

Report on the SATIO-TCS side meeting and related discussions at the 6th SPARC General Assembly 2018

Peter Hitchcock¹, Peter H. Haynes², Matthew H. Hitchman³, Tieh-Yong Koh⁴, Takatoshi Sakazaki⁵, and Shigeo Yoden⁵

¹Cornell University, Ithaca, USA (aph28@cornell.edu), ²University of Cambridge, Cambridge, UK (P.H.Haynes@damtp.cam.ac.uk), ³University of Wisconsin-Madison, Madison, USA (matt@aos.wisc.edu), ⁴Singapore University of Social Sciences, Singapore, Singapore (tykoh@suss.edu.sg), ⁵Kyoto University, Kyoto, Japan (zaki@kugi.kyoto-u.ac.jp; yoden@kugi.kyoto-u.ac.jp)

DATE:

4 October 2018

ORGANISERS:

Shigeo Yoden (Kyoto University, Japan), Matt Hitchman (University of Wisconsin-Madison, USA), Peter Haynes (University of Cambridge, UK)

MEETING VENUE:

General Assembly side meeting
at Miyakomesse in Okazaki, Kyoto, Japan

NUMBER OF PARTICIPANTS: 32

SPONSORS:



BACKGROUND:

SATIO-TCS is a SPARC activity focused on enhancing our understanding of the coupling between stratospheric processes and tropospheric convective systems, particularly in the tropics.

WORKSHOP WEBSITE:

<https://www.sparc-climate.org/activities/satio-tcs/>

On Sunday, September 30th, the tropical convective system Typhoon Trami exerted its influence on the SPARC working group Stratospheric and Tropospheric Influences On Tropical Convective Systems (SATIO-TCS). The working group's side meeting, originally scheduled for the Sunday, was held instead during a lunch break of the SPARC General Assembly (see page 8) on Thursday, October 4th. It was attended by 32 participants.

Interest in the downward influence of the stratosphere on tropical convection has grown rapidly since the still-recent discovery of the pronounced influence of the Quasi-Biennial Oscillation (QBO) on the Madden Julian Oscillation (MJO). The broader question of such stratospheric influences in tropical convection has, however, a longer history, spanning a vast range of temporal and spatial scales and involving a diverse array of atmospheric phenomena (Figure 10). Nearly thirty presentations, both oral and poster, were given at the SPARC General Assembly on related topics, including but not limited to the effects of the downward propagating solar tide on the diurnal cycle of convection (**T. Sakazaki**), the impact of the QBO on MJO predictability (**Y. Lim**), and the impacts of the stratospheric sudden warming on tropical cyclone development (**N. Eguchi**).

A central goal of SATIO-TCS is therefore to promote and facilitate research on these interactions and influences. The side meeting thus began with a brief introduction of all related poster presentations.

An initial deliverable for SATIO-TCS is to provide a review of existing research in related areas to provide an up to date reference for researchers to engage with the literature. Two separate review papers are now planned. The first will focus on observational studies of the relationship between the QBO and the tropical troposphere. The second paper will present a broader context, discussing modelling and theoretical studies including influences from polar stratospheric variability. An overview of the first paper was presented by **Matt Hitchman**, who highlighted the 'direct effect' of the QBO on the tropical and subtropical tropopause through the associated meridional circulation (Figure 11).

Stratospheric influence on multi-scale interactions of moist convection in the tropical troposphere

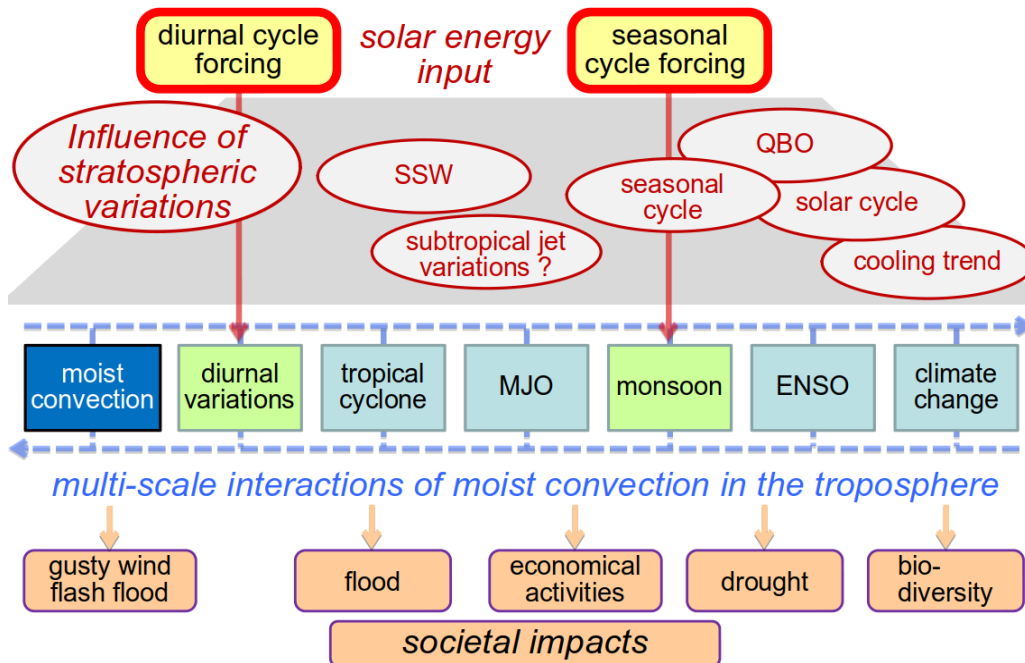


Figure 10: Multi-scale interactions of moist convection in the troposphere and influence of the stratospheric variations on them.

This can be contrasted with more ‘indirect’ pathways through the extratropical stratosphere or troposphere that have also been discussed. When QBO shear is easterly just above the tropopause, anomalous ascent is expected over the equator, closed by descent in the subtropics in either hemisphere. This has a measurable impact on tropopause heights, and is correlated with enhanced convective activity, particularly in DJF over regions of active deep convection. Details of the mechanism(s) by which the convection is modulated remain unclear, but the observed impacts are more consistent with the temperature signal than with the QBO shear itself.

Several other presentations were given highlighting SATIO-TCS related studies. **Lon Hood** discussed how the state of the stratosphere affects teleconnections between the MJO and the extratropical circulation during boreal winter. **Harry**

Hendon discussed the sensitivity of convectively coupled waves to the Quasi-Biennial Oscillation.

The remainder of the lunch break, as well as an additional meeting on Friday among a smaller group of SATIO-TCS core members, was devoted to discussions of next steps.

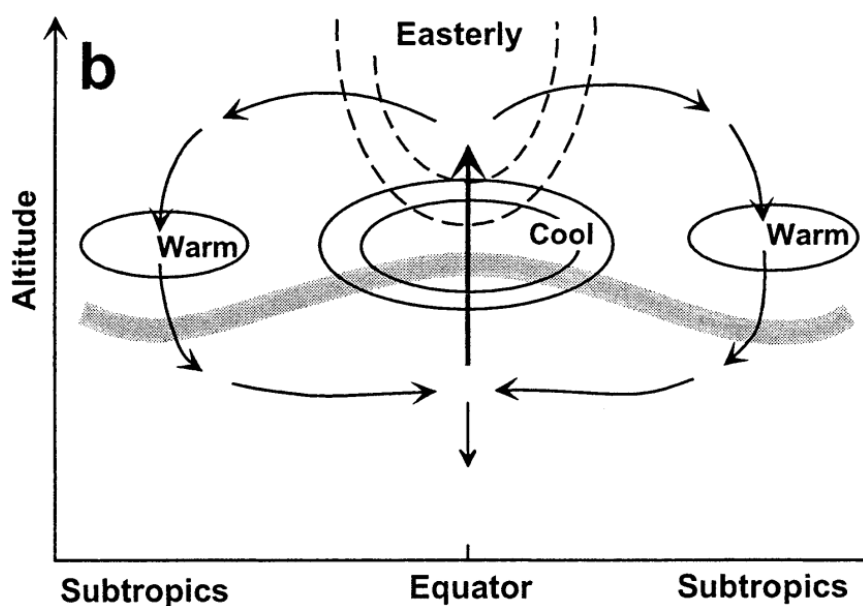


Figure 11: Easterly QBO shear is associated with anomalous ascent over the equator and subtropical descent in either hemisphere, as well as corresponding temperature anomalies. From Collimore et al. (2003).

In addition to the review papers that are under way, a mailing list has been generated from participants and a website is under construction to serve as a point of communication for interested parties. It was decided that current understanding and in particular modelling of the mechanisms driving the top-down influence on convection was not sufficiently advanced to warrant organising a SATIO-TCS-specific modelling effort. It was instead felt that a more effective strategy would be to coordinate efforts with other related modelling activities, both within and outside of SPARC, either through additional analysis of existing output or through the development of specific experimental protocols. Establishing and strengthening links with QBOi, DynVar, S2S and SNAP (which focus on sub-seasonal to seasonal prediction), as well as RCEMIP (which focuses on the intercomparison of efforts to model radiative-convective equilibrium) were seen as particular priorities.

Finally, the opportunity for future presentations of SATIO-TCS-related science was discussed. Although no specific stand-alone meetings are planned for 2019, several upcoming relevant meetings were highlighted, including the January AMS meeting in Phoenix, the April EGU meeting in Vienna, the June AMOS Annual Meeting 2019 and the International Conference on Tropical Meteorology and Oceanography in Darwin, the July 27th IUGG General Assembly in Montreal, and the July-August AOGS 16th Annual Meeting in Singapore.

References:

Collimore, C.C., Martin, D.W., Hitchman, M.H., Huesmann, A., and Waliser, D.E, 2003: On the relationship between the QBO and tropical deep convection. *J. Clim.*, **16**, 2552-2568. doi:10.1175/1520-0442(2003)016<2552:OTRBTQ>2.0.CO;2

URLs:

DynVar	http://www.sparcdynvar.org/
RCEMIP	http://myweb.fsu.edu/awing/rcemip.html
QBOi	http://users.ox.ac.uk/~astr0092/QBOi.html
SNAP	http://www.met.reading.ac.uk/~stratclim/snap/intro.php
S2S	http://www.s2sprediction.net/

AMOS-ICTMO 2019	https://amos2019.org.au/
AMS 99 th Annual Meeting (20 th Conf. on Middle Atmosphere)	https://ams.confex.com/ams/2019Annual/meetingapp.cgi/Program/1303
EGU General Assembly 2019	https://www.egu2019.eu/
27 th IUGG General Assembly	http://iugg2019montreal.com/
AOGS 16 th Annual Meeting	http://www.asiaoceania.org/aogs2019/public.asp?page=home.htm



Figure 12: Thirty two participants attended the SATIO-TCS side meeting.