ACTIVITY REPORT:

QBOi

(Quasi-Biennial Oscillation initiative)

Activity leads:
James Anstey, Environment and Climate Change Canada
Neal Butchart, Met Office Hadley Centre
Scott Osprey, NCAS & University of Oxford

28th SPARC SSG meeting

Part II: Activity reporting

February 2021

Activity overview

Goal: Improve representation and understanding of the quasi-biennial oscillation (QBO) in the tropical stratosphere, and its impacts elsewhere, in climate and forecasting models.

Current projects:

- Phase-2 experiments currently in development. Phase-2 planning to be completed at July 2021 workshop.
- ENSO experiments ("phase 1.5", lead: Yoshio Kawatani)
- QBO review paper updating Baldwin et al. 2001

Progress and achievements

- Analysis of QBOi phase-1 experiments is done
- Phase-1 analysis papers (5 published, 2 in review) in QJRMS Special Section on QBO modelling
- 2 papers on QBOs in CMIP6 models

Collaborations

Gravity Wave activity

- Joint seminar series beginning Feb 2021
- Other potential collaborations:
  - High resolution experiments
  - Improved gravity wave parametrizations

SNAP activity

- QBOi nudging experiments follow SNAP nudging protocol technical details (enable modelling groups to more easily participate in both activities)
- Possible QBO analysis for SNAP nudging experiments

Future plans

- **Create protocol for phase-2 experiments**
  - Scientific goals (phase-1 synthesis report in July 2021 SPARC newsletter article)
  - Experiment definitions
  - Data request
- **Plan analysis of phase-2 experiments**
  - Coordinated papers like in phase-1
- **Analyze and publish results of ENSO experiments**
- **QBO@60 workshop, week of 5-9 July 2021**
  - In-person at Met Office if possible, or virtual

Emerging issues

- Support for next in-person workshop (July 2021 or later)
  - ECS travel support (as for previous workshops)

- Online collaboration
  - Virtual workshop expertise & tools
  - Data hosting: currently at CEDA (UK)

- Engage with WCRP Lighthouse Activities?

Additional slides

References

- J. A. Anstey, N. Butchart, K. Hamilton, S. M. Osprey, 2020: The SPARC Quasi-Biennial Oscillation initiative. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3820
- A. C. Bushell et al., 2020: Evaluation of the Quasi-Biennial Oscillation in global climate models for the SPARC QBO-initiative. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3765.
- J. Richter et al., 2020: Response of the quasi-biennial oscillation to a warming climate in global climate models. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3749.
- T. N. Stockdale et al., 2020: Prediction of the quasi-biennial oscillation with a multi-model ensemble of QBO -resolving models. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3919.
- LA. Holt et al., 2020: An evaluation of tropical waves and wave forcing of the QBO in the QBOi models. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3827.
- J. A. Anstey et al., 2021: Teleconnections of the quasi-biennial oscillation in a multi-model ensemble of QBO-resolving models, under review for Quarterly Journal of the Royal Meteorological Society.
- AK. Smith et al., 2019: The equatorial stratospheric semiannual oscillation and time-mean winds in QBOi models. Quarterly Journal Of The Royal Meteorological Society, doi:10.1002/qj.3690
- J. H. Richter et al., 2020: Progress in Simulating the Quasi-Biennial Oscillation in CMIP Models. Journal Of Geophysical Research: Atmospheres, doi:10.1029/2019jd032362.
- N. Butchart et al., 2020: QBO changes in CMIP6 climate projections. Geophysical Research Letters, doi:10.1029/2019gl086903.
- F. Serva et al., 2021: Tropical stratospheric temperature variability in QBOi models: present-day simulations, under review for Quarterly Journal of the Royal Meteorological Society.

(phase-1 analysis **core papers** indicated by orange bullets)