

SPARC Report to the Working Group on Numerical Experimentation (WGNE)

John McCormack Space Science Division, Washington DC

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WCRP Organization



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SPARC Tasks Include:

- Research coordination through SPARC activities
- General Assemblies and WCRP
 Conferences
- Newsletters
- Assessment Reports
- http://www.sparc-climate.org/

Most recent SPARC General Assembly was held October 2018 in Kyoto. Location & date of 2024 GA is TBD.

Why is the Stratosphere Important for Extended Range Prediction?

Stratosphere & Mesosphere 10-85 km

Ocean

Large Angular Momentum Reservoir Long Radiative/Dynamical Time Scales Long Memory (weeks to months)

Data assimilation \rightarrow initialization and verification of models wave momentum & Dynamical coupling \rightarrow stratosphere-troposphere teleconnections energy

Reducing errors in the representation of the stratosphere to aid in S2S predictability of the troposphere

Tropo 0-10	osphere km	Short Radiative/Dynamical Time Scales Short Memory (hours to days)		heat
	Larg Long	e Heat Reservoir g Time Scales, <i>Long Memory (months to yea</i>	rs)	7









SPARC Activities Related to WGNE

- **1. DAWG**: Data Assimilation Working Group
- **2. SNAP:** Stratospheric Network for the Assessment of Predictability
- **3. DYNVAR:** Dynamics and Variability of the Stratosphere and Troposphere

4. Gravity Waves

5. S-RIP: SPARC-Reanalysis Intercomparison Project

1. DAWG: Data Assimilation Working Group (co-chairs Q. Errera & J. McCormack)

Recent meeting: Sep 11-12, 2019 at LASP in Boulder CO, USA.

New implementation plan for 2019-2023 includes:

Theme 1: Chemical reanalyses → Evaluation of constituent trends, data harmonization.

Theme 2: Dynamical reanalyses

- → extension of reanalyses to upper stratosphere/lower mesosphere, quantifying uncertainty in reanalyses.
- Theme 3: Support for development of new limb sounder instruments

 \rightarrow Observation sensitivity tests, OSSEs.

http://www.sparc-climate.org/activities/data-assimilation/



Intercomparison of zonal mean zonal wind for 1 Dec 2012 from 3 high-top analysis systems.

2. SNAP (Stratospheric Network for Assessing Predictability)

(co-leads: A. Charlton-Perez, A. Butler)

Daniela Domeisen's presentation on SNAP to WGNE 33: https://polybox.ethz.ch/index.php/s/WZXqZQ9kNKcfp3P

In review: Domeisen et al., **The role of the stratosphere in subseasonal to seasonal prediction**, Parts I & II, JGR-Atmospheres.

Recent book chapter: Butler, A.H., et al. (2019), *Sub-seasonal Predictability and the Stratosphere,* <u>https://doi.org/10.1016/B978-0-12-811714-9.00011-5</u>. (c) ERA-Interim (strong) (d) Multi-model mean (strong)

(b) Multi-model mean (weak)

(a) ERA-Interim (weak)

-2

-1.5

-1

-0.5

Composite 2m temperature anomalies (K) for weeks 3-4 for (top) weak vortex states and (bottom) strong vortex states.

T anomaly (K)

0.5

1.5

http://www.sparc-climate.org/activities/assessing-predictability/

3. DYNVAR: Dynamics and Variability of the Stratosphere and Troposphere

(co-leads: E. Manzini & E. Gerber)

DYNVAR workshop in Madrid 22-25 October 2019: <u>http://www.sparcdynvar.org/dynvar-workshop</u>

Key areas:

(1) DynVarMIP (model intercomparison project) assessment of atmospheric momentum and heat transport in CMIP models associated with subgrid scale boundary layer processes and parameterized gravity wave fluxes.

(2) Stratosphere-troposphere coupling and its role in surface weather predictability, taking advantage of ensemble hindcasts from a number of different forecast systems within the S2S project.



Correlation of 50 hPa, 50°N–80°N zonal wind anomalies with zonal wind anomalies at other pressure levels in CFHP models from Fiig 7 of *Butler et al., QJRMS, 2016*.

http://www.sparc-climate.org/activities/dynamical-variability/ and http://www.sparcdynvar.org/

4. Gravity Waves (co-leads: J. Alexander & K. Sato)

Activity report "New quantitative constraints on orographic gravity wave stress and drag to satisfy emerging needs in seasonal-tosubseasonal and climate prediction". See SPARC newsletter No. 53 and http://www.issibern.ch/teams/consonorogravity/

- → Parallel project on Surface Drag and Momentum Transport sponsored by GEWEX/GASS.
- → A joint workshop on orographic stress and drag from the surface to the middle atmosphere may be planned for late 2020.



Gravity wave temperature anomalies from AIRS high-resolution stratospheric temperature retrievals [Wright et al. ACP, 2017].

5. SPARC Reanalysis Intercomparison Project (S-RIP) *(co-leads: M. Fujiwara, L. Gray, G. Manney)*



Slide courtesy of M. Fujiwara

S-RIP research published in special issue of ACP: <u>https://www.atmos-chem-phys.net/special_issue829.html</u>

Final S-RIP report is under review and should appear soon.

ERA-Interim will officially end on 31 Aug 2019

ERA5 from Jan 1979 - Mar 2019. An "ERA5.1" version is being rerun for the 2000s with a change in the background error statistics that improves anomalies in the upper stratosphere.

A reanalysis session will be held at the AGU Fall Meeting 2019: A109 - Progress in Reanalysis: Development, Evaluation and Application



https://s-rip.ees.hokudai.ac.jp/



Going forward, WGNE/SPARC interactions could focus on:

- Stratospheric DA/reanalyses for initialization & verification
 → sources of middle atmosphere obs. now and in the future?
- Treatment of gravity waves (resolved & parameterized, orographic & non-orographic).