

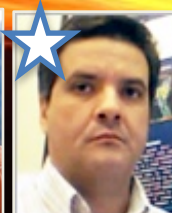
**Judith  
Perlwitz**  
Co-Chair



**Neil Harris**  
Co-Chair



## The SSG



**Boram Lee**  
WCRP Liaison



**SPARC  
Office  
Zurich**

# Outline

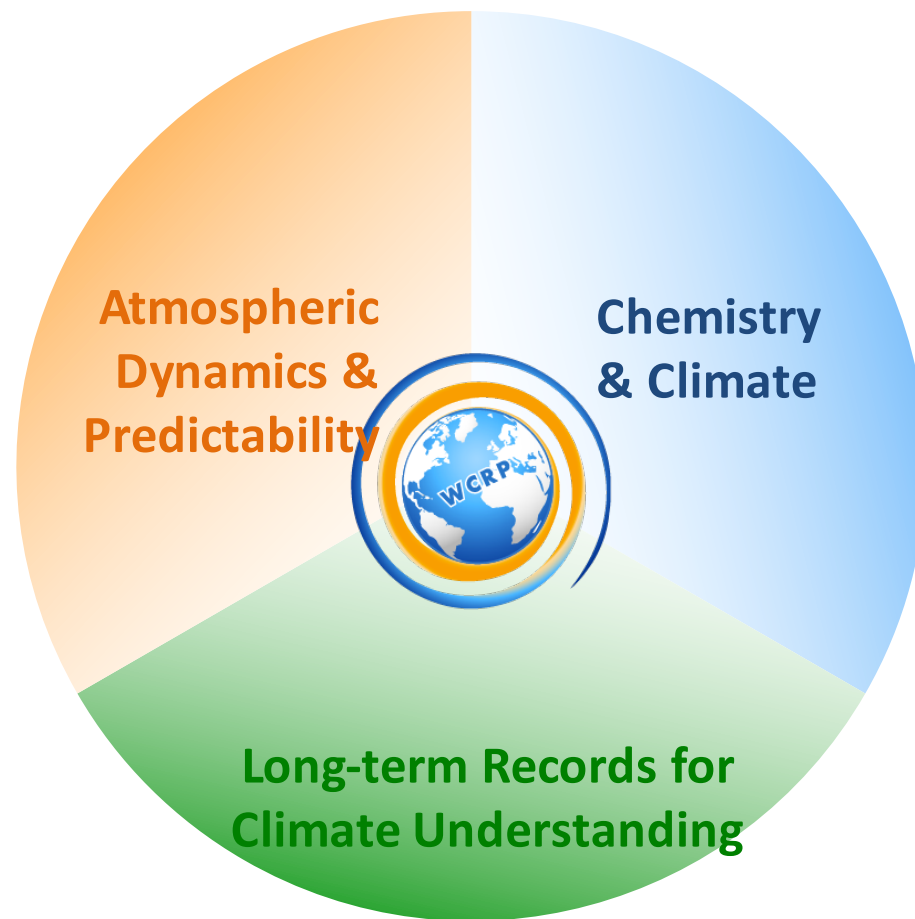
- Highlights of recent SPARC science
- Possible scientific developments
- Organisation
  - Management plans and challenges
  - Regional / training aspects of SPARC and WCRP
  - Modeling and data requirements

# Implementation Plan

## SPARC Implementation Plan 2016-2020



**SPARC**  
Stratosphere-troposphere  
Processes And their Role in Climate



Whole atmosphere approach



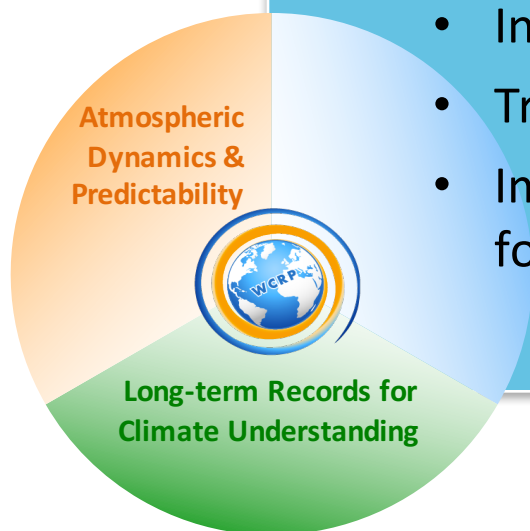
# Implementation Plan

## Chemistry & Climate

Changes in the **chemical composition** of the troposphere and stratosphere are critical factors **determining radiative forcing, modulating climate sensitivity, and decadal-scale climate change.**

### FOCI:

- Interactions between composition, clouds, and radiation
- Tropospheric ozone and stratosphere-troposphere exchange
- Impact of changes in atmospheric composition on radiative forcing and climate





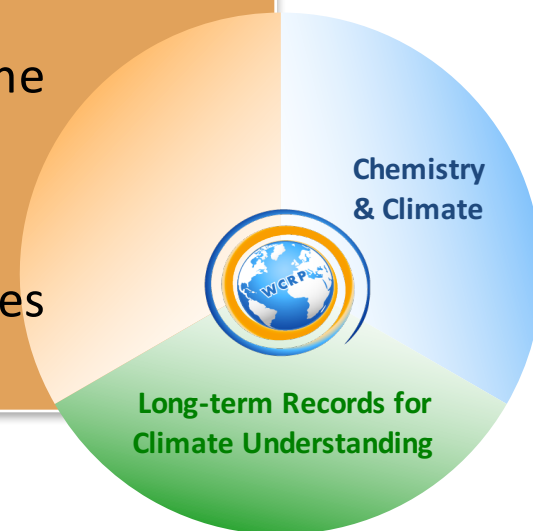
# Implementation Plan

## Atmospheric Dynamics & Predictability

On **regional scales**, unlike the global mean, it is the **dynamics** as much as the **thermodynamics** that determines climate. **Regional circulation patterns** can greatly **exacerbate** or **completely counter** the **thermodynamic component** of climate change.

### FOCI:

- Assess atmospheric predictability and variability, and the underlying mechanisms
- Bring observational expertise to bear on models
- Understanding the dynamics of surface climate extremes



# Implementation Plan



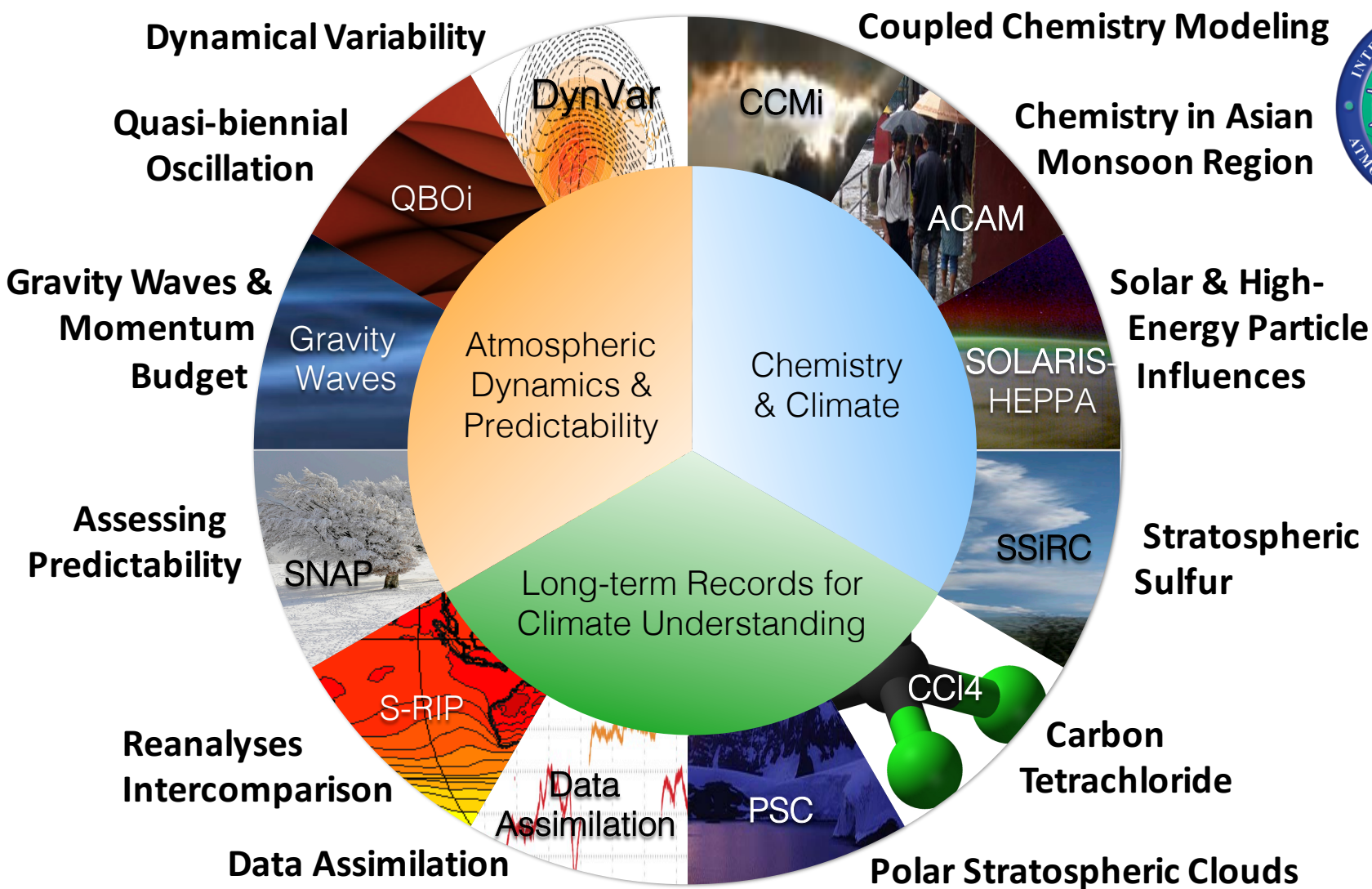
## Long-term Records for Climate Understanding

**Understanding** and **detecting** climate change requires a dedication to **creating, analysing, and interpreting** ground-based and satellite observations, as well as associated **uncertainties**.

### FOCI:

- Develop new methodologies for constructing climate data records (CDRs), time series analysis, and detection and attribution studies
- Promote the collection and curation of CDR metadata
- Ensure collaboration with relevant international groups

# On-going activities







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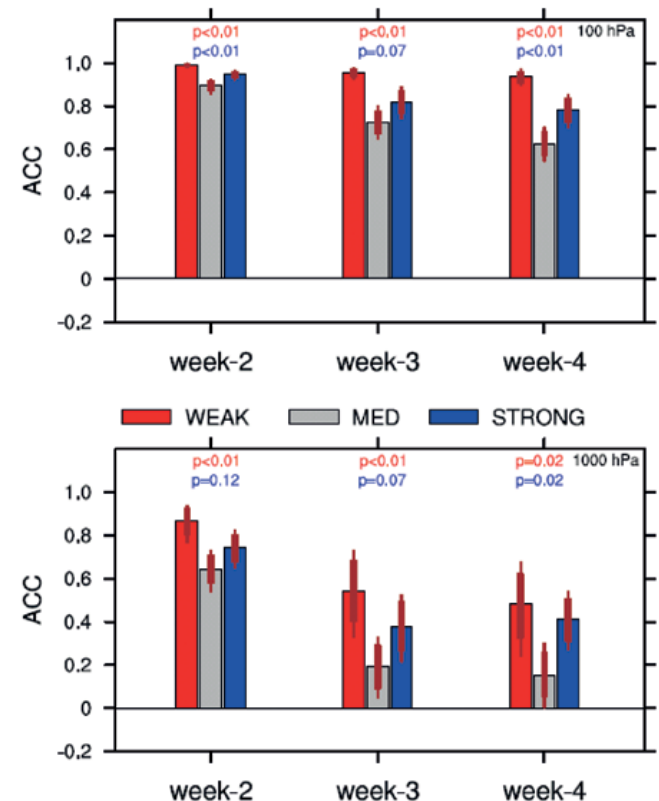
# SNAP

Stratospheric Network for Assessing Predictability

**WCRP**  
World Climate Research Programme

- **Review** role of the stratosphere in short-term predictability and coordinated WFM experiments
- Link between **SNAP** and **WWRP/WCRP S2S initiative** established
- Next phase of SNAP: Analysis of the S2S data by the SPARC community
  - *More information and invitation to participate via SPARC Newsletter No. 46 - January 2016 article (Tripathi et al. 2016).*

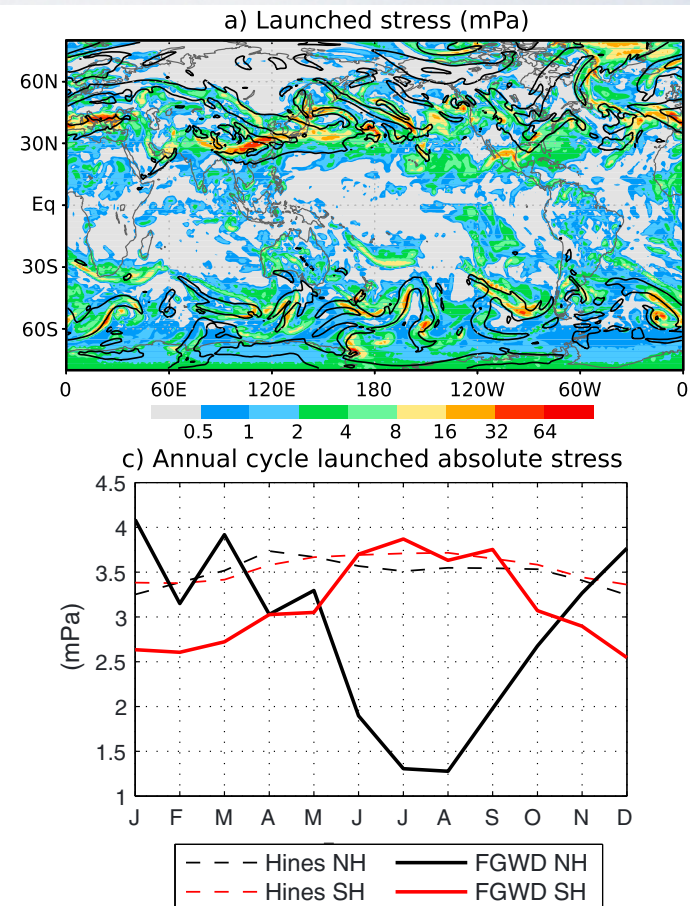
*Skill is significantly enhanced for tropospheric forecasts initialized during periods of weak and strong stratospheric winds.*



*Tripathi et al 2015*

# Gravity Waves

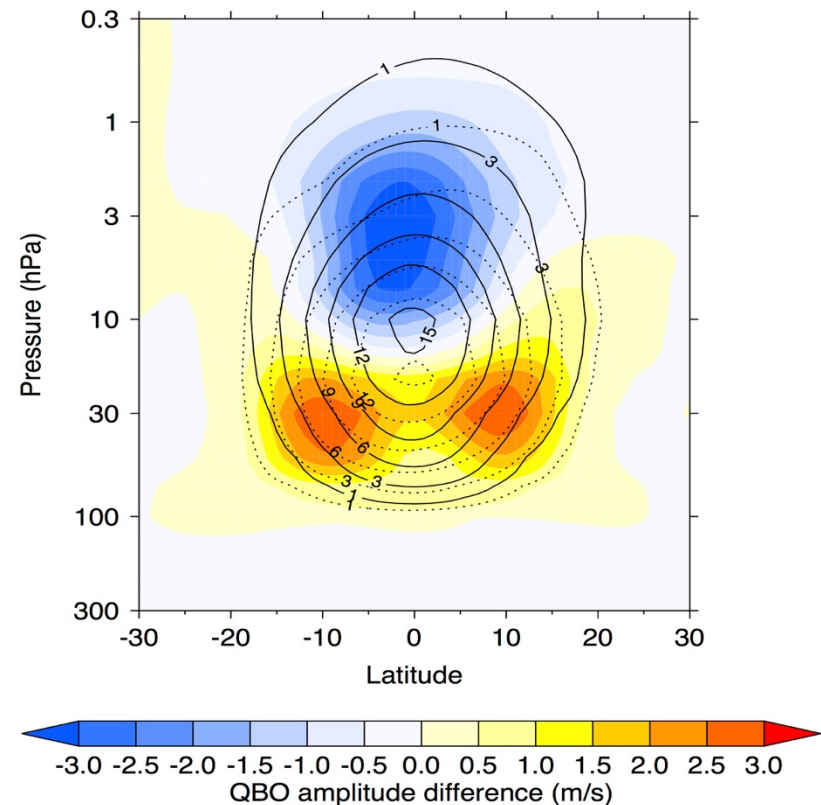
- Focused study group on *Gravity Wave Sources and Forces*
  - co-sponsored with ISSI
  - at least 4 papers in 2015
- 2016: define new foci related to weather effects and global high-resolution model studies
- SPARC Newsletter Article on Gravity Wave Dynamics and Climate (44, 2015, Alexander and Sato, review article in preparation)



*Stochastic gravity wave parameterizations can simulate realistic spatial and temporal intermittency in large amplitude gravity wave events and realistic stratospheric drag for improved climate simulations. de la Cámara and Lott (2015)*

- First workshop in March 2015
  - Defined key challenges and identified model experiments & analysis metrics
  - Meeting report published both in EOS and SPARC Newsletter
- 2016 Workshop in September 2016 in Oxford will discuss first results
- Successful with Belmont Forum bid on broader issues.....

## Modeling the Stratosphere's "Heartbeat"



*In models, the QBO peaks too high in altitude, and does not penetrate deeply enough and decays in latitude more quickly in the lowermost stratosphere. (Schenzinger et al 2016 in preparation)*

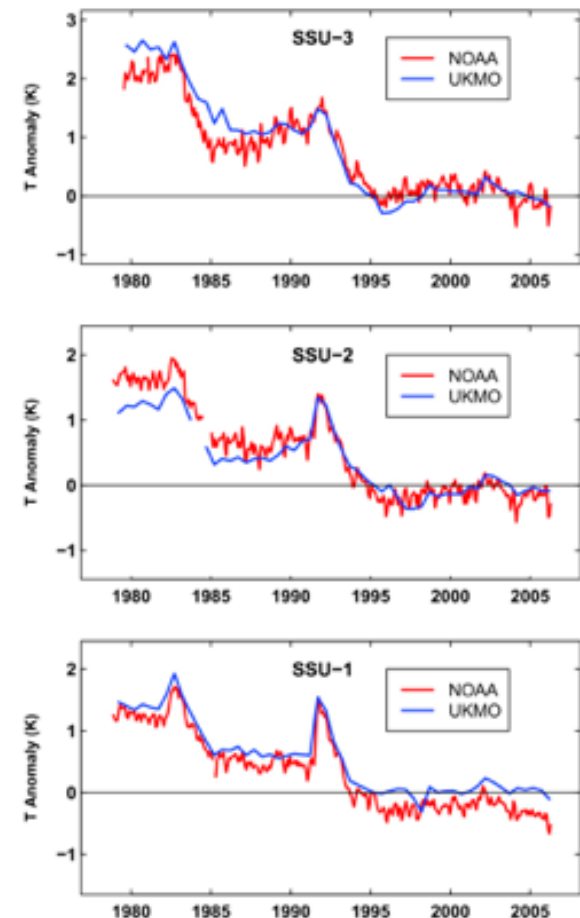


# Atmospheric Temperature Changes

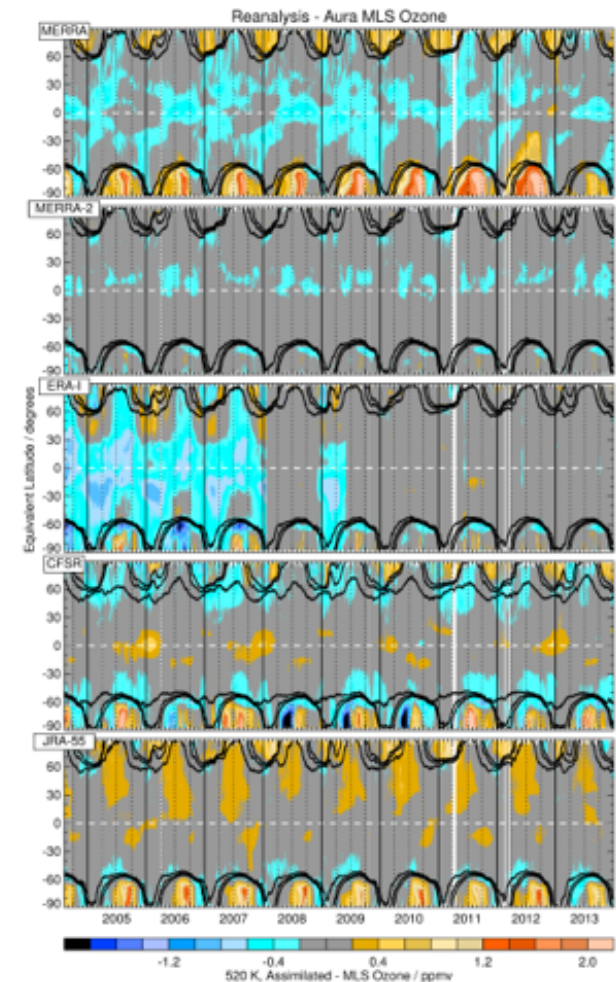
- Long standing SPARC activity (~20 years)
- 2015 Achievements: publication of several research/review papers, a workshop, and a transition of leadership: Andrea Steiner (University of Graz) and Amanda Maycock (University of Leeds)
- April 2016 workshop in Graz (Austria) with focus on new topics

Seidel et al. 2015

**Two climate data records derived from SSU – much better agreement**



- coordinated activity to:
  - understand differences between reanalyses in the stratosphere;
  - provide guidance on appropriate usage;
  - contribute to future improvements in reanalysis products.
- 2016 S-RIP Interim Report with four basic chapters in preparation
- ACP Special Issue on the S-RIP approved



*Comparison of reanalysis ozone with that from the Aura MLS near 20km, 50hPa*



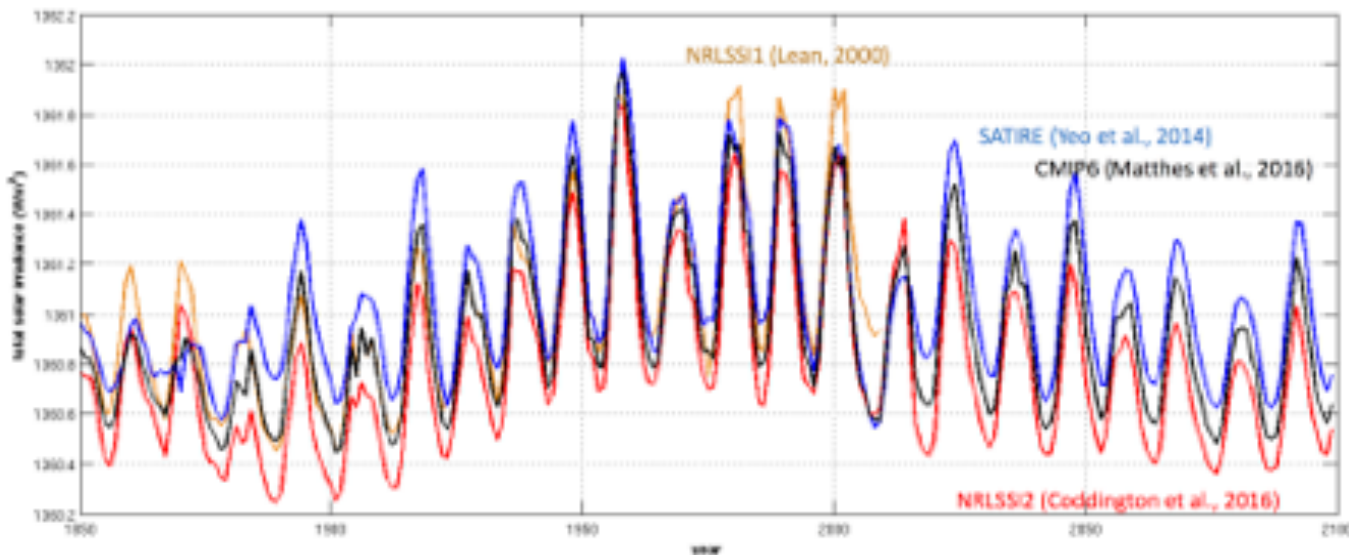
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# SOLARIS-HEPPA

## Solar Influence on Climate



- Three 2015 papers investigating the solar signal in CMIP5
- Paper describing CMIP6 solar forcing to be submitted to GMD CMIP6 special issue.
- SolarMIP for CMIP6 has been merged with DAMIP, with the experiment to include only solar cycle forcing
- Working group established to assess the solar signal in stratospheric ozone
- 2015 Workshop in Boulder and workshop planned for June 2016 in Helsinki



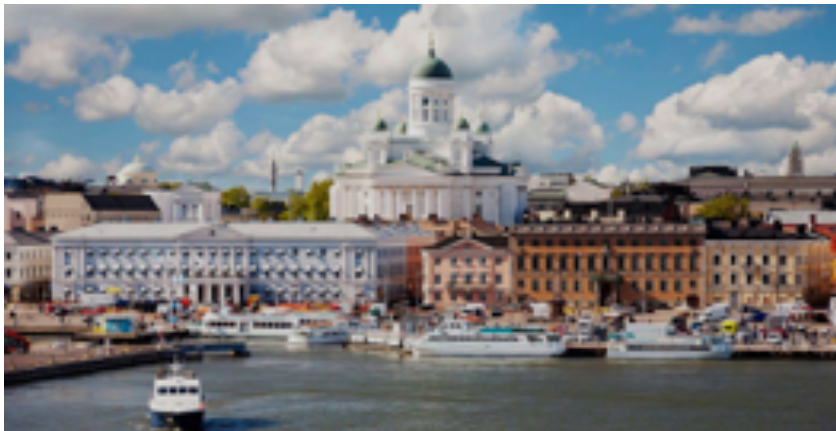
*Time series of historic (1850-2014) and projected (2015-2100) total solar irradiance (TSI) recommended for CMIP-6 (Matthes et al., in prep.).*



# DynVar

## Dynamical Variability

- Active discussion on how to best participate in CMIP6 -> DynVarMIP
- Additional model output requested by DynVarMIP will be archived on the Earth System Federation Grid to address the following key questions:
  - *How do dynamical processes contribute to persistent model biases in the mean state and variability of the atmosphere?*
  - *How does the stratosphere affect climate variability at intra-seasonal, interannual and decadal time scales?*
  - *What is the role of dynamics in shaping the climate response to anthropogenic forcings?*
  - *How do dynamical processes contribute to uncertainty in future climate projections?*



DynVar Workshop in Helsinki, 2016 - main goal:  
Develop focussed analyses of the CMIP6  
experiments



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# SSIRC

## Stratospheric Sulfur and its Role in Climate

**WCRP**  
World Climate Research Programme

- Review paper on stratospheric aerosol
- Very active in pre-CMIP6 activities related to developing forcing data set and modelling (VolMIP)
- New: archival of historic stratospheric aerosol measurements
- April 2016 SSiRC workshop in Potsdam
- 2017 Chapman conference in planning
- *Contribution to GC on “Clouds, Circulation and Climate Sensitivity” and GC imitative on proposed GC on “Near-Term Climate Prediction”*



*Activity supported extensive balloon campaign (BATAL-15 in summer 2015 throughout India (Gadanki, Hyderabad, Varanasi) and in Saudi Arabia (Thuwal)).*



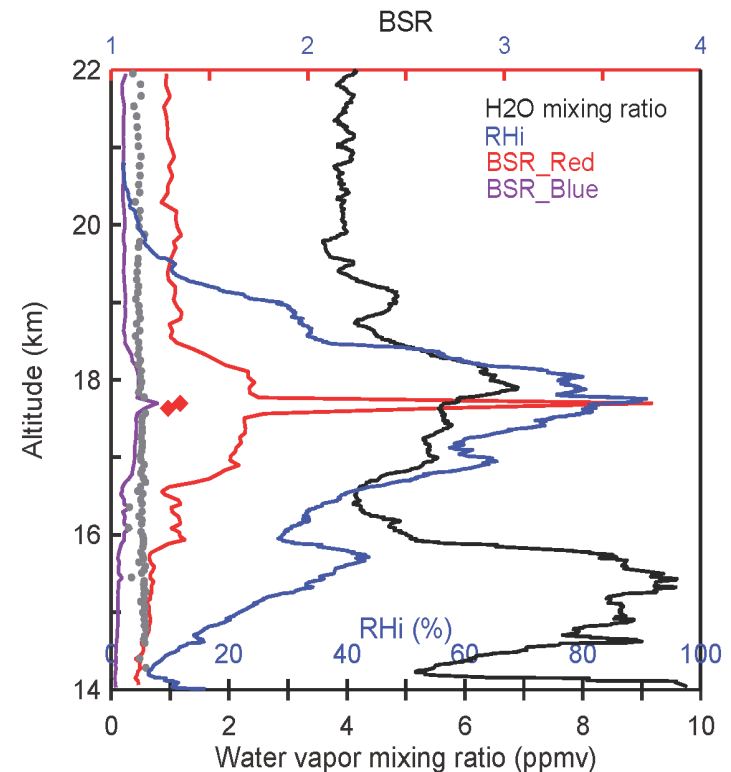
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# ACAM

## Atmospheric Composition and the Asian Monsoon

**WCRP**  
World Climate Research Programme

- Promoting international cooperation on research on Asian monsoon
- 2<sup>nd</sup> ACAM workshop took place from 8-10 June 2015 in Bangkok, Thailand, with participation from ~170 scientists from 22 countries
- Coupled with a training school for students and early career researchers
- Another planned for 2017.



Aerosols, cirrus particles and H<sub>2</sub>O over the Tibetan plateau during the Asian Summer Monsoon season. (Unpublished data presented by Jianchun Bian at the 2<sup>nd</sup> ACAM workshop)

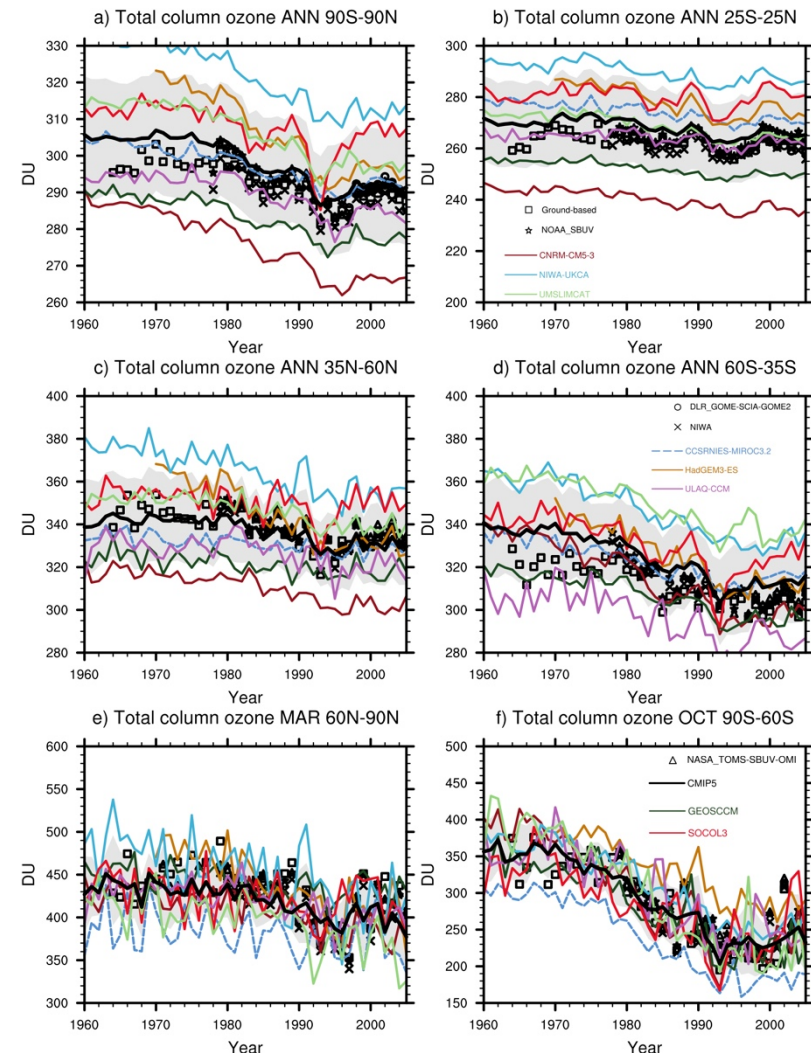


### ***AerChemMIP approved:***

- diagnose climate forcings and feedback in CMIP-6 models;
- understand past and potential future evolution of the chemical composition of the atmosphere;
- estimate the global-to-regional climate responses to these changes

### ***CCMI simulations being analysed***

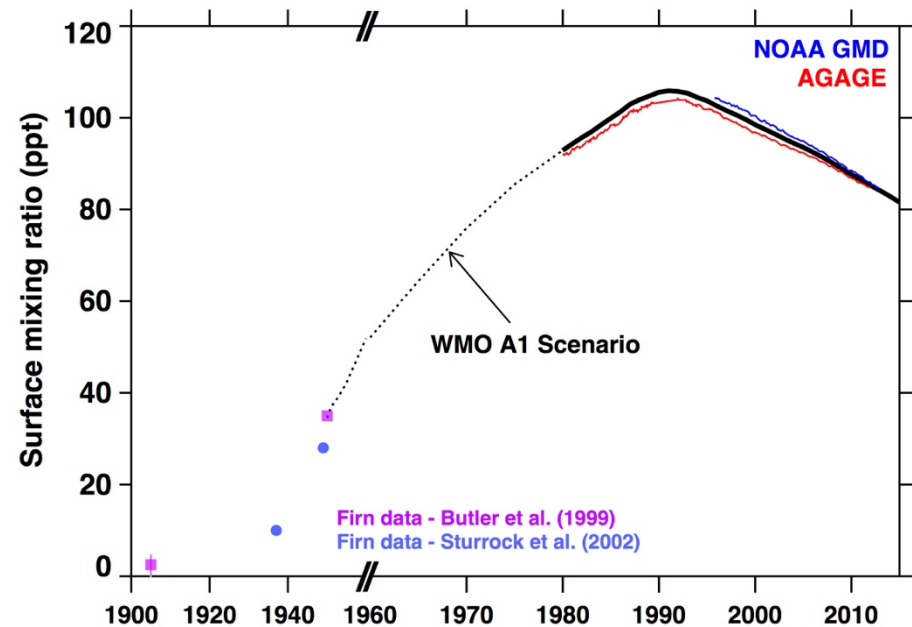
***New focus groups*** on (1) tropospheric OH and ozone budgets, (2) specified dynamics simulations, and (3) ocean-atmosphere coupling in CCMI models.





## Solving the mystery of Carbon Tetrachloride

- SPARC assessment
  - Under review
  - To be presented to Parties of Montreal Protocol in November
  - Prepared jointly by people connected with scientific and technical assessments



*Atmospheric concentration of CCl<sub>4</sub>:  
problem is that it is going down much  
slower than anticipated:*

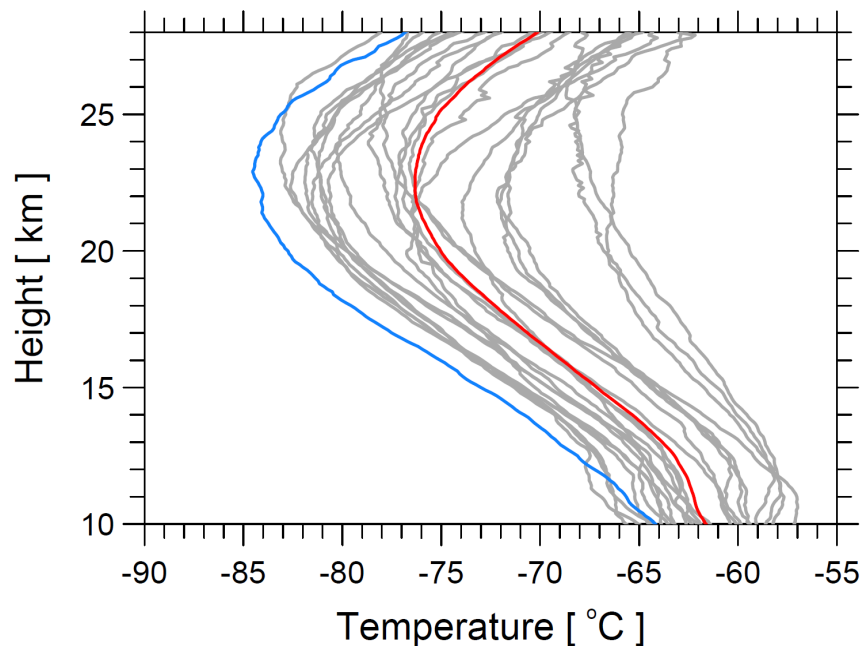
- *Unreported emissions?*
- *Unrecognized loss process?*

# PSCs

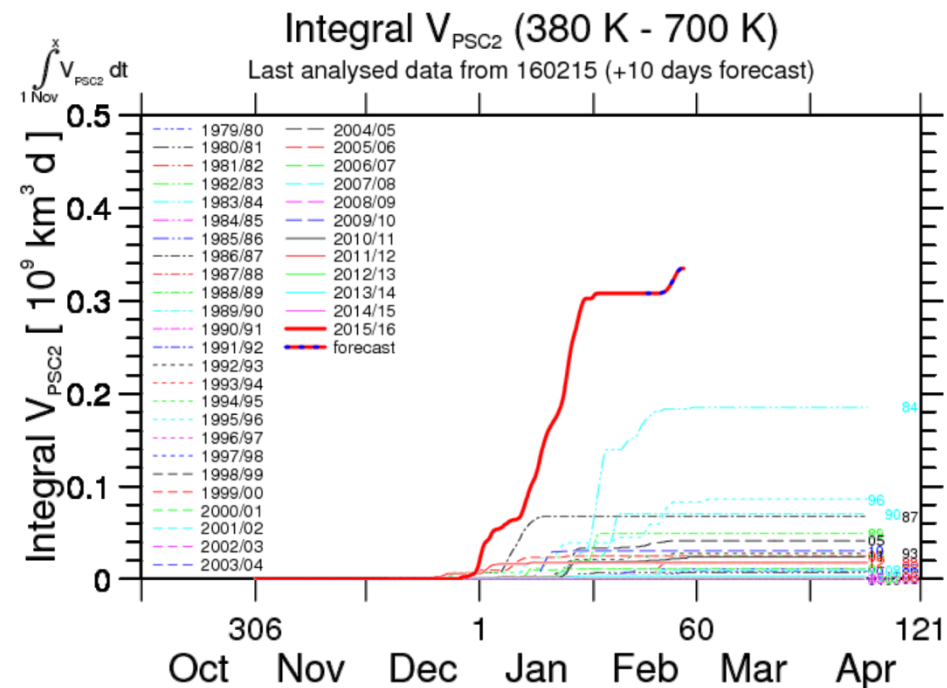
## Polar Stratospheric Clouds

- Series of workshops to
  - (i) assess all available measurements (satellite, balloon and ground)
  - (ii) check model performance

*Gruan radiosonde data from Ny Alesund – coldest Dec-Jan stratosphere on record*



*By far, largest formation of ice PSCs*





# WAVAS II

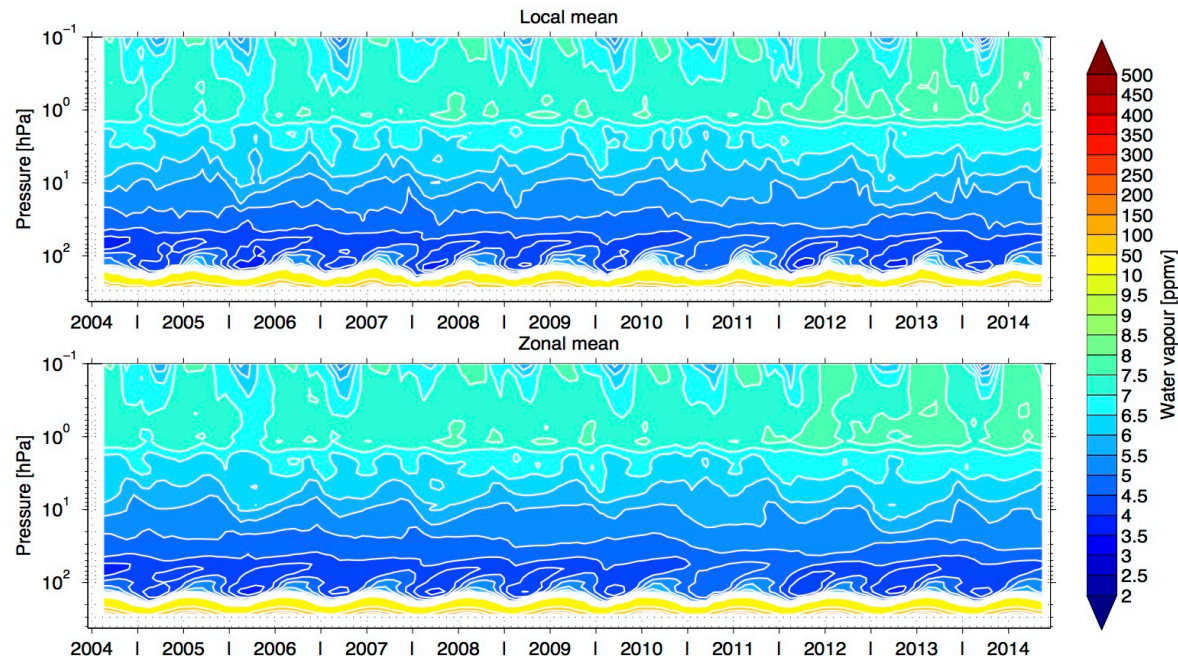
## Water Vapour Phase II

- Papers, papers, papers (ACP/AMT special issue)... and a SPARC report planned
- Mainly measurement characterisation, including upper troposphere humidity

*Top: Time series of MLS near Boulder (~1000 km).*

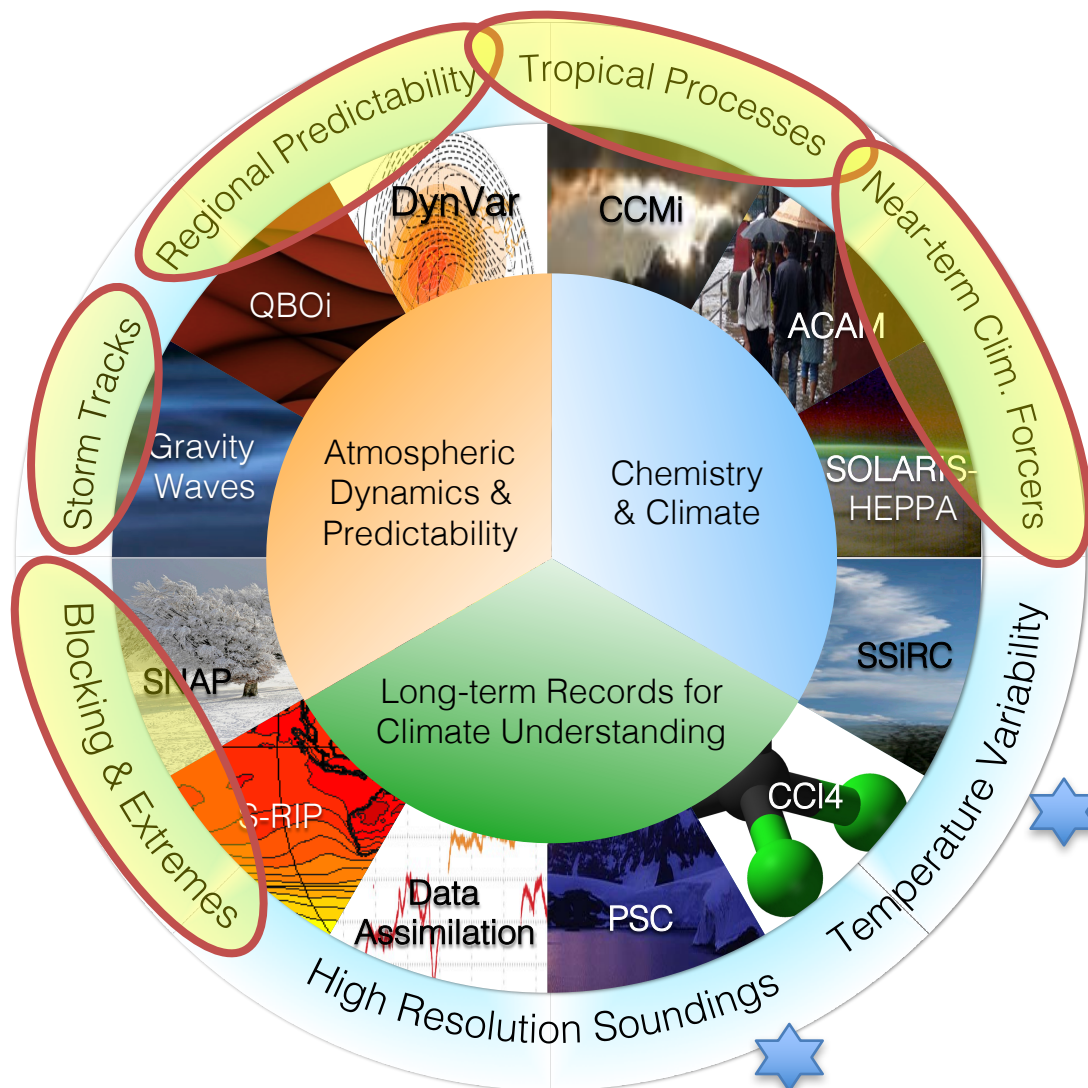
*Bottom: Time series of MLS zonal mean for 30-50N.*

*The values and patterns are similar, showing that Boulder is representative (in some ways).*



# Topics of future interest

# Topics of future interest





# Organisation

Future meetings

Products

Capacity development

SPARC SSG 2016

Office future

# Upcoming workshops

## **Atmospheric Temperature Changes**

**25-26 April, Graz, Austria**

## **Stratospheric Sulfur and its Role in Climate Workshop**

**25-29 April, Potsdam, Germany**

## **Atmospheric Gravity Waves: Sources and effects on weather and climate**

**16-20 May, State College, Pennsylvania, USA**

## **Joint GAW/SPARC workshop on UTLS observations**

**24-27 May, Geneva, Switzerland**



# Upcoming workshops

## **SPARC DynVar + S-RIP Meeting**

**6-10 June, Helsinki, Finland**

## **6<sup>th</sup> International HEPPA-SOLARIS workshop**

**13-17 June, Helsinki, Finland**

## **“The QBO and it’s global influence – past, present, and future”**

**26-30 September, Oxford, UK**

## **Joint SPARC Data Assimilation and S-RIP workshop**

**17-21 October, Paris, France**



## Kyoto October 2018

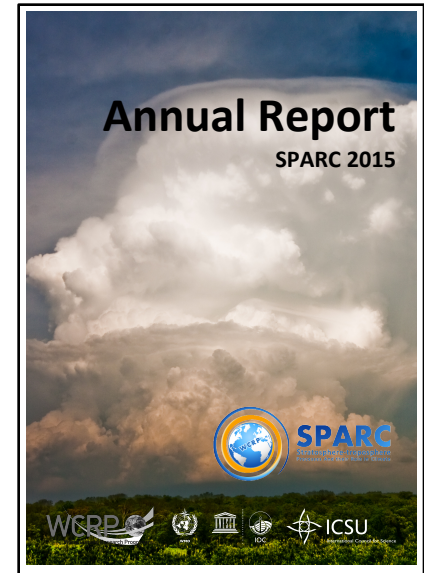
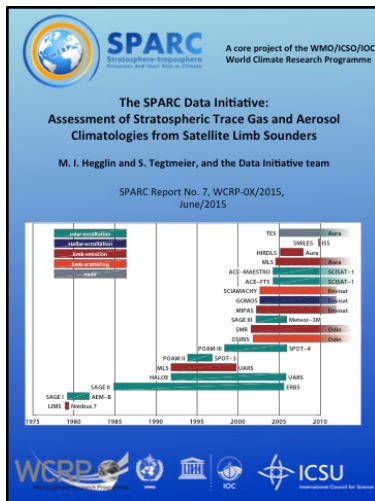


**Back-to-back with the 2018 IGAC Conference**

## Annual Reports

# SPARC Science Reports

- Carbon Tetrachloride
- SPARC Data Initiative
- S-RIP Interim Report



## Journal Special Issues

- Chemistry Climate Modelling Initiative
- Stratospheric Water Vapour
- S-RIP (approved)

• **All Open Access**







## SPARC eNews Bulletin

- Distributed via email every 2 months (~1000 people)
- Includes all recent news for the community



## SPARC Website

- > 1000 users/month
- Portal to SPARC Data Centre
- Community Calendar
- Updated regularly



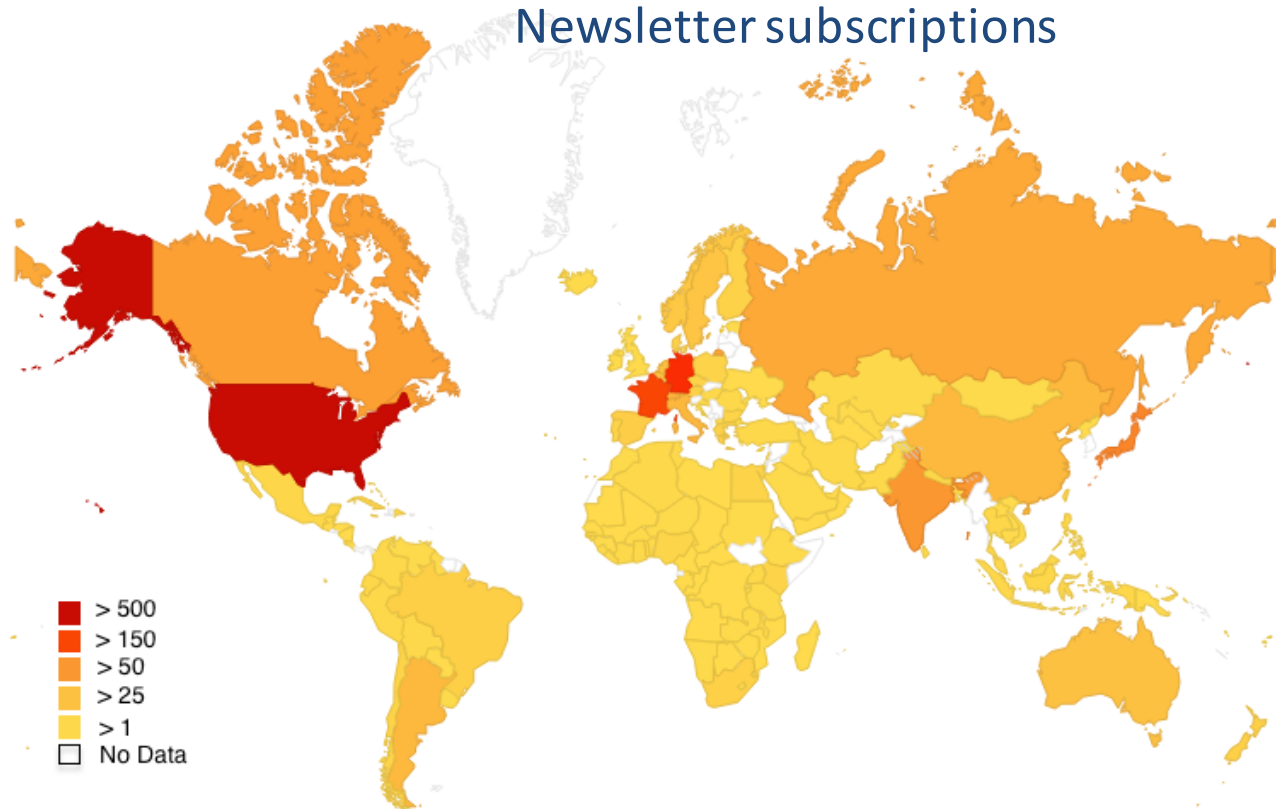




## Biannual Newsletter

- ~2000 hard copies
- ~300 digital

## Newsletter subscriptions





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# Capacity Development

**WCRP**  
World Climate Research Programme



**Regional Working Groups**



**Early Career Researchers**

**Training Schools**






# Capacity Development



- a) ACAM workshop and training school, Bangkok, June 2015
- b) Lunch-time session at the 11<sup>th</sup> International Conference on Southern Hemisphere Meteorology and Oceanography in Santiago, Chile
- c) South-East Asian School on Tropical Atmospheric Science, Bandung, Jan 2016





## Summer School on Atmospheric Composition and Dynamics

**28 November – 3 December, 2016**

**Maïdo Observatory, Réunion Island**

<http://lacy.univ-reunion.fr/formation/summer-school>

## Other training schools

- **Training school on atmospheric dynamics**
  - Proposal submitted to IUGG Grant Programme by Elisa Manzini & Bernd Funke
  - 4 days after the IUGG Conference in Cape Town, South Africa in early September 2017
  - Topics to be covered: Tropospheric dynamics and climate, stratospheric dynamics and chemistry, stratosphere-troposphere interactions.
- **Belmont Forum-funded GOTHAM project (Globally Observed Teleconnections in Hierarchies of Atmospheric Models) training school**
  - Top be held in Potsdam (organised by PIK), likely in summer 2017
  - 2 week intensive programme covering a wide range of topics, such as tropospheric and stratospheric dynamics, Rossby wave resonance, climate modelling, etc.
  - Definitely possibility to link with WCRP projects/Grand Challenges, e.g. extremes, detection and attribution topics, etc.
- **Tropical processes training school**
  - Shigeo Yoden is organising a summer school in August in Vietnam
  - Likely to be 2-3 days of lectures before/after a 2-day workshop
  - Main focus is to be on tropospheric dynamics



# Next SPARC SSG Meeting

**31 October – 4 November in Berlin, Germany**

- Regional workshop (1 day) on cross-cutting issues related to SPARC and the Grand Challenges







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# The future SPARC Office

**WCRP**  
World Climate Research Programme

- Have tried a number of countries in Europe, SE Asia & Oceania.
- No joy so far.
- Not dead (but certainly not thriving) are
- Germany and UK – places willing to host an office, but only if high level support could be found
- Will need to think more laterally if nothing comes up soon

# Model Development Needs

- Development of atmospheric models with tops above the stratopause that can be run in stand-alone mode or coupled to ocean and sea-ice models (DynVar)
- Future high-resolution model development should include a focus on in-line diagnostics for atmospheric momentum budget (in addition to cloud processes) (Gravity Waves/DynVar).
- Training need for scientist users of reanalyses to become more familiar with the modelling aspects (strengths/limitations) of reanalysis systems (S-RIP)
- Lack of technical capability to provide data to the ESGF (SNAP)
- Definition of the minimal requirements needed for radiative and photochemical schemes to adequately represent the solar signal (SOLARIS-HEPPA)
- Model training in WRF/WRF-Chem needed for ACAM participants (Nepal-India-China-Pakistan-SE Asia region)

# Data Needs/Requirements

## Overall

1. Continued improvement in meteorological re-analyses & past records
2. Continuation of existing core measurements – real funding pressure
3. Development of methodologies for robustly assessing uncertainties in long term records

## Specific

- Lack of planned satellite limb observations
- Need for quick response field campaigns after volcanic eruptions
- Access to high resolution radio soundings to expand global record



**Thank you**