

# SPARC Strategy and Implementation Plan 2022-2026

*This strategy was developed with input from a SPARC Strategy Task Team who met online in the autumn of 2020 and updated from SPARC SSG discussions. Task Team was led by Amanda Maycock (UK) and composed of 22 members worldwide. The members are Julie Arblaster (AU), Andrew Charlton-Perez (UK), Gloria Manney (US), Daniela Domeisen (CH), Andrea Steiner (AT), Karen Rosenlof (US), Federico Fierli (IT), Harry Hendon (AU), Alexey Karpechko (FI), Stefanie Kremser (NZ), Thando Ndarana (ZA), Olivia Romppainen-Martius (CH), Swapna Panickal (IN), Hauke Schmidt (DE), Amos Tai (HK), Hiroshi Tanimoto (JP), Andrea Carril (AR), Louisa Emmons (US), Shipra Jain (UK), David Plummer (CA), Isla Simpson (US), and Neil Harris (UK).*

## SPARC Vision

*To continue building our scientific understanding of the atmosphere, illuminating the dynamical, physical, chemical and radiative processes, and their connections to the climate system and the health of our planet. SPARC recognizes the need to demonstrate societal benefits from science.*

## SPARC Mission

*Atmospheric and climate sciences are increasingly becoming a focus of decision-making across policy, research, and industry, and of interest to the public. SPARC supports the scientific and user/policy communities in addressing science questions relevant to our changing planet. SPARC takes on the mission of building the atmospheric science community's strengths in four key areas: (i) critical analyses and reviews of emerging scientific topics for international assessments; (ii) cross/transdisciplinary science projects that connects researchers across borders and domains, linking atmospheric science to other Earth system science; (iii) community development and capacity building of international and early/mid-career scientists with development opportunities to participate in and lead projects; (iv) publicity and outreach for the atmospheric sciences to building an informed public and inspiring a new generation of climate scientists.*

## Overview

SPARC has many achievements in its 30-year history (1992-2022). This strategy is about ensuring SPARC will advance those achievements by taking a leadership role at the forefront of international atmospheric science research. We all inhabit a rapidly changing environment and face myriad challenges both as scientists and citizens and therefore must work together both within and beyond the SPARC community to develop comprehensive knowledge of the complex Earth system.

**The objectives of SPARC's new 5-year strategy are:**

- To promote innovative research in atmospheric science that addresses research questions and knowledge gaps across the breadth of atmospheric science topics.
- To foster and support community research activities aligned with the core themes of 'Climate and Composition Processes', 'Predictability, projections, attribution, extremes' and 'Observations and tools for climate understanding'.
- To deliver rapid, timely and coordinated responses to emerging atmospheric science topics in support of WCRP's 'science for society' ethos.
- To increase the visibility of SPARC sciences within WCRP and beyond.
- To foster and support the next generation of atmospheric scientists and lead capacity building activities.
- To provide support for open access community datasets and data tools connected to SPARC science.
- To represent the atmospheric science community within WCRP and in international contexts.
- To ensure SPARC sciences support all five WCRP Lighthouse Activities through scientific input, discussion, and research collaborations.
- To increase the cooperation of SPARC with other WCRP core projects.
- To strengthen SPARC's partnerships with other international scientific programmes and projects outside of WCRP.
- To strengthen SPARC's supports for international climate assessments.
- To establish a sunset strategy for evaluating and closing out current activities in favour of initiating new activities based on emerging science.

## SPARC structure for a new era

A major focus of this strategy is a restructuring of SPARC, developing a new way of working that will support SPARC's work for the next five years and beyond. This structure will enable SPARC to contribute to the renewed priorities of WCRP and increase SPARC's ability to remain agile in a rapidly changing scientific landscape. The supportive, open and bottom-up culture of SPARC has been highlighted as a strong attribute as well as the successful integration of early career scientists into the community. A new structure aims to maintain and further strengthen such culture.

The structure of SPARC comprises leadership from the Co-chairs and the Scientific Steering Group (SSG), with support from the SPARC Project Office. This leadership group has oversight of the SPARC Activities, which are where the SPARC community is sustained. SPARC Activities have their own self-defined management structures, with activity leaders acting as liaisons with the SPARC leadership group (Co-chairs & SSG). This basic structure will remain in the future, but the proposed new structure will give SPARC additional internal foundations to provide enhanced connectivity and greater strategic oversight on the impact of the work performed within SPARC.

## Governance

The SPARC Co-chairs and Steering Group will be responsible for governance and leadership. The remit of the Steering Group is broad, having oversight on international scientific assessments, partnerships and outreach, hence the change of name.

## Research core themes

SPARC's research is organised around the following science themes:

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

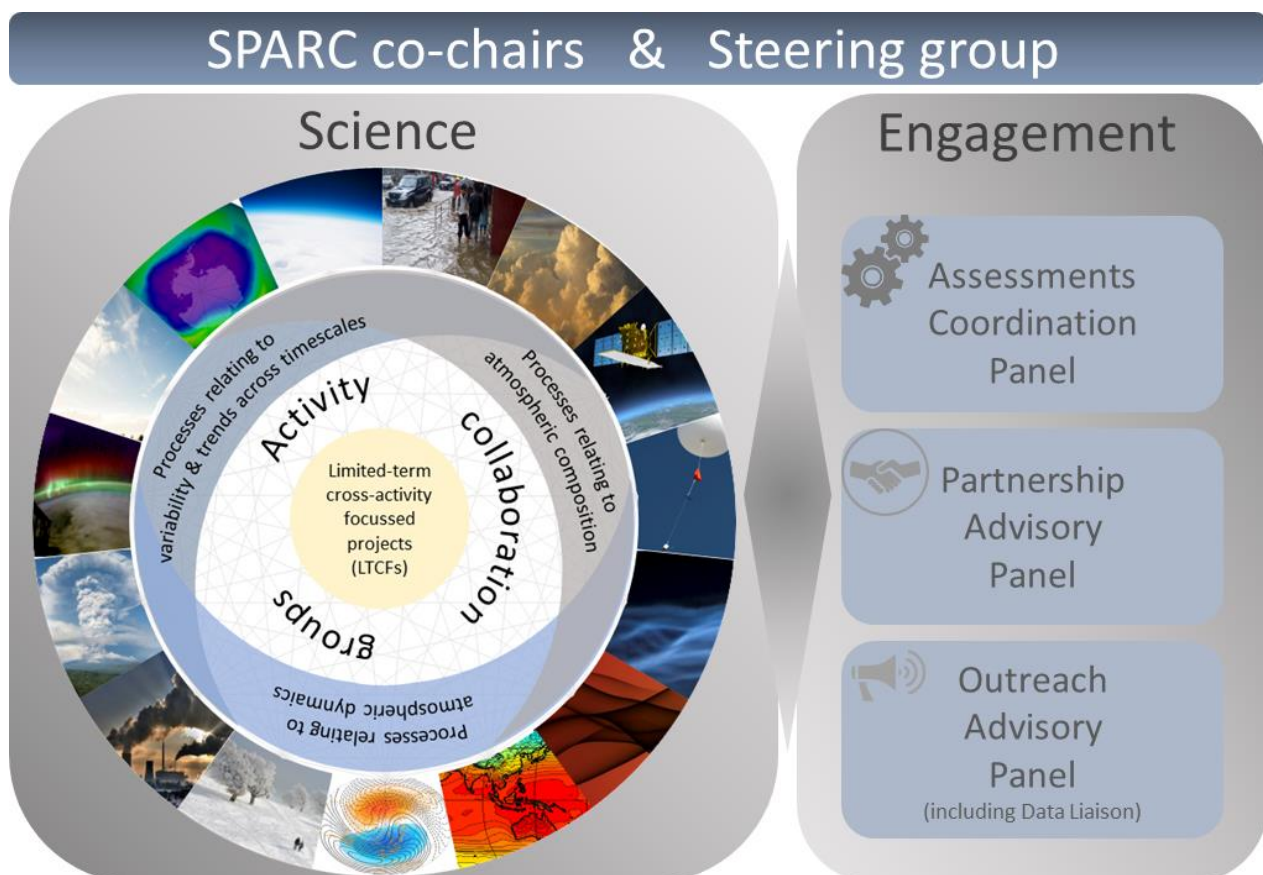
**Processes related to variability and trends across timescales**, including research related to atmospheric and climate prediction, and occurrence and attribution of extreme events.

**Processes related to atmospheric dynamics** focused on leveraging observations, reanalyses, models, and innovative analysis and attribution methods to demonstrate new understanding of the climate system, its changes and drivers

Each core theme will be aligned with an Activity Collaboration Group consisting of representatives from the SPARC Activities falling under each theme.

## Activity Collaboration Groups

SPARC will create "Activity Collaboration Groups (ACGs)" aligned to its three core themes, with the current and new SPARC Activities being aligned to at least one ACG. **The core business of ACGs will be to informally report on current and planned work in Activities, discuss areas of mutual interest/cooperation, and identify opportunities to contribute to the Assessments Coordination Panel and the Partnerships and Outreach Advisory Panels.** ACGs will be overseen by an appointed Chair and will consist of representatives from aligned SPARC Activities. The ACG representatives and the chair will meet regularly with the meeting minutes being shared with the other ACGs, SPARC Co-chairs and the Steering Group.



**Figure 1:** Proposed new structure for SPARC.

In addition to the ACGs, “limited-term cross-activity focused projects” (LTCFs) will be formed. The LTCFs are short-term (<1 year) cross-Activity projects that address specific and focused emerging research needs in a timely manner. The topics could include specific events of interest (e.g., Hunga Tonga eruption, southern hemisphere sudden warming) or policy-relevant matters (e.g., illegal CFC-11 emissions). There will be an accelerated process for launching LTCFs. ACGs may propose topics for LTCFs to the Steering Group or proposals may come from anyone in the atmospheric science community via a short statement of interest to the SPARC Steering Group. Open calls should be made when establishing membership of LTCFs.

## Assessments Coordination Panel

SPARC has a longstanding role supporting international scientific assessment reports, most notably the WMO/UNEP Ozone Assessment Reports. These contributions are generally delivered through individual SPARC Activities liaising with external Assessment coordinators. SPARC will launch a new “Assessments Coordination Panel” that will unite scientists from the SPARC community who are supporting international assessments. This panel will provide a forum to share best practices, identify synergies and complementarity from across SPARC contributions, and support the delivery of content in a timely manner. Where individual contacts have not yet been established, the Assessment Coordination Panel will provide a point of contact for external Assessment coordinators to seek expertise from the SPARC community. It will also act as a focal point for supporting the SPARC community to deliver timely and relevant evidence to scientific assessments. The Panel will also monitor the contributions of the SPARC community to other assessments such as IPCC reports and associated impacts. The panel will also advise on what assessments SPARC could lead after consultation with the community.

## Partnerships Advisory Panel

Under the new WCRP structure, it is more important than ever that SPARC maintains its external connections and grows its links with other groups. SPARC will launch a “Partnerships Advisory Panel” comprising external representatives from organisations, groups and other projects with whom SPARC wishes to collaborate, partner, and engage. The Panel will take strategic leadership of the connections between SPARC and other groups, focusing on opportunities, synergies, and co-benefits. The purpose is to ensure that SPARC is well connected with the network of other groups and organisations who have complementary remits.

## Outreach Advisory Panel

SPARC will launch an “Outreach Advisory Panel” whose remit will be to take strategic responsibility for SPARC’s outreach and engagement, capacity building, training, and open science. A key function of SPARC is to provide wider community benefits, opportunities for engagement, and training. Historically these activities have been driven from within SPARC Activities, with some Activities lending themselves to stronger engagement than others. The Panel should enable a longer-term strategic oversight of SPARC and identify opportunities for shared best practice, elevated impact, and the development of new initiatives. SPARC will appoint Regional Ambassadors across the world who will engage with local communities and stakeholders, identify their needs, and communicate research results. They will work with local organisations that are active in outreach, e.g. universities, and support their work.

The above changes constitute the proposed restructuring of SPARC. The expectation is that introducing greater connectivity and interaction will support synergy, communication, and impact of SPARC science.

## SPARC Outputs

The major outputs from SPARC that its activities should demonstrate capability to deliver are: 1) Critical reviews of emerging science. 2) Joint community research outputs that require coordination and group effort. 3) Cross-disciplinary science projects including coupling of the atmosphere with the Earth system. 4) Community development including ECRs and capacity building. 5) Publicity and outreach for science.

## SPARC name

As part of this new strategy and the restructuration of SPARC, SPARC leadership will undertake a consultation on SPARC's name with the view of launching with a new name in early 2023.

## Emerging science themes

Several emerging themes have been identified for next few years. There are also opportunities following the sunseting of the Grand Challenges (GCs) to provide a new home for atmospheric science research within WCRP that was previously linked to the GCs but is not captured within the LHAs. The SPARC Steering Group will undertake a scoping exercise to establish the wider community representation around emerging topics and identify whether SPARC can provide a scientific home and support for groups of researchers interested in those topics.

### **Scoping of new Activities by the SPARC steering group:**

#### SPARC/CLIVAR/GEWEX joint activity on extratropical cyclones and climate

Extratropical cyclones are a key feature of the general circulation. They are frequently associated with impactful events. SPARC has contributed to several community workshops on storms tracks. Some of this community used to engaged within the Grand Challenge on Clouds, Circulation and Climate Sensitivity. A scoping exercise should identify whether there is scope and a need for SPARC to offer leadership in this area within WCRP.

#### SPARC/CLIVAR/GEWEX joint activity on convection

The Clouds, Circulation and Climate Sensitivity GC had a focus on convective organisation. This is an established international community around clouds, circulation and climate sensitivity, but this is not a focus of a LHA. CMIP houses a vibrant modelling community on cloud-climate coupling within the Cloud Feedbacks Model Intercomparison Project (CFMIP). However, additional expertise may be needed to support the LHA on Digital Earths which has global coupled ultra-high-resolution modelling as one of its major areas of activity. SPARC can explore whether it can support this area of research in coordination with other CPs.

#### SPARC/CLIVAR joint activity on Rossby waves

Rosby waves are a fundamental part of the general circulation. Rossby waves are involved with many aspects of weather and climate, e.g. teleconnections, stratosphere-troposphere coupling, atmospheric blocking, compound extremes. However, there remain fundamental questions about Rossby wave dynamics, their representation in models and the response to external forcing. This is an area where SPARC has existing expertise that could be brought together in a more coordinated way.

## SPARC Activity on multi-variate atmospheric trends

SPARC has supported several activities focused on atmospheric trends. These have been separate activities with distinct scientific foci. Deeper understanding can be gained by viewing these trends holistically as interconnected aspects of the coupled atmospheric system.

Examples of possible LTCF topics include:

- Rapid attribution of observed sub-seasonal and seasonal anomalies/extremes
- Aerosol and chemistry science for solar radiation management
- Atmospheric science needs for very high-resolution modelling

## Atmospheric composition science

SPARC supports substantial expertise in atmospheric composition research. This has historically focused on processes affecting stratospheric and upper-troposphere lower-stratosphere composition (e.g., transport, chemistry), but there has been interest in broadening the focus to processes affecting the climate (SPARC SSG meeting, 2018). The international research community around atmospheric composition comprises a complex network of bodies and panels, including IGAC (FutureEarth), GAW (WMO), AeroCom, AerChemMIP (CMIP). While SPARC has made connections with some of these groups, for example through the joint SPARC/IGAC Chemistry Climate Model Initiative (CCMI), there is a complex landscape of programmes and it is currently unclear to what extent SPARC can usefully provide input to any existing knowledge gaps. To clarify this issue, SPARC will commission the Steering Group to undertake a review of the international landscape for atmospheric composition research, including future measurement needs, and report specific outcomes of this scoping to the co-chairs by 2023.

## SPARC capacity developments

The SPARC community involves a large body of early career researchers (ECRs). These researchers are engaged and proactive, and bring new perspectives to SPARC. SPARC's support for ECRs is currently met through travel support to attend meetings/workshops and through delivery of training, e.g. SPARC sponsored summer schools. SPARC has historically supported the involvement of ECRs in Activity leadership as a development opportunity and this will continue in the next five years. The shift to hybrid working during the COVID-19 pandemic has opened new possibilities for interaction and community building. For example, an online journal club has been operating led by a SPARC ECR. As part of SPARC's new strategy, capacity development will be built from this example to support other ECR initiatives. For instance, given the growth in Artificial Intelligence (AI) and Machine Learning (ML) in atmospheric science and the fact that ECRs are rapidly becoming the new generation of experts in the application of AI/ML techniques, SPARC will consult with the ECR community on the appetite for an AI/ML Researcher Forum that could comprise presentations, discussion sessions and an online base for sharing code/tools. Such an initiative will be developed in a complementary way to existing ECR networks with links to SPARC, such as the YESS Learning Groups.