

ACTIVITY REPORT:

SNAP

(Stratospheric Network for the Assessment of Predictability)

Activity leads:

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Chaim Garfinkel, Hebrew University

28th SPARC SSG meeting

Part II: Activity reporting

February 2021

- The SNAP project seeks to better understand the role of the stratosphere in predictability across timescales.
- Upcoming goals include designing experiments for operational centres to perform that isolate the role of the stratosphere on predictive skill; and evaluating biases in the S2S Project reforecasts and their influence on prediction.

- Major achievement has been the production of two significant papers led by Daniela Domeisen outlining the predictability of the stratosphere and stratosphere-troposphere coupling on S2S timescales. Both appeared in the S2S special issue of JGR early in 2020.
- We are also very proud of the impact of SNAP in partly inspiring a greater focus on studying extra-tropical dynamics on the S2S timescale. A significant number (~10) of the papers in a recent special issue of GRL/JGR have a link to SNAP.
- SNAP contributed two newsletters to the February 2020 SPARC newsletter:
Karpechko, A., A.H. Butler, N. Calvo, A. Charlton-Perez, D. Domeisen, E. Gerber, E. Manzini, and A. Ming, Joint DynVarMIP/CMIP6 and SPARC DynVar & SNAP Workshop: Atmospheric circulation in a changing climate, SPARC newsletter, 54, p. 33-39, February 2020.
Domeisen, D.I.V., A.H. Butler, A.J. Charlton-Perez, The role of the stratosphere in sub-seasonal to seasonal prediction, SPARC newsletter, 54, p. 14-18, February 2020.

Stratospheric biases in S2S forecast systems (Lead: Zachary Lawrence)

- We currently have researchers from 11 countries contributing to this analysis (Switzerland, Israel, Spain, United States, Finland, South Korea, United Kingdom, Japan, Australia, Norway, Argentina).
- Core questions we seek to answer include:
 - What are the lead time dependent mean biases in the stratosphere and in stratosphere-troposphere coupling processes, and how do they compare among models? What about biases in variability?
 - Which biases have the greatest impact on predictive skill? How large are the impacts?
 - What are the sources of the biases? Can they be linked to biases in the troposphere, and/or can biases in the troposphere be linked to those in the stratosphere?
 - Are biases linked to stratospheric processes/variability? E.g., are biases larger before or after SSWs, vortex intensifications, phases of the QBO, etc?

Deliverables: We have coordinated the analysis to be completed, and are now in the “initial analysis” phase with plans to finalize the results by late spring 2021, and submit 1-2 publications by late summer 2021.

Coordinated experiment to nudge stratosphere towards the observed evolution in S2S forecast models (Leads: Peter Hitchcock and Tim Stockdale)

- Three test cases: NH SSWs in 2018 and 2019 (very different tropospheric impacts) and the 2019 SH warming (preceded extreme wildfires over Australia in 2019/20).
- The goals of this project are:
 - To assess the contribution of the stratospheric evolution to forecast skill in a controlled fashion.
 - To assess the representation of coupling processes across different operational models.
 - Attribute particular meteorological events to stratospheric conditions
 - To assess the representation of stratospheric wave driving.
- 5 modelling centers have confirmed participation, and another 5 have indicated significant interest. Test experiments at ECMWF have been completed.
- Talks with QBOi and SATIO-TCS are ongoing about forming additional working groups focusing on tropical processes.

Deliverables: Experimental protocol is currently being finalized and we are hoping to publish it in spring 2021, and then have modelling centres complete the experiments by fall 2021 (publications would be completed in mid-2022).

SNAP forms the stratosphere subproject of the WCRP Subseasonal to Seasonal (S2S) Project.

- Daniela Domeisen has served as the S2S Project stratosphere lead, and we have contributed to her reports to the S2S group.
- Amy Butler has served as the US liaison between the U.S. Weather Research Science Working Group (WRSWG)-S2S and the S2S Project stratosphere group, to help inform S2S research priorities in the U.S.
- The damping experiments mentioned on the previous slide are being developed and coordinated with QBOi and SATIO-TCS.

Steps towards the damping experiment:

1. Additional meetings between SNAP and QBOi and SNAP and SATIO-TCS.
2. Finish discussions with S2S centres
3. Finalise protocol and incorporate feedback from partners
4. Develop plan for data archiving/storage
5. Run and analyse experiment

Steps towards the biases papers in S2S models:

1. Many of the participants have already completed their planned analysis, and the deadline for the rest is the end of January.
2. The results are to be finalized in the spring
3. We plan submit 1-2 publications by late summer 2021.

- Session at AGU or the AMS annual meeting in late 2021/early 2022
 - Topic: subseasonal stratosphere-troposphere coupling
 - Foster discussion of preliminary results of the damping experiments
 - The scope could be expanded if other related SPARC groups are interested.
- Consider virtual “side meeting” at QBOi meeting in July 2021 to discuss nudging experiments and joint SNAP/QBOi goals
- In discussion with DynVar about potential joint workshop in 2022 or 2023

Andrew Charlton-Perez has stepped down as a co-lead of SNAP to pursue further leadership within WCRP. We thank Andrew for his leadership! Chaim Garfinkel is now co-lead of SNAP with Amy Butler.

Funds needed to:

- support a data archiving facility for the results of the damping experiments (possibly through CEDDA)
- defray publication costs for our two community projects.
- We would welcome strong endorsement and support from WCRP for the continuation and further development of the S2S project beyond 2023 when current project funding will end.