Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

Report on the Drag Project

WGNE - 31
Council for Scientific and Industrial Research
South Africa
26 - 29 April 2016

WCRP World Climate Research Programme

World Meteorological Organization

CSIR our future through science

Ayrton Zadra
RPN/ECCC

Networking

Recent presentations/reports given at

- **SPARC-SSG23** meeting, Nov 2015, NCAR, Boulder, CO, USA
  - invitation to submit abstract to 2016 SPARC Gravity Wave Symposium, 16-20 May 2016, Pennsylvania State University, State College, PA, USA
  - contact to give invited talk at the SPARC DynVar Workshop & S-RIP Meeting on “The Large-Scale Atmospheric Circulation: Confronting Model Biases and Uncovering Mechanisms”, 6-10 June 2016, Finnish Meteorological Institute, Helsinki, Finland
- **GEWEX-SSG28** meeting, Jan 2016, ETH, Zurich, Switzerland

Update on ECMWF workshop

Drag processes and their links to large-scale circulation

ECMWF | Reading | 12-15 September 2016

World Meteorological Organization
Weather • Climate • Water

WCRP World Climate Research Programme

WWRP World Weather Research Programme

The workshop will comprise 25 minute talks from invited speakers across 2 days; and working group and plenary discussions across 1.5 days.

Scientific committee:

Co-chairs: Irina Sandu (ECMWF) and Felix Pithan (University of Reading)
Julio Bacmeister (NCAR)
Andreas Dörnbrack (DLR)
Ted Shepherd (University of Reading)
Gunilla Svensson (MISU)
Ayrton Zadra (Environment Canada)

Update on ECMWF workshop

Workshop description

The representation of drag processes is a major source of uncertainty in General Circulation Models. This ECMWF/WCRP/WWRP workshop, with the support of SPARC/WGNE/GASS, aims to assess the current state of our understanding of drag processes and their impact on the large-scale circulation on timescales ranging from numerical weather prediction to climate. By drag processes we refer here to the terms entering the surface momentum balance, which include the surface stress associated with orographic gravity wave drag (wherever it is deposited). The workshop also aims to review how these processes are represented in global models; discuss and sharpen the research questions to pursue in order to achieve substantial advances in this area; foster collaborations and stimulate further research addressing these questions.

Update on ECMWF workshop

The workshop will be centred around the following ***themes****:*

- *Underlying* ***processes*** *and their representation in models*
- *Impact of* ***uncertainty*** *associated with drag in NWP and climate models*
- *Representation of* ***drag across scales****: What are the implications of increasing resolution?*
- *Constraining drag processes through* ***observations and fine-scale modelling***
- *Interpretation of* ***tendencies/increments from NWP analysis*** *and reanalysis*

Update on ECMWF workshop

Invited speakers will include:

Norm McFarlane (University of Victoria)
Ayrton Zadra (Environment Canada)
Simon Vosper (Met Office)
Frederic Hourdin (LMD)
Ad Stoffelen (KNMI)
Jenny Lindvall (MISU)
Peter Lauritzen (NCAR)
Felix Pithan (U. Reading)
John Scinocca (CCCma)
Francois Lott (LMD)
Ulrich Achatz (Frankfurt University)
Francois Bouyssel (Meteo-France)
Isla Simpson (NCAR)
Mark Rodwell (ECMWF)

Partly funded by

- WCRP
- WWRP
- SPARC
- GEWEX
- ECMWF
- NCAR

Science committee currently preparing a list of scientific questions to be addressed during the workshop.

Associated publications

Journal of Advances in Modeling Earth Systems

RESEARCH ARTICLE
10.1002/2015MS000564

Key Points:
- Parameterized orographic drag affects the Northern Hemisphere winter circulation at all time scales
- The partition of the surface stress between various parameterizations affects circulation aspects

Impacts of parameterized orographic drag on the Northern Hemisphere winter circulation

Irina Sandu[1], Peter Bechtold[1], Anton Beljaars[1], Alessio Bozzo[1], Felix Pithan[2], Theodore G. Shepherd[2], and Ayrton Zadra[3]

[1]European Centre for Medium-Range Weather Forecasts, Reading, UK, [2]University of Reading, Reading, UK, [3]Environment Canada, Dorval, Quebec, Canada

- study inspired by preliminary results from the WGNE Drag Project
- sensitivity tests using the IFS model with
  - enhanced turbulent drag
  - enhanced orographic blocking

  within the uncertainty range suggested by the Drag Project results
- impact measured in middle-range (10-day) forecasts and seasonal integrations
- partitioning of stress is shown to be important at all timescales

Associated publications

From Sandu et al. 2015:
sensitivity results in the middle-range forecasts (up to day 10)

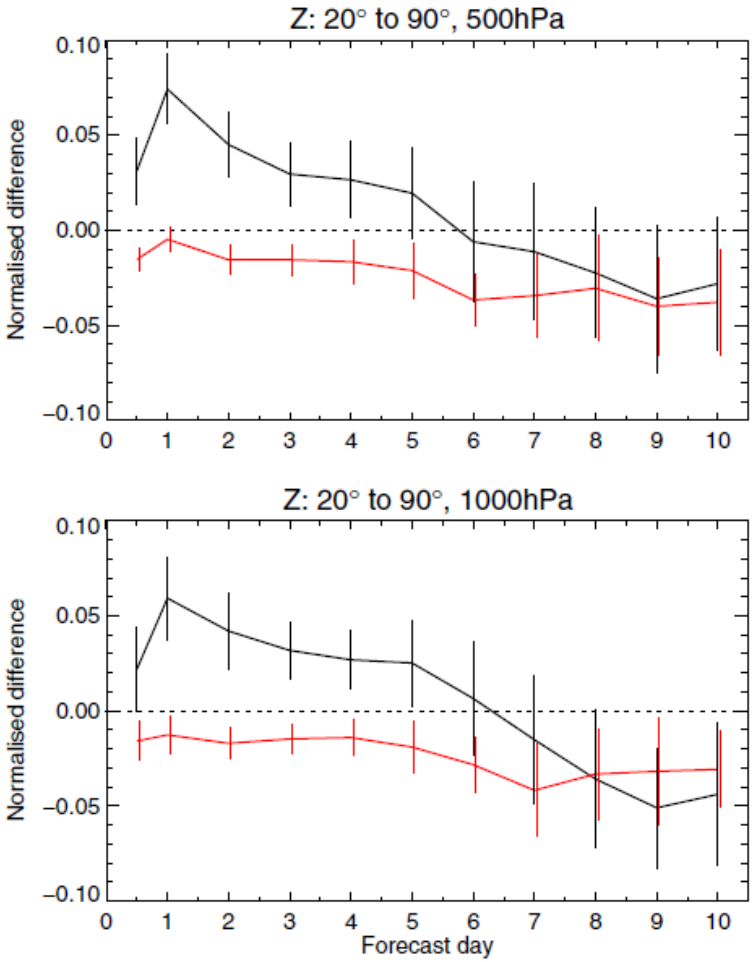

Figure 9. Relative difference of root mean square error (RMSE) of 500 and 1000 hPa geopotential height, between the H-TOFD (black), respectively, H-BLOCK (red), and the CTL forecasts, as a function of lead time. When error bars do not cross the zero line, the performance of the respective experiment is significantly worse/better (95% interval) than the CTL. For both the experiments and the CTL forecasts the RMSE was computed with respect to the analysis from which the forecasts started. A positive difference in RMSE indicates a deterioration of the model performance in the experiment with respect to the CTL.

Associated publications

From Sandu et al. 2015: sensitivity results in the seasonal integrations

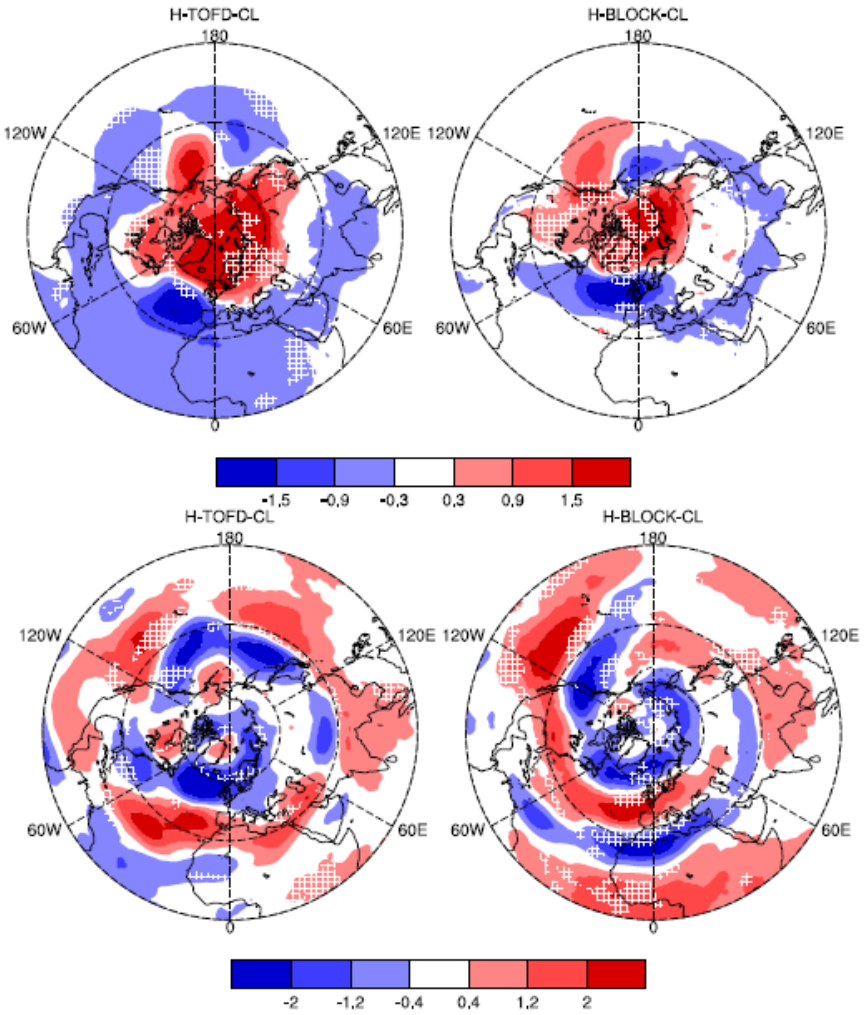

Fig 10: Mean change in surface pressure (hPa) (top row) and zonal wind at 200 hPa (m/s) (bottom row) in H-TOFD-CL and H-BLOCK-CL with respect to CTL-CL experiment over the 30 DJF seasons (1984-2014).

Associated publications

From Sandu et al. 2015: main conclusions

- *increase in surface stress has a significant impact on the NH winter circulation, both in 10-day forecasts and longer integrations, regardless of which scheme is modified*
- *for 10-day forecasts: increases in stress due to changes in the PBL or blocking scheme have opposite impacts in terms of medium-range forecast skill*
- *in seasonal integrations: while an increase in the PBL stress mainly affects the lower troposphere and midlatitude stratosphere, the enhanced blocking has a significant impact on the polar vortex*
- *different impacts could be related to inherent differences between the formulations of the two schemes – i.e. stability versus non stability dependence, diurnal cycle, horizontal scales on which they act*

Other news and items

- Concept paper for BAMS: in preparation
- Session on momentum budget at Systematic Error workshop?
- Momentum transfer modelling and verification for YOPP?
- Other suggestions?