WORLD CLIMATE RESEARCH PROGRAMME

Extraordinary Session of the WCRP Joint Scientific Committee (JSC41B)

Report from SPARC

SPARC Stratosphere-troposphere Processes And their Role in Climate

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1. Briefly outline the nature of the review and what you hope to achieve?

2. Are there any preliminary recommendations to share with the JSC?

3. Any discussion with key partners / collaborators within and outside WCRP?

Possible Future SPARC

1. Briefly outline the nature of the review and what you hope to achieve?

- A Strategy Task Team with 22 members (considering expertise, geographical balance, career stage, etc.) has been assembled, which
  - reviewed the current SPARC structure, its strengths & weaknesses,
  - discussed possible future science topics for SPARC,
  - discussed future structure of SPARC and implementation plan,
  - presented their interim results to the SPARC SSG on 18 November.

- The YESS community and IGAC are represented in the Task Team.

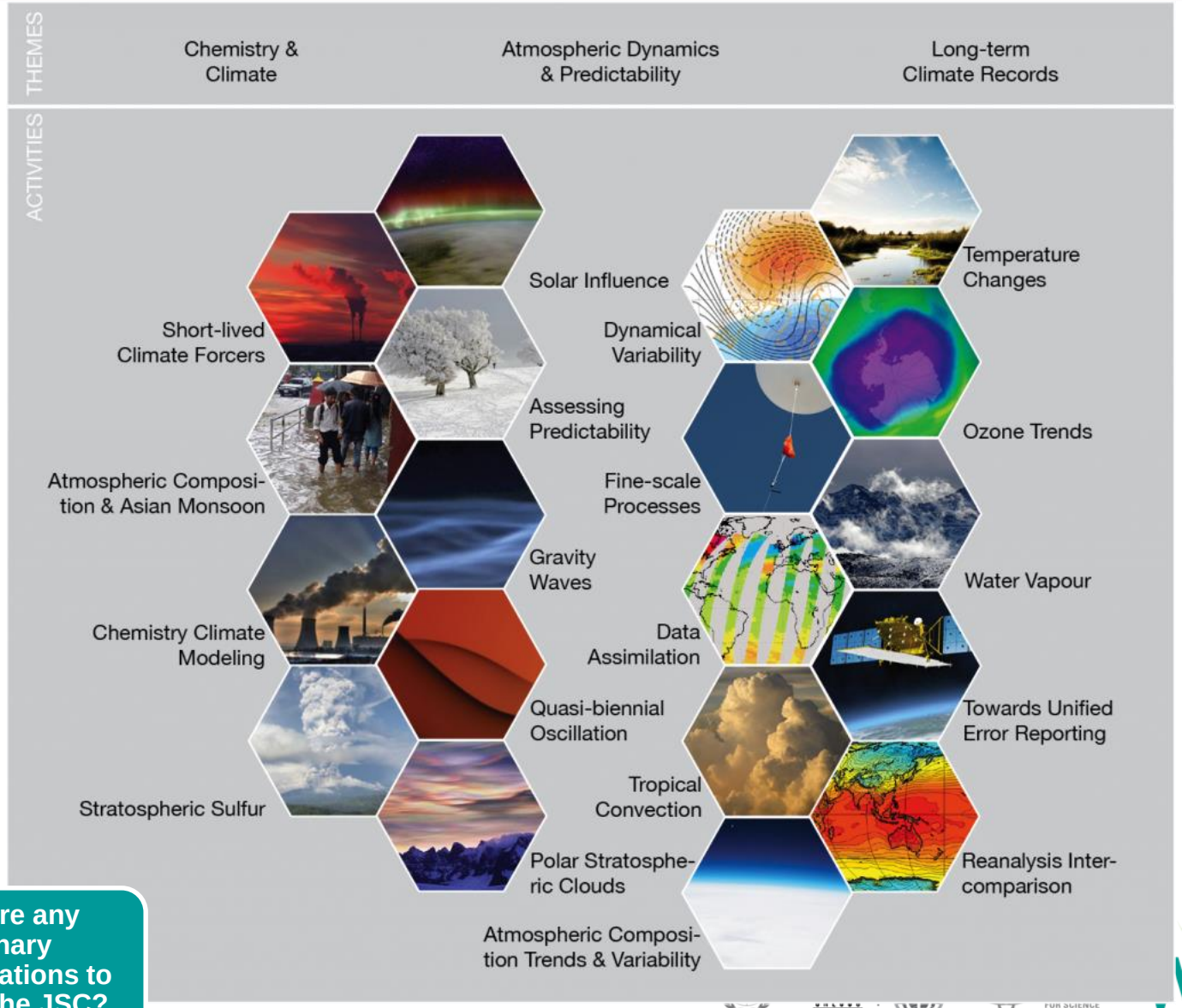
- Discussion will continue within SPARC, the Task Team and the community.

- The new strategy/implementation plan will be written after more discussions, to be completed in time for the JSC-42 meeting.

- Data storage and management may require specific funding and be a cross-WCRP topic. Online activities may need different support to traditional activities

1. Briefly outline the nature of the review and what you hope to achieve?

Present SPARC



2. Are there any preliminary recommendations to share with the JSC?

Future SPARC: Overview

SPARC is positioned at the interface of the weather and climate communities – bridging WCRP and WWRP.

SPARC consists of bottom-up activities and builds up (new) communities.

SPARC as a facilitator of good research

- Encourage focused research activities in the context of Light House Activities
- Provide dynamical insights into modeling studies and technical support for model analysis
- Take lead in emerging areas; e.g. machine learning / data science topics
- Collect code basis, data, open-source tools and make them accessible
- Could develop a set of diagnostics for dynamics
- Distribute knowledge through workshops/training

Advocacy towards policy makers and funding agencies

- Take on leadership, to make sure efforts are not “forgotten” or “lost on the way”
- Maintain and advance long-term climate records
  for large assessments (IPCC, WMO/UNEP Ozone, etc.) & mission planning
- Address local impacts of climate change
- Geoengineering (i.e., radiation management)

2. Are there any preliminary recommendations to share with the JSC?

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Future SPARC: Structure

Activity structure works well

- Need to push opportunities to take on whole-atmosphere approach
- Focused topics should still be encouraged
- Need a balance between top-down and bottom-up organisation
  (some top-down activity is likely needed and some current activities could be merged)
- Room for different natures of activities (report-oriented, network-oriented,…)

Need for more/different ways to engage with early career scientists and other communities.

- Make sure future members of the community are equipped with the necessary tools and knowledge to contribute
- Engage with regional communities (e.g., regional ambassadors)
- Create room for “informal” ways to form groups
  - Less reporting requirements, more community-engagement (e.g. small “local groups”)
  - Early career “forum” to discuss latest work in more informal environment
  - Connect to existing communities outside of SPARC to facilitate regional & thematic expansion
  - Offer opportunity for ECS to build something new within their communities

2. Are there any preliminary recommendations to share with the JSC?

Future SPARC: Functions

Facilitate scientific exchange & collaboration

- (traditional) Workshops on specific topics, e.g.,
  i. Use ccmi model runs on chemical impacts of geoengineering to connect to other geoengineering communities
  ii. heat storage in the Earth system publication as outcome of SPARC/CLIVAR/GEWEX
- Other options including online seminars, a platform to share latest research results, and informal workshops with no dedicated output
- Write reviews on emerging issues, e.g., future directions in geoengineering, machine learning, and causality study tools and methods
- Host code bases in style of, or cooperation with pangeo; create SPARC catalogue to find analysis tools online, as a reference point for people looking for tools & diagnostics

New forms of SPARC "products"

- Write guidance documents & white books
- Conduct surveys to identify needs
- Define guidelines of "best practices"
- Reach out to society & policy makers
  (requires different forms of deliverables than for science community)

2. Are there any preliminary recommendations to share with the JSC?

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3. Any consultations with key partners / collaborators – inside and outside of WCRP?

- SPARC activities already have links to other core projects as well as partner projects (e.g. IGAC, S2S).
- Collaboration with IGAC seen as key for many activities (tropospheric expertise; connection to regional communities).
- Collaboration with GAW is wanted, and will be initiated now that the initial stage of the SPARC review is complete (GAW chair aware).
- Connecting to / building up regional groups in collaboration with partner projects
- SPARC‘s strong engagement in the S2S project could make it the future WCRP home for some S2S activities – guidance from JSC welcome.

Open issues:

- Collaboration with new homes
- Guidance on radiation management topic needed
- Grand challenge ‘homes‘

3. Any discussion with key partners / collaborators within and outside WCRP?

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SPARC as seen by the task team

Thematic expertise

Atmospheric Circulation
- Rossby wave dynamics
- Dynamical coupling & feedback mechanisms
- Extreme events/ compound events
- Attribution & detection
- Understanding variability
- Local impacts of climate change
- Role in predictability

Atmospheric Composition
- Geoengineering
- Long-term records
- Cloud processes
- Air quality

Model assessment
- Consistency checks *(btw. models; time scales; time-variations of parameters,..)*
- Understanding model bias & internal variability
- Understanding prediction skill *(windows of opportunity; signal-to-noise paradox)*

Those are all connected…

Methodologies

Observations
- Support for observation missions
- Long-term record analysis
- Produce climatologies
- Data assimilation
- Uncertainty reporting
- Identify needs in global observation networks

Model simulations
- Provide input data sets *(e.g. aerosol)*
- Impact studies
- Model expansion *(higher altitudes)*
- Assessment studies *(e.g. after extreme events/season)*
- Intercomparison studies
- Large ensemble studies
- Consistency checks

New: Machine learning & Data Science

Implementation

Longer-term activities
- Networking-focus
- Sustaining long-term assessments of data records or model developments

Short-term activities
- On specific topics
- Rapid assessments
- Workshops *(knowledge assessment & connecting communities)*

Scientific exchange & collaboration
- ECS forums
- Informal community events
- (Online) Seminar series

SPARC deliverables:
- Best practice guidelines
- White papers
- Reviews Assessment Reports/ special issues
- Set of dynamical analysis tools

SPARC outreach
- Regional ambassadors
- Advocacy towards funding agencies; mission planning

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Additional slide: Expanding scientific horizon of SPARC

Move towards whole-atmosphere theme

- Include tropospheric weather and climate
- Include also higher altitudes
- Bring in knowledge of wave dynamics as a core expertise of SPARC community
- Apply emerging tool (e.g., machine learning) to whole-atmosphere study
- Local impacts of climate change
- Need to expand the works on composition

Dynamical attribution and detection

- Relate extreme seasons or months to teleconnection patterns/anomalies
- Study dynamics behind climate extremes
- Important role of observations (composition & dynamics) & use of large ensembles in whole-atmosphere context

Predictability

- Identify windows of opportunity for S2S and multi-year predictions
- Identify untapped sources of predictability including signals from higher altitudes
- Understand and predict compound events & their impacts
- Seamless prediction and its application in the context of "Science for Society"
- Use machine learning /data science tools for understanding and improving predictions
- SPARC would be the natural home for S2S project within WCRP

Geoengineering: radiation management

- Expertise: SPARC has traditionally been good at linking composition with dynamics
- Important role of observations (composition & dynamics)
- Work out ways to collaborate with the different community (e.g., GeoMIP)