Stratosphere-troposphere Processes And their Role in Climate

SPARC

44th Session of the WCRP Joint Scientific Committee

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Climate Centre, Brussels, Belgium

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Progress and achievements over the last year

- SPARC 7th General Assembly 24-28 October 2022.
- 415 participants (162 online and 252 in-person).
- Innovative hybrid continental-hub model to reduce the carbon footprint (Boulder, Reading, Qingdao).
- Estimated total carbon footprint from travel: 223 tCO2-eq (→ factor of 2-4 smaller than using single hub).
- Sessions streamed across time zones.
- Paper submitted on the climate benefits – example for future meetings.

- Overall, very good feedback.

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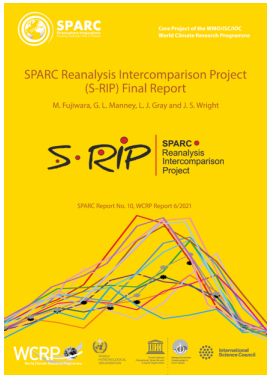
Progress and achievements over the last year

- **SPARC Report No. 10: SPARC Reanalysis Intercomparison Project (S-RIP) Final Report (2022)**
- **Contributions to Assessments, Special Reports, and collaborative efforts**
  - **2022 WMO/UNEP Ozone Assessment Report**
  - **BAMS Report "State of the Climate in 2021"**
  - **The Earth heat inventory**
- **5 major review/community papers**
  - **from the Gravity Waves, SNAP, DynVar, and QBOi activities**



- **Continued contributions to various (SPARC) special issues**
- **TUNER-compliant error reporting being adapted by international instrument teams**

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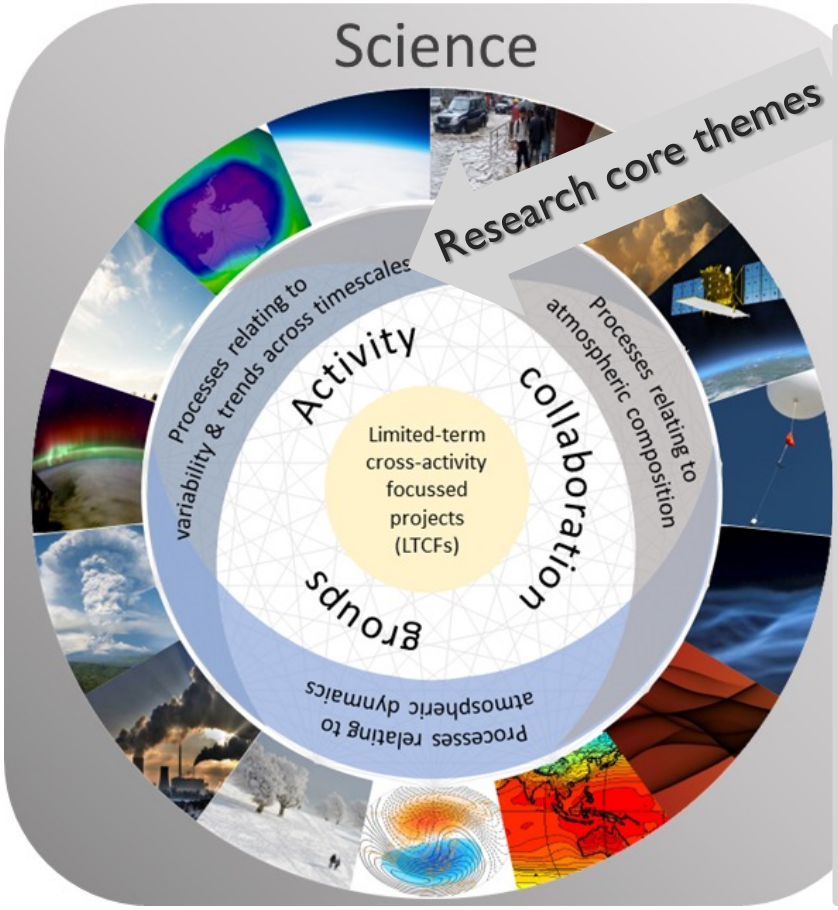
Future plans

- **The SPARC Strategic Plan 2022-2030 was approved by the SSG and presented to the SPARC community at the General Assembly.**
- **Ambitious new plans to take SPARC forward this decade.**
  → implementation phase in 2023 and 2024

Future plans

SPARC co-chairs & Steering group



<u>Processes relating to atmospheric composition</u>

to improve understanding of fundamental climate processes, including those related to atmospheric chemistry, radiation and dynamics.

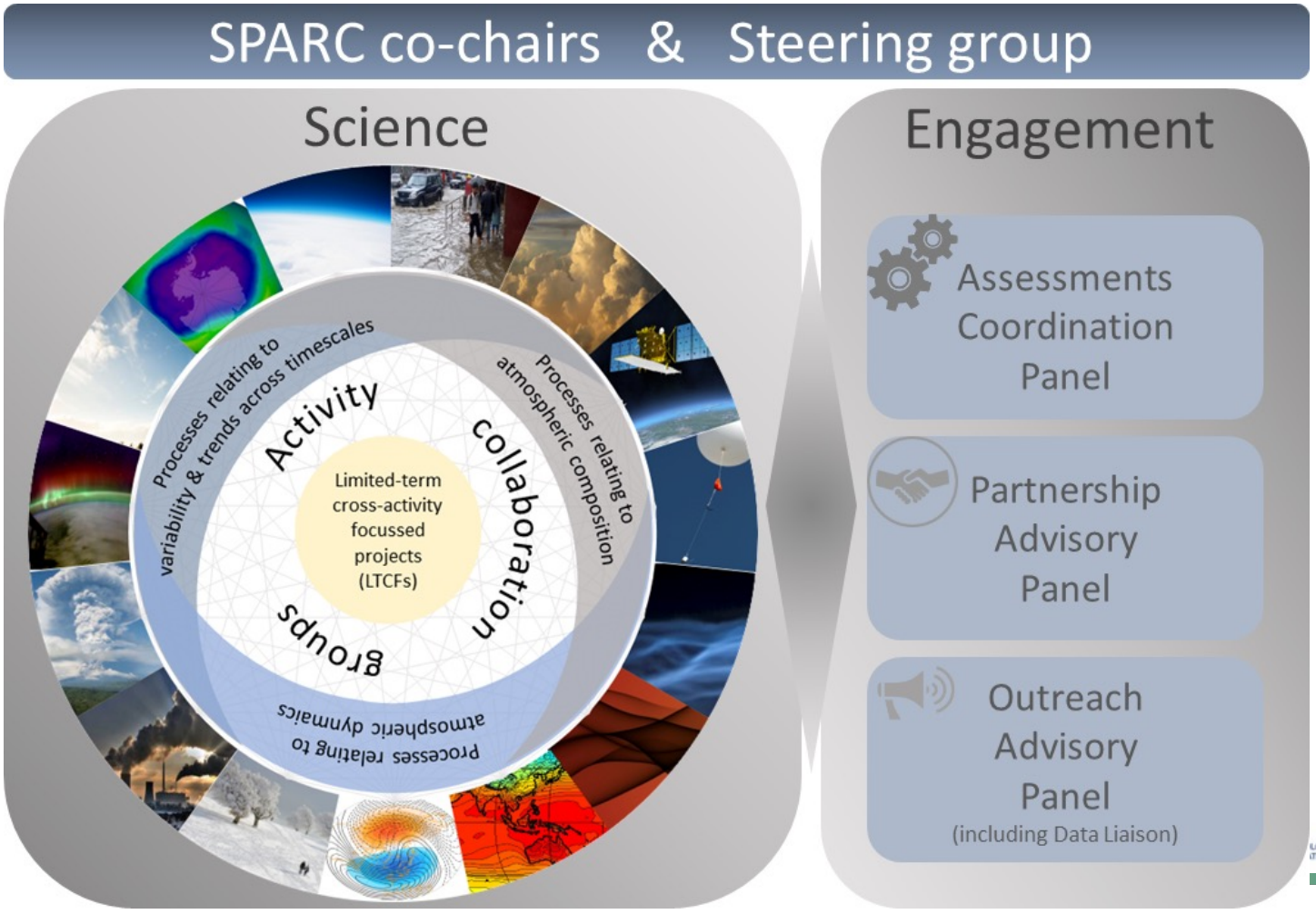
<u>Processes related to variability and trends across timescales</u>,

including research related to atmospheric and climate prediction, and occurrence and attribution of extreme events.

<u>Processes related to atmospheric dynamics</u>

focused on leveraging observations, reanalyses, models, and innovative analysis and attribution methods to demonstrate new understanding of the climate system, its changes and drivers.

Future plans



Three umbrella panels who will focus on:

- Coordination of SPARC's contributions to assessment activities – forcing datasets, analyses, scientific outputs
- Strategic focus on SPARC's collaboration with groups within WCRP and beyond
- Strategic focus on SPARC's community contributions: ECRs, capacity building, regional representatives

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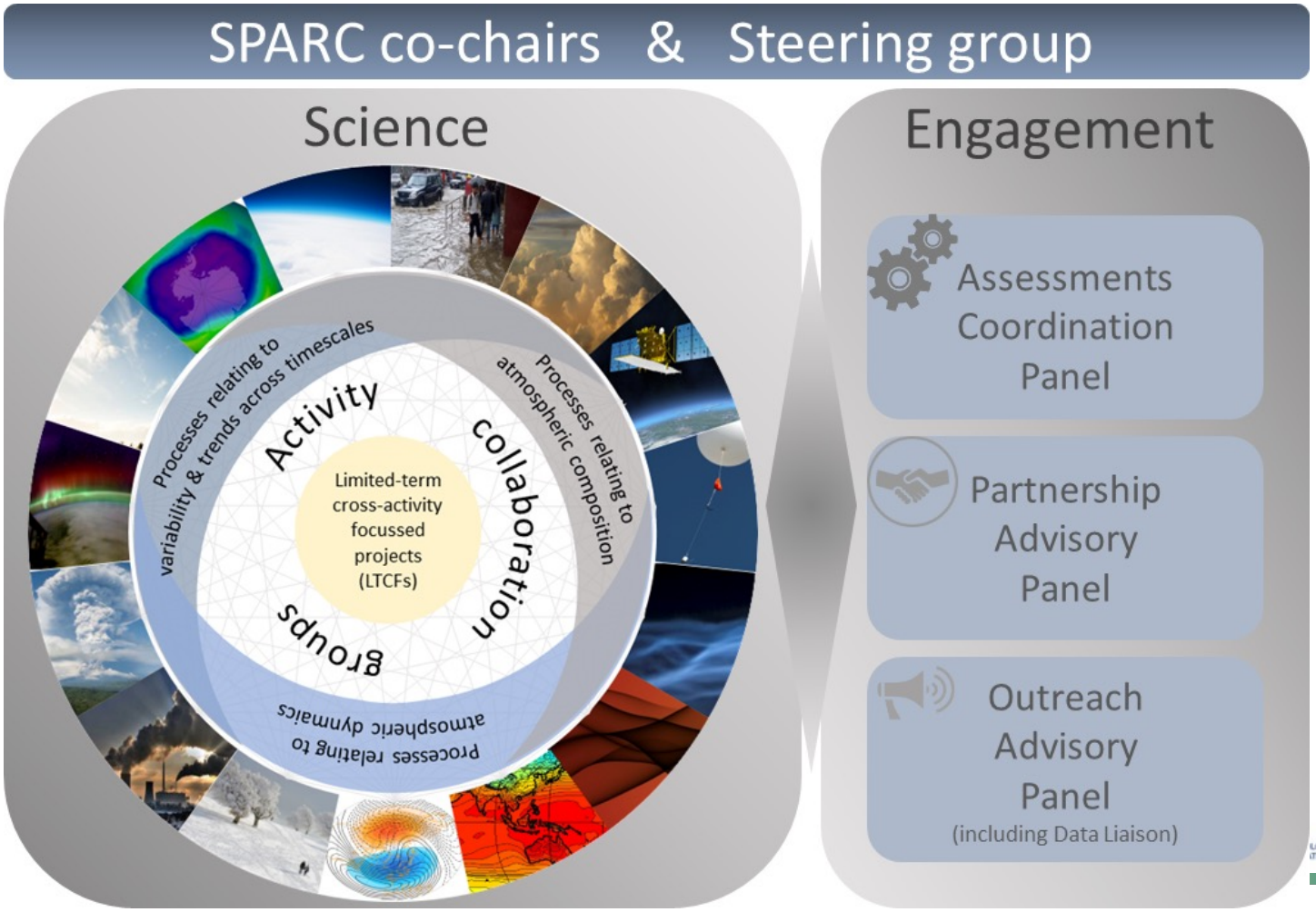
Future plans



Activities

- SPARC is continuing its efforts to include more tropospheric science.
- All current activities will submit refreshed science plans and objectives for the next 4 years
- SPARC will write new guidelines on activity proposals (including definitive timelines & milestones)
- SPARC activities will sunset once their communities are well-established and able to sustain themselves.

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Future plans

- SPARC IPO contract at DLR ends this year.
- Call for new IPO host; interest from one potential host.
- Critical period for SPARC: to implement our ambitious new structure and deliver our objectives we need adequate support in the IPO.
- Staffing: Director and 2 project staff – return to levels of staffing during ETH tenure.
- Strong support from Secretariat needed in negotiations to ensure new host fully supports SPARC's future.

Future plans

- **SPARC started a new short term Hunga-Tonga activity**
  - ✓ **Objective: Publish a SPARC Special Report on the HTHH eruption ahead of the 2026 WMO/UNEP Ozone Assessment Report.**
  - ✓ **Will focus an international effort to synthesize studies in the published literature for the broader community and to coordinate multi-model assessments.**

- **A number of SPARC activities are preparing work on topics relevant to the upcoming 2026 WMO/UNEP Ozone Assessment (LOTUS, OCTAV-UTLS, CCMi, …) including:**
  - ✓ **Scientific Assessment of wildfires in various SPARC activities**
  - ✓ **Creating forcing datasets for CMIP7 simulations (solar forcing, ozone forcing datasets)**

- **Planning for the the next General Assembly in 2026 – 2028**

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Future plans

- **LOTUS moving to Phase 3.** → **The goal is to prepare trend analyses of observations and models for the 2026 WMO/UNEP Ozone Assessment.**
- **S-RIP is entering phase two of the project. This phase is expected to take five years, and to be centered around a new multi-journal special issue. Goals of the new phase include:**
  - **Full evaluation of ERA5 and other recently completed reanalyses (e.g., CRA-40), as well as upcoming reanalyses (e.g., JRA-3Q)**
  - **Extension of existing diagnostics and topic areas**
  - **New diagnostics in new areas (as proposed and coordinated within the community (e.g., stratosphere-troposphere coupling, Asian monsoon, atmospheric composition)**
- **QBOi: new coordinated experiments to address outstanding science questions related to the QBO, investigating: Vertical resolution and other model sensitivities related to QBO biases; QBO-MJO connections; QBO predictability using hindcasts (e.g. predictability of QBO disruptions); Stratospheric aerosol effects on the QBO (geoengineering / volcanic eruptions)**
- **A number of Review/community papers are planned to be published by various SPARC activities within the next 5 years**

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Linkages with Core Projects

- **SPARC would like to connect to the GEWEX/CLIVAR Monsoon Panel.**
  - **Propose establishing permanent liaisons through the new ACAM activity leads in 2023. Both sides are very interested in establishing closer relationships. Current connection is through Alexey Karpechko (Panel member and DynVar co-lead)**
- **ATC continues collaborations with WCRP core projects involved in the work on the Earth's heat inventory and via the Task Team on Energy and Budget Cycles**
- **Gravity Waves has some interaction with GEWEX, on the role of gravity waves for clouds. Contacts with the UTCC PROES activity**
- **Communication started between S-RIP and CLIVAR during Workshop on Future Earth System Reanalysis**
- **CLIVAR and ESMO may benefit from the experience from phase 1 of the S-RIP activity in push toward coupled Earth system reanalyses.**
- **S-RIP also intends to adopt and adapt climate model evaluation tools, such as ESMValTool, that are widely used within the CMIP community.**

Already Established links to LHAs

- **Various SPARC activities have interest or already established links to ESMO:**
  - **QBOi aims to improve QBO modelling. This is related to all the modelling & prediction groups (WGCM, WGSIPS, WGNE) contained under ESMO.**
  - **SNAP would like to be involved in ESMO through continued S2S activities**
  - **Masatomo Fujiwara is S-RIP liaison with the WCRP TIRA, which is now within ESMO.**
  - **S-RIP and SSiRC are also interested in collaborating with ESMO**
- **Already established links to the EPESC LHA:**
  - **ATC has good connection to EPESC through appointed SSG member Andrea Steiner**
  - **One of the QBOi coordinators (Scott Osprey) is on the SSG of the EPESC lighthouse activity and co-lead of their WG2 (Integrated Attribution, Prediction and Projection).**
  - **Several DynVar committee members are members of the EPESC WG2. Both SNAP co-chairs are members of the new WCRP EPESC WG2.**
  - **Early interest in using the planned Large Ensemble Single Forcing MIP data (LESFMIP)**
  - **SOLARIS-HEPPA collaborates with the EPESC WG2 (Liaison: Bernd Funke, WG2 member).**
- **SOLARIS-HEPPA activity lead Bernd Funke is a member of the WCRP Climate forcing Task Team**

Activities expressing interest to connect to LHAs

- **Many other SPARC Activities express interest and/or links to the EPESC LHA:**
  - **Gravity Waves: connection of stratospheric dynamics to predictions on multiple timescales**
  - **LOTUS assesses the efficacy of models via comparisons with observations and trend analyses.**
  - **QBOi: analysis of predictability related to the QBO in the LESFMIP5**
  - **Further interested SPARC Activities: CCMi, DynVar, OCTAV-UTLS, SSiRC**
- **DynVar wants to investigate climate risk for extreme events.**
- **The Digital Earths LHA:**
  - **Two SNAP scientists on planning committee for the DE high-resolution modelling group**
  - **Gravity Waves: high-resolution modelling and machine learning parameterization methods are beneficial for both the GW activity (information on gravity waves) and for the modelling community (realism of the processes described at these newly available resolutions).**
  - **SPARC QBOi scientists could contribute**
  - **SSiRC could contribute through looking at the stratospheric aerosol layer as a key component of the climate system.**

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Connections to WCRP Academy

- **The SPARC Outreach Advisory Panel will be charged with developing new initiatives for training and development of ECRs within SPARC. They will also have oversight on the transfer and impact of SPARC science beyond the realm of blue skies research. It may well be useful for the Outreach Advisory Panel to establish contact with the WCRP Academy, perhaps by co-opting an Academy representative onto the panel.**

- **SSiRC is keen to engage young researchers as well as researchers from underrepresented regions of the world wherever possible. In that context, SSiRC hopes to be able to contribute to as well as benefit from the WCRP academy.**

- **Overall SPARC hopes to benefit from exchange of experience as well as availability of platforms & tools supported by the Academy LHA**

Partnerships with entities outside of WCRP

- As part of its new Strategic Plan, SPARC will establish a new Partnerships Panel as a dedicated forum to review and plan SPARC's engagement with other WCRP groups (CPs, LHAs) and with projects external to WCRP.
- Gravity Waves is exploring the use of Machine Learning connecting to the DataWave project of the Virtual Earth Scientific Research Institute
- SOLARIS-HEPPA is interacting with SCOSTEP within its new PRESTO Science Programme.
- SSiRC collaborates with COSANOVA, a community of researchers that use atmospheric measurements of carbonyl sulfide and other emerging methods in ecosystem science. They seek improving connectivity to the International Partnership in Ice Core Sciences (IPICS). Also, improved communications with organisations like the International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI) and PAGES/VICS.
- Existing collaborations continue with IGAC, GAW, NDACC, CEDA
- Interactions with the international space agencies (i.e., responding to RFIs))

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Emerging issues

- **With support from the SSG, SPARC is proposing to change its name to**

  APARC (Atmospheric Processes And their Role in Climate)

- **Legacy of the S2S project in ESMO seems to focus more on decadal predictability. SPARC strongly recommends ESMO to also include the S2S scope of shorter time-scale prediction.**

Emerging issues

- The challenge of data storage is ever present and growing with increasingly larger data files from model output from high-resolution simulations
  - Currently: Good collaboration with CEDA
- There have been difficulties motivating model centers to participate in modelling experiments due to workload the centers are experiencing.
- Computational resources required to do SPARC science is expected to become more expensive in the future
- SPARC activities repeatedly ask for support to submit publications in open access journals (3-5 kCHF per publication)
- The current political situation makes some collaboration difficult:
  - SPARC IPO in Germany is not allowed to pay support towards China or any Russian citizens
  - IPO had to help with communication between some U.S. government employees and Chinese colleagues.
- It would be helpful if WCRP provided a platform for abstract submission / registration to workshops and general assemblies.

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