General circulation of the atmosphere

Paper report

Due date: Fri 8 May 2020

1. Instructions:

Choose a journal paper from the list on the next page that addresses an aspect of the general circulation. Write a summary of the paper and its findings. Pay particular attention to placing the research in a larger context, considering both work that came before and work that has been done since. You will also be required to give a 10-minute oral presentation to explain the paper to the rest of the class.

The report (15%) and presentation (5%) accounts for 20% of the final grade.

2. Report:

While the format of the report (in terms of section headings, etc.) is left up to you, the report should include the following:

- **Background:** Introduce the topic of the paper. Why did the authors perform this study?
- **Methods:** What methods (models/obs., analysis techniques, theories) are used?
- **Results:** What was found?
- **Implications:** Why does it matter?
- **Impact/Further work:** Has there been further work on this topic? Are the conclusions still valid? Summarise the current state of the art in the field.

The report will be marked on the following three criteria:

1) *Content*: how well was the content of the paper explained?
2) *Context*: was the paper placed in its proper context within the literature?
3) *Writing*: was the report clear, well-organised, and succinct?

The report should be no more than 1500 words. **The due date for the report is Friday the 8th of May 2020.**

3. Oral presentation:

In the final week of classes, students will present their paper to the rest of the class in the form of an oral presentation. The aim will be to explain the results and significance of the paper at a level understandable to the rest of the class.

The oral presentation should be no more than 10 minutes in length.

4. List of papers:

Choose from the list below. If you prefer to present an article not on this list that nevertheless deals with the general circulation, talk to the instructor.

1. Barnes, E.; Hartmann, D.; Frierson, D. & Kidston, J. (2010), Effect of latitude on the persistence of eddy-driven jets. *Geophys. Res. Lett.,* **37**, L11804.
2. Bischoff, T. & Schneider, T. (2014), Energetic Constraints on the Position of the Intertropical Convergence Zone, *J. Climate,***27**, 4937-4951.
3. Chadwick, R.; Boutle, I. & Martin, G. (2013), Spatial Patterns of Precipitation Change in CMIP5: Why the Rich Do Not Get Richer in the Tropics, *J. Climate,* **26**, 3803-3822.
4. Ceppi, P. and D. L. Hartmann (2013). On the Speed of the Eddy-Driven Jet and the Width of the Hadley Cell in the Southern Hemisphere, *J. Climate*, **26**, 3450–3465.
5. Ceppi, P. and J. M. Gregory (2017). Relationship of tropospheric stability to climate sensitivity and Earth's observed radiation budget, *Proc. Nat. Acad. Sci. U.S.A.,* **114**, 13126-13131.
6. Chen, G., & Held, I. M. (2007), Phase speed spectra and the recent poleward shift of Southern Hemisphere surface westerlies. *Geophys. Res. Lett.*, **34,** L21805.
7. Held, I. M. & Soden, B. J. (2006), Robust responses of the hydrological cycle to global warming. *J. Climate,* **19**, 5686-5699.
8. Kang, S. M.; Held, I. M.; Frierson, D. M. W. & Zhao, M. (2008), The response of the ITCZ to extratropical thermal forcing: Idealized slab-ocean experiments with a GCM. *J. Climate,* **21**, 3521-3532.
9. Merlis, T. M. (2015), Direct weakening of tropical circulations from masked CO2 radiative forcing, *Proc. Nat. Acad. Sci.*, 112, 13167-13171.
10. Neelin, J. & Held, I. (1987), Modeling tropical convergence based on the moist static energy budget. *Mon. Wea. Rev.,* **115**, 3-12.
11. O'Gorman, P. A. (2010), Understanding the varied response of the extratropical storm tracks to climate change. *Proc. Nat. Acad. Sci.,* **107**, 19176-19180.
12. Plumb, R. A. & Hou, A. Y. (1992), The response of a zonally symmetric atmosphere to subtropical thermal forcing: threshold behaviour, *J. Atmos. Sci.*, 1992, **49**, 1790-1799.
13. Randel, W. J. & Held, I. M. (1991), Phase speed spectra of transient eddy fluxes and critical layer absorption. *J. Atmos. Sci.,* **48**, 688-697
14. Rodwell, M. & Hoskins, B. (1996) Monsoons and the dynamics of deserts, *Q.J.R. Meteorol. Soc.,* **122**, 1385-1404.
15. Seo, K.-H.; Frierson, D. M. & Son, J.-H. (2014), A mechanism for future changes in Hadley circulation strength in CMIP5 climate change simulations, *Geophys. Res. Lett.,* **41**, 5251-5258.
16. Sherwood, S. C.; Kursinski, E. R. & Read, W. G. (2006), A distribution law for free-tropospheric relative humidity, *J. Climate,* **19**, 6267-6277.
17. Thompson, D. & Wallace, J. (2000) Annular modes in the extratropical circulation. Part I: Month-to-month variability. *J. Climate,* **13,** 1000-1016.
18. Voigt, A. & Shaw, T. A. (2015), Circulation response to warming shaped by radiative changes of clouds and water vapour, *Nat. Geosci.,* **8**, 102-106.
19. Vecchi, G. A. & Soden, B. J. (2007), Global warming and the weakening of the tropical circulation, *J. Climate,* **20**, 4316-4340.
20. Walker, C. C. & Schneider, T. (2006) Eddy influences on Hadley circulations: Simulations with an idealized GCM. *J. Atmos. Sci.,* **63**, 3333-3350.