. R., Wang, Y., Taha, G., Zawada, D. J., Ueyama, R., & Dessler, A.: Evolution of the climate forcing during the two years after the Hunga Tonga-Hunga Ha'apai eruption. *Journal of Geophysical Research: Atmospheres*, 129, e2024JD041296. <https://doi.org/10.1029/2024JD041296>, 2024.
 - Zhu, Y., Akiyoshi, H., Aquila, V., Asher, E., Bednarz, E. M., Bekki, S., Brühl, C., Butler, A. H., Case, P., Chabrillat, S., Chiodo, G., Clyne, M., Falletti, L., Colarco, P. R., Fleming, E., Jörimann, A., Kovilakam, M., Koren, G., Kuchar, A., Lebas, N., Liang, Q., Liu, C.-C., Mann, G., Manyin, M., Marchand, M., Morgenstern, O., Newman, P., Oman, L. D., Østerstrøm, F. F., Peng, Y., Plummer, D., Quaglia, I., Randel, W., Rémy, S., Sekiya, T., Steenrod, S., Sukhodolov, T., Tilmes, S., Tsigaridis, K., Ueyama, R., Visionsi, D., Wang, X., Watanabe, S., Yamashita, Y., Yu, P., Yu, W., Zhang, J., and Zhuo, Z.: Hunga Tonga-Hunga Ha'apai Volcano Impact Model Observation Comparison (HTHH-MOC) Project: Experiment Protocol and Model Descriptions, *EGUsphere* [preprint]. <https://doi.org/10.5194/egusphere-2024-3412>, 2024.
 - Jucker, M., C. Lucas, and D. Dutta: Long-Term Climate Impacts of Large Stratospheric Water Vapor Perturbations. *J. Climate*, 37, 4507–4521, <https://doi.org/10.1175/JCLI-D-23-0437.1>, 2024.
 - Stocker, M., Steiner, A.K., Ladstädter, F. et al. Strong persistent cooling of the stratosphere after the Hunga eruption. *Commun Earth Environ* 5, 450 (2024).
- WMO/UNEP Ozone Assessment Reports:
 - Millán, L. F., Hoor, P., Hegglin, M. I., Manney, G. L., Boenisch, H., Jeffery, P., Kunkel, D., Petropavlovskikh, I., Ye, H., Leblanc, T., and Walker, K.: Exploring ozone variability in the upper troposphere and lower stratosphere using dynamical coordinates, *Atmos. Chem. Phys.*, 24, 7927–7959. [doi:10.5194/acp-24-7927-2024](https://doi.org/10.5194/acp-24-7927-2024), 2024.

- Hossaini, R., Sherry, D., Wang, Z., Chipperfield, M. P., Feng, W., Oram, D. E., Adcock, K. E., Montzka, S. A., Simpson, I. J., Mazzeo, A., Leeson, A. A., Atlas, E., and Chou, C. C.-K.: On the atmospheric budget of 1,2-dichloroethane and its impact on stratospheric chlorine and ozone (2002–2020), *Atmos. Chem. Phys.*, 24, 13457–13475, <https://doi.org/10.5194/acp-24-13457-2024>, 2024.
- *State of the Climate Reports:*
 - Po-Chedley, S., J. R. Christy, L. Haimberger, C. A. Mears, and C.-Z. Zou: Tropospheric temperature, In: *State of the Climate in 2023, Section 2 Global Climate*, *Bull. Amer. Meteor. Soc.*, 105(8), <https://doi.org/10.1175/BAMS-D-24-0116.1>, 2024.
 - Randel, W. J., C. Covey, L. Polvani, and A. K. Steiner: Stratospheric temperature, In: *State of the Climate in 2023, Section 2 Global Climate*, *Bull. Amer. Meteor. Soc.*, 105(8), <https://doi.org/10.1175/BAMS-D-24-0116.1>, 2024.

Publications related to partnerships across WCRP and beyond

- *S2S project:*
 - Garfinkel, C. I., Lawrence, Z. D., Butler, A. H., Dunn-Sigouin, E., Statnaia, I., Karpechko, A. Y., Koren, G., Abalos, M., Ayarzagüena, B., Barriopedro, D., Calvo, N., de la Cámara, A., Charlton-Perez, A., Cohen, J., Domeisen, D. I. V., García-Serrano, J., Hindley, N. P., Jucker, M., Kim, H., Lee, R. W., Lee, S. H., Osman, M., Palmeiro, F. M., Polichtchouk, I., Rao, J., Richter, J. H., Schwartz, C., Son, S.-W., Taguchi, M., Tyrrell, N. L., Wright, C. J., and Wu, R. W.-Y.: A process-based evaluation of biases in extratropical stratosphere–troposphere coupling in subseasonal forecast systems, *Weather Clim. Dynam.*, 6, 171–195, <https://doi.org/10.5194/wcd-6-171-2025>, 2025. (SNAP)
 - Lee, R. W., & Charlton-Perez, A. J.: Diversity of stratospheric error growth across subseasonal prediction systems. *Geophysical Research Letters*, 51, e2023GL107574. <https://doi.org/10.1029/2023GL107574>, 2024. (SNAP)
- *DynVarMIP as part of CMIP6:*
 - Karpechko, A. Y., Wu, Z., Simpson, I. R., Kretschmer, M., Afargan-Gerstman, H., Butler, A. H., et al.: Northern Hemisphere stratosphere-troposphere circulation change in CMIP6 models: 2. Mechanisms and sources of the spread. *Journal of Geophysical Research: Atmospheres*, 129, e2024JD040823. <https://doi.org/10.1029/2024JD040823>, 2024. (DynVar)
- *Tropospheric dynamics and extremes:*
 - Lembo, V., Bordoni, S., Bevacqua, E., Domeisen, D. I. V., Franzke, C. L. E., Galfi, V. M., Garfinkel, C. I., Grams, C. M., Hochman, A., Jha, R., Kornhuber, K., Kwasniok, F., Lucarini, V., Messori, G., Pappert, D., Perez-Fernandez, I., Riboldi, J., Russo, E., Shaw, T. A., Strigunova, I., Strnad, F., Yiou, P., & Zagar, N.: Dynamics, Statistics, and Predictability of Rossby Waves, Heat Waves, and Spatially Compounding Extreme Events. *Bulletin of the American Meteorological Society*, 105(12), E2283–E2293. <https://doi.org/10.1175/BAMS-D-24-0145.1>, 2024. (DynVar)

2. Capacity Building/Education and Training Highlights

Support for Early Career Researchers (ECRs)

- *Conference & Workshop Support (2024)*
 - *APARC supported numerous ECRs to attend conferences, workshops, and activity meetings.*
 - *More than 30 ECRs received full or partial funding to attend the STIPMEX workshop in Pune in June 2024.*
 - *At the Quadrennial Ozone Symposium (15–19 July 2024, Boulder, Colorado), APARC organized two side meetings:*
 - *LOTUS side meeting with active ECR participation.*
 - *A-RIP side meeting, including an ECR Networking Event with 11 ECRs, 5 of them fully supported by APARC. Word cloud polls, science speed dating, career development panel, and extensive discussions as well as a group hike were part of the program.*
- *Seminar & Webinar Programs*
 - *A group of ECRs is organizing A-RIP webinars.*
 - *The QBOi/GW Seminar Programme has been reintroduced, providing increased visibility for ECRs.*
- *Leadership & Steering Committee Involvement*
 - *Several activities aim to increase ECR representation in their steering committees.*
 - *SSiRC continues to prioritize ECR leadership roles across all its activities.*
- *Hands-on Research & Training*
 - *PhD students and ECRs actively participate in Stratéole and TeamX campaigns, gaining practical experience in atmospheric gravity wave research.*
 - *LOTUS Python code and training materials are available on GitHub for accessibility and skill development.*
 - *Early planning is underway for a Marie Skłodowska-Curie Actions (MSCA) Doctoral Network application (Nov 2025) to support PhD training in gravity wave science.*

Major Events & Training Opportunities in 2025

- *March 2025: Joint workshop with SNAPSI & QUOCA, serving as the in-person kickoff for QUOCA. APARC will provide substantial funding to support ECR travel and an ECR night.*
- *June 2025: ACAM Workshop & Training School in Bali, Indonesia (8–13 June 2025).*
 - *ACAM's mission includes developing early-career scientists focused on Asian monsoon research and its regional & global impacts.*
- *July 2025: a joint LEADER-EPESC Workshop will take place in Busan, South Korea, to discuss progress from the various working groups.*
- *November 2025: Data Science for Weather & Climate Research Workshop in Dakar, Senegal. This builds on the training school held in Kigali held after the WCRP OSC with a goal of continuing to build capacity for APARC researchers in Africa. Additional funding for the training school to supplement the partial funding offered by WCRP has been secured by the APARC IPO host FZ Jülich.*

3. Linkages with other Core Projects, Lighthouse Activities, Academy etc.

- *Climate Modelling & Experiment Coordination*
 - *The HTHH Activity is closely aligned with VolMIP (CMIP), conducting coordinated climate model experiments of the January 2022 Hunga Tonga eruption.*
 - *The LEADER activity focuses on analysing LESFMIP data, produced within the WGCM (Working Group on Coupled Modelling).*
 - *LEADER and EPESC are closely aligned, with two LEADER working groups co-organized with EPESC.*
 - *A new request for DynVarMIP variables has been submitted for CMIP7.*
 - *SSiRC contributes expertise and capacity to the new LHA “Research on Climate Intervention”.*
- *Collaborations with WCRP Core Projects & Lighthouse Activities*
 - *Strong synergies exist between APARC and ESMO, particularly in modelling:*
 - *QBOi aims to improve Quasi-Biennial Oscillation (QBO) modelling.*
 - *SNAP contributes through ongoing Subseasonal-to-Seasonal (S2S) research.*
 - *Masatomo Fujiwara serves as A-RIP liaison with WCRP TIRA, now part of ESMO.*
 - *SSG member Yaga Richter serves as APARC liaison with WGSIP in ESMO.*
 - *EPESC Lighthouse Activities are linked to LESFMIP, Detection & Attribution (D&A), and Extremes research.*
 - *Continued collaboration with WCRP core projects, including CLIVAR, GEWEX, and CliCon EEI.*
- *Monsoon & Tropical Meteorology Research*
 - *APARC is working to strengthen ties with the GEWEX/CLIVAR Monsoon Panel. With new ACAM activity leads appointed in 2023, there is an opportunity to establish deeper connections. Lin Wang attended the APARC SSG meeting on behalf of the Monsoon Panel.*
 - *Collaboration with the WWRP Working Group on Tropical Meteorology Research (WGTMR) and the WCRP CLIVAR/GEWEX Monsoons Panel in organizing the Eighth Quadrennial WMO International Workshop on Monsoons (IWM), scheduled for March 2025 in Pune, India.*
- *Atmospheric Processes & Climate Forcing*
 - *The Gravity Wave Activity collaborates with GEWEX and WWRP via TeamX, particularly within the Waves & Dynamics component, improving gravity wave modelling and their interactions with weather and climate.*
 - *SOLARIS-HEPPA leads (Bernd Funke & Michaela Hegglin) are part of the WCRP Climate Forcing Task Team, developing the CMIP7 solar forcing and ozone datasets.*
 - *ATC contributed to the WCRP-GCOS Task Team on Earth’s Energy and Budget Cycles Task Force & Workshops.*

- *Training & Capacity Building*
 - *CMIP, Safe Landing Climates, ESMO, and My Climate Risk support the APARC Training School in Dakar. Additional funding has been requested from the International Commission on the Middle Atmosphere (ICMA), and efforts are ongoing with the Academy to promote the workshop.*
- *Digital & Computational Earth Research*
 - *Hella Garny represents APARC on the Digital Earth Steering Committee, with a particular focus on gravity waves in high-resolution models.*

4. Partnerships with entities outside of WCRP

- *Strategic Partnerships & Collaborative Frameworks*
 - *APARC is establishing a Partnerships Panel as part of its new Strategic Plan, providing a dedicated forum to coordinate engagement with other WCRP groups (CPs, LHAs) and external projects.*
 - *APARC continues to collaborate with CEDA for long-term data storage, with plans to expand dataset accessibility. This has been a very important resource for APARC but at present an MoU isn't in place. CEDA have suggested given the increasing requirements from APARC and shifting priorities/funding with CEDA, we need to revisit the MoU to ensure mutual agreement and understanding of the available support.*
- *Collaborations with IGAC & Atmospheric Composition Research*
 - *Strong ongoing partnerships with IGAC, including:*
 - *ACAM collaborations with IGAC initiatives such as MANGO and MAP-AQ.*
 - *ACAM co-organized a side meeting at the 2024 iCACGP-IGAC Conference in Kuala Lumpur, Malaysia.*
 - *Collaboration with iCACGP in organizing the "Atmospheric Composition and the Asian Monsoon" session at BACO-25 (IAMAS-IACS-IAPSO Joint Assembly 2025) in Busan, South Korea.*
 - *CCMi collaboration with the ROSTEES working group under the IGAC TOAR activity.*
 - *LOTUS collaboration with IGAC TOAR to analyse tropospheric ozone trends and their impact on total ozone levels.*
 - *OCTAV UTLS participation in IGAC TOAR-2 meetings.*
- *Field Campaigns & Observational Research*
 - *ACAM partnerships:*
 - *Collaboration with ACCLIP to study regional and global impacts of the Asian summer monsoon.*
 - *Partnership with NASA ASIA-AQ for the 2026 field experiment.*
 - *LOTUS & OCTAV UTLS collaboration with WMO GAW and NDACC, using ground-based ozone records for trend analyses, with several data providers directly involved in LOTUS.*

- *LOTUS engagement with the satellite community, working with NASA, ESA, NOAA, CSA, and EUMETSAT to generate combined long-term ozone records.*
- *Participation in major satellite proposals, including:*
 - *CAIRT (ESA) – APARC letter of support to be sent in spring 2025 ahead of final mission selection in summer.*
 - *Keystone (ESA)*
 - *STRIVE (NASA)*
- *Active involvement in atmospheric gravity wave research, including:*
 - *TeamX winter and summer campaigns (2025) to refine gravity wave process constraints.*
 - *Stratéole balloon campaigns, with additional launches planned for 2026 to enhance observational datasets.*
- *Climate Modelling & Policy Contributions*
 - *SSiRC & CMIP Collaborations:*
 - *Contributions to CMIP6 and CMIP7, particularly on aerosol forcing data.*
 - *Cross-collaboration with CMIP groups on designing new experiments, including HighResMIP and other CMIP7 simulations.*
 - *CCMi contributions to modelling ozone recovery by analysing ODS and GHG impacts.*
 - *QUOCA partnership with eight modelling centres, including GEOSCCM, GISS E2.2, ICON, MIROC-ES2H, LMDZ-Reprobus, CESM2-WACCM6, UKESM1-StratTrop, and E3SM.*
 - *Leader project contributions to the IPCC and WMO Climate Update and State of Climate reports.*
 - *SNAP biases results presented at the WGSIP/WGNE meeting (Nov 2024).*
- *International Scientific Collaborations & Workshops*
 - *SSiRC initiatives, including:*
 - *Co-organization of a workshop on volcanic effects on the atmosphere and climate in Greifswald, Germany (April 23-25, 2025) with the DFG Research Unit VollImpact.*
 - *Collaboration with COSANOVA on atmospheric aerosol research.*
 - *Partnership with David Sherry (Nolan Sherry and Associates) for TEAP assessment reports.*
 - *Collaboration with University of Bristol to access UNEP and Defra data on HCFC and HFC production/consumption.*
 - *WMO/UNEP Ozone Assessment (2026): Key contributions from HTHH, CCMi, and LOTUS.*
 - *Solaris HEPPA partnership with SCOSTEP under the PRESTO Science Programme.*
 - *Collaboration with the International Space Science Institute (ISSI) on the "INFO-QBO" project, studying ozone feedback in the Quasi-Biennial Oscillation.*

5. Future Science Directions for JSC consideration (e.g., new groups, activities)

- *What role can the stratospheric aerosol community in APARC (SSiRC) play in the WCRP Climate Intervention LHA?*
- *Dakar Workshop / Training School planning is currently in progress: promoting the event through various mailing lists / web sites; preparing the call for Workshop abstract submissions and Training School applications; identifying the Training School coordinators and instructors and organizing its program; and approaching potential sponsors to provide funding support, especially to cover travel expenses for Training School participants*
- *EPESC-LEADER can serve as a case study of successful joint working between LHA and CPs. Relevant for others to consider?*
- *Appetite from APARC Gravity Wave activity, GEWEX and DE LHA to collectively work on analysis of gravity waves and precipitation in storm resolving model simulations (e.g. DYAMOND). Would a dedicated workshop help to move this forward?*
- *APARC co-sponsoring workshops in 2025/26 on Storm Tracks (June 2025, Norway) and Rossy Waves (spring 2026, Netherlands). These workshops are led by tropospheric dynamics communities that operate somewhat independently of WCRP – is there an opportunity to provide them a ‘home’ within WCRP? What would be the added value for them?*
- *Discussion between CliC and APARC planned to follow-up work on cold spells and Arctic-midlatitudes linkages.*
- *Could APARC co-organise the CLIVAR Climate Dynamics Panel Annual Workshop to facilitate collaboration?*

6. New Activities (e.g., structural changes to your activity, plans for databases and other products not covered in the above)

- *A new joint QBOi-CCMI working group, [QUOCA](#) (**QU**asibiennial oscillation and **O**zone **C**hemistry interactions in the **A**tmosphere), which is aimed at improving understanding of QBO-ozone feedbacks in present-day and future climates has been founded in 2024. A first virtual workshop for the new working group took place 18-21 Nov, 2024.*
- *Gravity Wave activity: Development of a software testbed for comparing GW parameterisations (led by François Lott) and involvement in DataWAVE high-res modelling studies, where simulations are complete and now synthesized with machine learning methods (Pahlavan et al).*
- *LEADER (Large Ensembles for Attribution of Dynamically-driven Extremes): This limited-term activity (2024-2026) is coordinating analysis of the Large Ensemble Single Forcing Model Intercomparison Project (LESFMIP) output. The analysis of the LESFMIP data will be facilitated by archiving post-processed model output at JASMIN. DynVar leadership is involved in 3 working groups for the LEADER activity*

7. General (Highlight any other outcomes etc. that you wish to make the JSC and other WCRP activities aware of (in particular regionally focussed activities we could use in any highlights brochure). Are there particular challenges faced in the last year that the JSC should be aware of?

- An APARC promotional video was recorded during the SSG meeting. Planned release in spring 2025.
- New APARC website is currently being created and planned to be online in spring 2025.
- Limited financial support beyond ECR initiatives, affecting broader activity sustainability. Several strategic requests related to ECR skills training were not approved in 2025. If budgetary constraints allow, it would be helpful to revisit these.
- Need for enhanced infrastructure for database management and experiment coordination
- A lack of clear guidance on potential synergies between Lighthouse Activities (LHAs) and other projects