How has SPARC been enhancing its climate dynamics focus during last couple of years?

SPARC
Stratosphere-troposphere
Processes And their Role in Climate

Response to Stephen Belcher's request

SSG members with a climate dynamics focus (atmospheric dynamics, teleconnections, tropospheric prediction, monsoon and dynamically driven tropospheric extremes)

Proposed 2018 SSG membership

Enhance focus on climate dynamics in SPARC activities

- **DynVar** (Modelling the Dynamics and Variability of the Stratosphere-Troposphere System)- Principal SPARC activity that focusses on atmospheric dynamical processes, serves as generator of new atmospheric dynamics-related activities in SPARC
- **Focused dynamics activities relevant to WWRP**
  - QBOi (Towards Improving the Quasi-Biennial Oscillation in Global Climate Models) – understanding and representation in models of linkage between QBQ and extratropical circulation both in the stratosphere and troposphere
  - SNAP (Stratospheric Network for the Assessment of Predictability) –focuses on outstanding questions about stratospheric predictability and its tropospheric impact
- Satio-TCS (The Stratospheric and Tropospheric Influences On Tropical Convective Systems)
    - New emerging activity that focusses on tropical region where weather systems involved multi-scale interactions with moist convection.

Enhance focus on climate dynamics in SPARC activities

- **Other SPARC activities with connection to climate dynamics**
  - S-RIP (SPARC Reanalysis Intercomparison Project)
    - Focuses on reanalysis output in the stratosphere, upper troposphere and lower mesosphere.
    - Chapter 6: Stratosphere-Troposphere Coupling
    - Provides guidance for tropospheric focused reanalysis intercomparison project
  - SOLARIS-HEPPA (Solar Influences on Climate)
    - Focuses on impact of solar forcing on climate via dynamical processes (top-down, bottom-up)
  - Gravity Waves
    - Guides improvement of global circulation models used for weather forecasting and climate prediction through observational constraints of gravity wave drag parameterizations
    - Recent workshop in 2016 focused on dynamics and sources of gravity waves in the troposphere including convection, jet/fronts, and orography.

Organize workshops on atmospheric dynamics

- **DynVar workshop** in 2016 in Helsinki on "*The Large-Scale Atmospheric Circulation: Confronting Model Biases and Uncovering Mechanisms*" with 74 participants from 16 countries. Specific topics were:
  - The origin and consequences of systematic model biases in the context of atmospheric dynamics with a focus on tropical – extratropical connections, storm tracks, polar vortex and sea ice variability.
  - The role of atmospheric dynamics in shaping the climate response to anthropogenic forcing (e.g. global warming, ozone depletion).
  - How dynamical processes contribute to uncertainty in climate prediction at seasonal and decadal time scales.

Contribute to WCRP-cross cutting dynamics activities:

- International workshops that have a dynamics focus (e.g. **Blocking workshop in 2016**, **Storm Tracks workshop in 2015**)
  - Atmospheric Blocking and Storm tracks are important drivers of regional climate variability and change
- CMIP6-endorsed Modeling Intercomparison Project **DynVarMIP**.
  - Proposes extra list of output diagnostics
  - to help understand consistent model biases of aspects of atmospheric dynamics (sea level pressure change, mean position of the mid-latitude jets)
- Grand Challenge on **Near-Term Prediction**

Partnerships:

- Dynamics-related science in SPARC leveraged via a Belmont Forum-funded project on **Globally Observed Teleconnections in Hierarchies of Atmospheric Models (GOTHAM)**
  - Investigates impact of teleconnections on tropics and and high-latitude regional variability
- SPARC/IGAC joint activities
  - **ACAM** (Atmospheric Composition and the Asian Monsoon)
  - **CCMI** (Chemistry-Climate Model Initiative)

Organize Dynamics Training Schools

- “Southeast Asia School on Tropical Atmospheric Science” (SEASTAS) held in 2016, 2017 and planned for 2018
- Training school on stratosphere – troposphere interactions on the occasion of IAPSO-IAMAS-IAGA 2017 in Cape Town, South Africa
- Planned joint IGAC/SPARC training school in 2018

Plans to further enhance climate dynamics focus

- Enhance understanding on the role of the stratosphere in tropospheric prediction on the S2S time scale (Phase 2 of SNAP-Project)
- SOLARIS-HEPPA working group on impact of solar irradiance and particle effects on surface climate taking atmosphere-ocean coupling processes into account (CCMI and CMIP6 historical and future simulations)
- Re-focussing of DynVar activity
- Lead a new focus on “How will storm tracks change in a future climate?” within the Grand Challenge on Clouds, Circulation, and Climate Sensitivity.

Some issues

- ***Links between some SPARC activities could be strengthened***
  - CCMI links to DynVar and QBOi (highly relevant for interpretation of chemistry climate model simulations specifically when they increasingly include Coupled Atmosphere-Ocean CCMs).
- ***Links between SPARC and other Core Projects could be strengthened***
  - CLIVAR Dynamics Panel (Elisa Manzini)
  - CLIVAR working group on Arctic-Lower latitude linkage
  - GEWEX
- ***Identifying SPARCS role in WCRP's Regional Initiative and CORDEX***
  - Reducing systematic atmospheric model biases in the context of atmospheric dynamics
  - Developing knowledge on role of dynamical processes in regional climate predictions (shaping climate response to external forcing, understanding uncertainties due to internal atmospheric variability)