

The Role of Atmospheric Dynamics for Climate and Extremes

A Joint DynVar · SNAP Meeting

Organized by the Meteorological Institute at Ludwig-Maximilians-University Munich

9-13 October 2023 · Munich

Workshop Program

We thank our organizational sponsors for making this workshop possible.



Monday, 9 October 2023

8.00-8.45 Registration

8.45-9.00 Welcome

Session 1: Arctic and mid-latitude linkages, Chair: Gabriel Chiodo

9.00-9.45: **Paul Kushner (keynote)**, Perspectives on SPARC DynVar

9.45-10.00: **Michael Sigmond**, Key role of the basic state in the atmospheric circulation response to future sea ice loss

10.00-10.15: **Dörthe Handorf**, The role of the Scandinavian blocking for pathways of Arctic-midlatitude linkages

10.15-10.30: **Joonsuk Kang**, Arctic Sea Ice Loss Weakens Northern Hemisphere Summertime Storminess but Not Until the Late 21st Century

10:30-10.55: coffee break

Session 1: Arctic and mid-latitude linkages (cont'd), Chair: Gabriel Chiodo

10.55-11.10: **Xiaocen Shen**, Quantifying the causal effect of Barents-Kara Sea sea ice loss on stratospheric polar vortex variability in large ensembles

11.10-11.25: **Regan Mudhar**, Understanding the Stratospheric Response to Arctic Amplification

Session 2: Circulation and climate change, Chair: Clara Orbe

11.25-11.45: **Tim Woollings (invited)**, Revisiting observed jet stream trends and the link to tropical warming

11.45-12.00: **Orli Lachmy**, The midlatitude circulation response to climate change and the role of midlatitude diabatic heating

12.00-12.15: **Or Hadas**, The Lagrangian response of storms to changes in atmospheric forcing

12.15-12.30: **Gang Chen**, Response of Northern Hemisphere Winter Circulation Waviness to Climate Change in Large Ensemble Simulations

12.30-14.00: Lunch break (DynVar lunch)

Breakout 1

14.00-14.15: **Doug Smith (virtual)**, Attribution of multi-annual to decadal changes in the climate system: The Large Ensemble Single Forcing Model Intercomparison Project (LESFMIP)

14.15-15.00: Breakout group on "A new SPARC limited-term cross-activity focused project (LTCF) on analysis of LESFMIP"

15.00-15.25: coffee break

Session 2: Circulation and climate change (cont'd), Chair: Zachary Lawrence

15.25-15.40: **Tiffany Shaw**, Fast jet stream winds get faster under climate change

15.40-15.55: **Molly Menzel (presented by Darryn Waugh)**, Connections between Upper Tropospheric and Lower Stratospheric Circulation Responses to Increased CO₂

15.55-16.10: **Rei Chemke**, Human-induced weakening of the Northern Hemisphere tropical circulation

- 16.10-16.25: **Simchan Yook**, The role of moist lapse rate on the temperature variability in the tropical atmosphere
- 16.25-16.40: **Gwendal Riviere**, Trends in troposphere-stratosphere interactions using ERA5 reanalysis
- 16.40-16.55: **Benny Keller**, Unraveling the large scale forcing of projected drying in the Mediterranean region
- 16.55-17.10: **Marlene Kretschmer**, Subseasonal and Seasonal drivers of European winter Weather
- 17.10-17.25: **Kevin Grise**, Atmospheric circulation constraints on 21st century seasonal precipitation storylines for the southwestern United States

17.25-...: Poster session A and Ice Breaker

Tuesday, 10 October 2023

8.45-9.00 Announcements

Session 3: Climate models and biases, Chair: Ewa Bednarz

9.00-9.20: **Christiane Jablonowski** (invited), Tropical Stratosphere-Troposphere Interactions in Selected CMIP6 Models

9.20-9.35: **Ghyslaine Boschat**, Evaluation of the seasonal evolution of the Antarctic stratospheric vortex in CMIP6 models

9.35-9.50: **Petr Šácha**, Unraveling climate impacts of atmospheric internal gravity waves

9.50-10.05: **Felix Plöger**, Stratospheric water vapor affecting atmospheric circulation

10.05-10.30: coffee break

Session 3: Climate models and biases (cont'd), Chair: Ewa Bednarz

10.30-10.45: **Yuan-Bing Zhao**, Atmospheric bias responses to regional systematic SST errors: background-SST dependence and geographical dependence

10.45-11.00: **Xinhuiyu Liu**, Implications of warm pool bias in CMIP6 models on the Northern Hemisphere wintertime subtropical jet and precipitation

11.00-11.15: **Albert Ossó**, Models underestimate the North Atlantic jet persistence

11.15-11.30: **Simon Lee**, Why is the Pacific center-of-action of the Northern Annular Mode larger in models than observations?

11.30-13.00: Lunch break (LESFMIP single forcing lunch meeting)

Session 4: Extratropical Dynamics, Chair: Rei Chemke

13.00-13.15: **Hisashi Nakamura**, Cyclonic and anticyclonic contributions to the midwinter minimum of the North Pacific storm-track activity

13.15-13.30: **Alice Portal**, Atmospheric circulation anomalies resulting from cold East-Asian orography in climate models

13.30-13.45: **Gabriele Messori**, Stratospheric wave reflection modulates North American wintertime temperatures

Panel Presentations

- 13.45-13.50: Brief overview of SPARC Activity Collaborations - Seok-Woo Son
- 13.50-14.05: **Jonathon Wright**, Expanding Stratosphere Troposphere Coupling Evaluations in the SPARC-Reanalysis Intercomparison Project Phase 2 (S-RIP2): Planned S-RIP Phase 1 Updates
- 14.05-14.45: Panel Discussion on “Interaction of DynVar and SNAP with other SPARC/WMO activities”. Short presentations by: WWRP SAGE - Steve Woolnough; WCRP WGSIP - Yuhei Takaya; HTHH activity - Paul Newman; CCMi activity - Gabriel Chiodo; QBOi activity - Neil Butchart; Gravity Waves - Laura Holt
- 14.45-16.05: **Poster session A and coffee break**

Session 4: Extratropical Dynamics (cont'd), Chair: Zachary Lawrence

- 16.05-16.20: **Pedram Hassanzadeh**, The Intrinsic 150-Day Periodicity of the Southern Hemisphere Extratropical Large-Scale Atmospheric Circulation
- 16.20-16.35: **Morio Nakayama**, Impacts of a Midlatitude Oceanic Frontal Zone on the Southern Baroclinic Annular Mode
- 16.35-16.50: **Ian White**, On the Role of Midlatitude Diabatic Heating in the Extratropical Circulation

Session 5: Tropical processes, Chair: Mohamadou Diallo

- 16.50-17.10: **Dillon Elsbury** (invited), Zonal asymmetries in the QBO's wintertime extratropical teleconnections and their representation in climate models
- 17.10-17.25: **Mario Rodrigo**, Is there an impact of the QBO on ENSO? A first approach from EC-EARTH
- 17.25-17.40: **Kohei Yoshida**, Large ensembles unveil quantitative impact of El Niño-Southern Oscillation and Quasi-Biennial Oscillation on Northern Hemisphere stratosphere-troposphere coupling
- 17.40-17.55: **Aleena Moolakkunnel Jaison**, On alleviating semi-annual oscillation wind biases in climate models

19.30: **Conference Dinner at the Augustiner-Keller Restaurant, downtown Munich**

Wednesday, 11 October 2023

8.45-9.00 Announcements

Session 6: Stratospheric circulation changes and interactions with chemistry, Chair: Felix Ploeger

- 9.00-9.20: **Marta Abalos** (invited), Trends in the Brewer-Dobson circulation: an overview
- 9.20-9.35: **Mohamadou Diallo**, New insights of the Brewer-Dobson circulation changes from the ERA5 reanalysis and CCM12
- 9.35-9.50: **Samuel Benito-Barca**, Role of polar vortex and Brewer-Dobson Circulation projections uncertainties on the spread of ozone recovery
- 9.50-10.10: **Marina Friedel** (invited), Springtime surface anomalies forced by Arctic ozone
- 10.10-10.25: **Eun-Pa Lim** (virtual), The impact of ozone forcing on the 2020 super vortex

over Antarctica and associated positive SAM

10.25-10.40: **Gabriel Chiodo**, The influence of springtime Arctic ozone recovery on stratospheric and surface climate

10.40-11.50: **Poster session B and coffee break**

Session 6: Stratospheric circulation changes and interactions with chemistry (cont'd),

Chair: Felix Ploeger

11.50-12.05: **Ewa Bednarz**, Impact of the latitude of stratospheric aerosol injection on the stratosphere-troposphere coupling

12.05-12.20: **Frederik Harzer**: On the pattern of interannual polar vortex-ozone co-variability during northern hemispheric winter

Session 7: North Atlantic Decadal Variability, Chair: Ian White

12.20-12.40: **Noel Keenlyside** (invited; presented by **Nour-Eddine Omrani**), Internal climate dynamics as a key source of recent Atlantic climate decadal variability

12.40-12.55: **Clara Orbe**, Coupled Stratospheric Ozone and Atlantic Meridional Overturning Circulation Feedbacks on the Northern Hemisphere Midlatitude Jet Response to 4xCO₂

12.55-13.10: **Liping Wang**, How the Tibetan Plateau impacts stratosphere-troposphere coupling over the North Atlantic on decadal timescales

13.10-....: **Lunch to-go and Optional Social Activity**

Thursday, 12 October 2023

8.45-9.00 Announcements

Session 8: Stratosphere-troposphere coupling and biases in S2S models, Chair: Xiuyuan Ding

9.00-9.20: **Peter Hitchcock** (invited), Mechanisms of stratospheric influence on surface weather: insights from SNAPSI Working Group 3

9.20-9.35: **Seok-Woo Son**, Downward coupling mechanism of Sudden Stratospheric Warming: A Mass Flux Perspective

9.35-9.50: **Jonas Spaeth**, Tropospheric planetary waves before, during and after sudden stratospheric warmings as represented in extended-range ensemble forecasts

9.50-10.10: **Zachary Lawrence** (invited), Stratosphere and stratosphere-troposphere coupling biases in subseasonal-to-seasonal forecast models: An international SNAP community effort

10.10-10.15: **Waves to Weather Presentation**

10.15-10.40: coffee break

Session 9: S2S predictability of extremes, Chair: Hilla Afargan-Gerstman

10.40-11.00: **William Seviour** (invited), Attributing the role of sudden stratospheric warming events in surface weather extremes

11.00-11.15: **Jinlong Huang** (virtual), Stratospheric Influence on the Development of the 2018 Late Winter European Cold Air Outbreak

11.15-11.30: **Irina Statnaia**, Factors influencing subseasonal predictability of Northern Eurasian cold spells

Breakout 2

11.30-12.30: Breakout group discussion on “Bridging prediction and projections: Future collaborations and directions of DynVar and SNAP”

12.30-14.00: Lunch break (SNAPSI working group lunch)

Session 9: S2S predictability of extremes (cont'd), Chair: Hilla Afargan-Gerstman

14.00-14.15: **Xiuyuan Ding**, Stratospheric Wave Precursor of Cold Events over North America

14.15-14.30: **Christopher Polster**, A new atmospheric background state to diagnose local wave guidability

14.30-14.45: **Andrea Lopez Lang**, A multiscale perspective of the dynamics of North American winter extremes

14.45-15.00: **Vikki Thompson**, Large Scale Dynamics of the Western European flooding of July 2021

15.00-15.15: **Justin Finkel**, Revealing the Statistics of Extreme Events Hidden in Short Weather Forecast Data

15.15-16.55: **Poster session B and coffee break**

Session 10: Stratosphere-troposphere coupling and surface predictability, Chair: Irina Statnaia

16.55-17.15: **Hera Kim** (invited), Quantification of the stratospheric contribution to surface predictability

17.15-17.30: **Robert Lee**, Fitting a minimal model to investigate S2S hindcast predictability associated with stratosphere-troposphere coupling

17.30-17.45: **Verónica Martínez-Andradas**, Precursors of the North Atlantic jet response to sudden stratospheric warmings

17.45-18.00: **Hilla Afargan-Gerstman**, The role of the stratosphere in predictability of the storm track in the North Atlantic and Europe

Friday, 13 October 2023

8.45-9.00 Announcements

Session 11: Upward wave coupling and predictability of stratospheric events, Chair: Dillon Elsbury

9.00-9.20: **Blanca Ayarzagüena** (invited), Quantifying the role of the stratosphere in upward wave propagation during stratospheric polar vortex disturbances: A SNAPSI analysis

9.20-9.35: **Chris Kent**, An Atlantic tipping point for a sudden stratospheric warming

9.35-9.50: **Rachel Wu**, Bimodality in the Predictability of Sudden Stratospheric Warming Events: A Case Study of the 2009 and 2018 Events

- 9.50-10.05: **Hyeong-Oh Cho**, The predictability of 2021 SSW event controlled by the zonal-mean state in S2S prediction models
- 10.05-10.20: **Wolfgang Wicker** (virtual), Extended stratospheric predictability during sudden stratospheric warmings due to resolved and parameterized gravity wave processes
- 10.20-10.45: coffee break

Session 11: Upward wave coupling and predictability of stratospheric events (cont'd),

Chair: Dillon Elsbury

- 10.45-11.00: **Zheng Wu**, Seasonal Prediction of Stratospheric Polar Vortex Strength Using an Explainable Artificial Intelligence Framework
- 11.00-11.20: **Hamid Pahlavan** (invited), Evolution and Wave Forcing of the QBO in the Subseasonal Forecast Models

Session 12: Weather regimes, Chair: Philip Rupp

- 11.20-11.35: **Sohan Suresan** (presented by **Nili Harnik**), Computing and analyzing persistent merged jet state in climate model using rare event algorithm
- 11.35-11.50: **Nili Harnik**, The relationship between cyclones, anticyclones, and Rossby Wave Breakings in different Atlantic weather regimes
- 11.50-12.05: **Seraphine Hauser**, Tropospheric pathways to Greenland Blocking in ERA5 from a weather regime perspective and the role of moist processes
- 12.05-12.20: **Hera Guðlaugsdóttir** (virtual), The climate response after high latitude volcanic eruptions: Implications for NA weather regimes and extreme events
- 12.20-13.50: Lunch break (SNAP lunch. Discussion on future projects in SNAP, with presentations by WCRP ESMO- Bill Merryfield; WWRP SAGE- Steve Woolnough).

Breakout Wrap-ups, Chair: Tiffany Shaw

13.50-14.45: Breakout group wrap-ups and community paper planning

14.45-15.00: Final remarks

Poster Presentations: Posters are assigned to either Poster Session A (with sessions on Monday and Tuesday) or Poster Session B (with sessions on Wednesday and Thursday). Please plan to present your poster during one of your assigned poster days.

Poster Session A:

- A1. Leo Saffin:** Eddy Feedbacks in CMIP6 Models
- A2. Eswyn Chen:** Resolution dependence of surface forcing within North Atlantic extratropical cyclones and possible role for the signal-to-noise paradox
- A3. Robert Jnglin Wills:** Resolving weather fronts increases the large-scale circulation response to Gulf Stream SST anomalies
- A4. Priyanka Ghosh:** Momentum Flux and Vertical Wind Power Spectral Characteristics in

the Troposphere and Lower Stratosphere Over Andøya, Norway as Observed by MAARSY

- A5. Hagar Bartana:** Projected Future Changes in Equatorial Wave Spectrum in CMIP6
- A6. Y. Qiang Sun (presented by Pedram Hassanzadeh):** Sub-filter Scale Waves or Sub-grid Scale Waves? Quantifying 3D Gravity Wave Forcing in Convection-Permitting Simulations for Data-Driven Parameterizations
- A7. Hamid A. Pahlavan:** Offline & Online Training GW Parameterization: A 1D-QBO model testbed
- A8. Shingo Watanabe:** Does better tropospheric circulation bring better QBO?
- A9. Koffi Ayassou:** Evolution of Ozone above Togo during the 1979-2020 Period
- A10. Alison Ming:** Ozone-QBO interactions: a perspective using idealized calculations
- A11. Siming Liu:** Factors Controlling the Probability Distribution of Winter Stratospheric Zonal Winds
- A12. Bhupendra Bahadur Singh:** Upper tropospheric moistening during the Asian summer monsoon in a changing climate
- A13. Alexey Karpechko** Northern Hemisphere Stratosphere-Troposphere Circulation Change in CMIP6 Models
- A14. Natalia Calvo:** On the bias of the stratospheric polar vortex strength during boreal winter in CMIP6 models.
- A15. Darryn Waugh:** Nonlinearity of Atmospheric Circulation response to increased CO₂
- A16. Gabriel Chiodo:** Exploring the Impact of Climate Change on Stratospheric Ozone in Idealized DECK Experiments from CMIP6 / IPCC-AR6 Models
- A17. Chaim Garfinkel:** Stationary Waves Weaken and Delay the Near-Surface Response to Stratospheric Ozone Depletion
- A18. Chaim Garfinkel:** Impact of parameterized convection on the storm track and jet stream response to global warming: implications for mechanisms of the future poleward shift
- A19. Chaim Garfinkel:** Revisiting the utility of the Matsuno index of refraction for wave propagation into, and reflection from, the stratosphere
- A20. Or Hess:** Anthropogenic forcings reverse a multi-century naturally-forced Hadley cell intensification
- A21. Erez Aviv:** Climate Change Effect on the Eddy-Driven Jet Meandering and the Connection to Extreme Events
- A22. Juho Koskentausta:** The impact of Arctic sea ice loss on Eurasian winter climate simulated by ECHAM6
- A23. Ralf Jaiser:** The Impact of Sea Ice Concentration and Sea Surface Temperature Boundary Forcing in different Experimental Setups with ECHAM6 on the Polar Stratosphere
- A24. Yvonne Anderson:** The effect of Arctic sea ice loss on North Atlantic jet stream morphology and variability
- A25. Jiankai Zhang:** Important role of stratosphere-troposphere coupling in the Arctic mid-to-upper tropospheric warming in response to sea-ice loss
- A26. Deepashree Dutta:** Low orography and high methane drive Arctic amplification
- A27. Satoru Okajima:** Distinct roles of cyclones and anticyclones in setting the midwinter minimum of the North Pacific eddy activity: a Lagrangian perspective
- A28. Dor Sandler:** Localized Finite Amplitude Wave Activity as a Diagnostic for Mediterranean Cyclones and their Large Scale Drivers

- A29. Chiem van Straaten:** Drivers of Mediterranean winter drought
- A30. Nour-Eddine Omrani:** Coupled stratosphere-troposphere-Atlantic multidecadal oscillation and its importance for near-future climate projection
- A31. Zoe Gillett:** Linking ENSO to Synoptic Weather Systems in Eastern Australia
- A32. Jakob Schloer:** Characterizing Nonlinearities in ENSO Dynamics using Hybrid Machine Learning Models
- A33. Luke Davis:** Relationship between cloud feedbacks and the large-scale circulation across CMIP5 and CMIP6
- A34. Gloria Manney (presented by Zachary Lawrence):** Relationships between stratospheric polar vortex, upper tropospheric jet, and tropopause variability (and cold air outbreaks)

Poster Session B:

- B1. Mark P. Baldwin:** Surface Amplification of Stratosphere-Troposphere Coupling
- B2. Daniela I.V. Domeisen:** The role of zonally propagating waves for stratosphere-troposphere coupling: Mechanisms and model biases
- B3. Hyeong-Oh Cho:** Possible Impact of the 2019 Southern Hemisphere Stratospheric Sudden Warming on Tropical Cyclone activities over the western North Pacific
- B4. Dong-Chan Hong:** Downward coupling of 2018 Sudden Stratospheric Warmings in SNAPSI nudging experiments
- B5. Xiaocen Shen:** The Dominant Intraseasonal Coupling Mode between the Stratosphere and Troposphere: Stratosphere-Troposphere Oscillation
- B6. Raphael Köhler:** How do different pathways connect the stratospheric polar vortex to its tropospheric precursors?
- B7. Zachary Lawrence:** Process-oriented diagnostics of dynamical coupling between the troposphere and stratosphere in Earth System Models
- B8. Sheena Loeffel:** Which sudden stratospheric warming events are more likely to produce a tropospheric response?
- B9. Kamilya Yessimbet:** Observational perspective on SSWs and blocking from E-P fluxes
- B10. Shunsuke Noguchi:** Ocean Circulation Responses in a Stratospheric Nudging Experiment by an Earth System Model: A Case Study for the Abnormal 2019-2020 Season
- B11. Ryan Williams:** Attributing the role of the strong stratospheric polar vortex on serial extratropical cyclone clustering in the North Atlantic in February 2022
- B12. Natalia Calvo:** On the anomalous wave forcing preceding SSWs during ENSO events
- B13. Jacopo Riboldi:** How are the shape and the propagation of Rossby waves changing during SSW and SPV events?
- B14. Kathrin Finke:** The stratospheric polar vortex and surface effects: The case of the North American 2018/19 cold winter
- B15. Weronika Osmolska:** Large-scale Dynamical Controls on Cold Air Outbreaks
- B16. Philip Rupp:** Coupled planetary wave dynamics in the polar stratosphere and their contribution to polar vortex variability
- B17. Alexey Karpechko:** The tropical influence on sub-seasonal predictability of wintertime stratosphere and stratosphere-troposphere coupling
- B18. Ming Bao:** Influence of Preconditioned Stratospheric State on the Surface Response to Displacement and Split Sudden Stratospheric Warmings

- B19. Toshihiko Hirooka:** Downward propagation of wave packets from the stratosphere and their influences on cold spells during the Northern Hemisphere winter
- B20. Andrew Charlton-Perez:** Impact of SSW events on human mortality
- B21. Amy Butler:** A vertically coherent perspective of sinuosity and its ties to climate extremes on S2S timescales
- B22. Hasanain Al-Shamarti:** Circulation aspects associated with heat wave events over Iraq and their associated sub-seasonal predictability
- B23. Valeriy Khokhlov:** Impact of atmospheric circulation on extreme weather in Ukraine
- B24. Kai Kornhuber:** Recent increase in a recurrent pan-Atlantic wave-pattern driving concurrent wintertime extremes
- B25. Irina Rudeva:** What modulates the extreme rainfall in Southeastern Australia?
- B26. Yuxuan Ding:** Influences of Meteorological Conditions and Cloud Properties on Precipitation in Atmospheric Rivers: Taking the “712” Beijing-Tianjin-Hebei Extreme Precipitation as an Example
- B27. Msawenkosi Thabo Mpanza:** Further probing the mechanisms driving projected decreases of extreme precipitation intensity over the subtropical Atlantic.
- B28. Anas Ali:** Influence of Horizontal Model Resolution on the Spatial Scale of Extreme Precipitation Events
- B29. Chaim Garfinkel:** Revisiting the signal-to-noise paradox in S2S models: role of synoptic eddy feedback
- B30. Qingyu Cai:** Influence of the Quasi-Biennial Oscillation on the Spatial Structure of the Wintertime Arctic Oscillation
- B31. Tianjiao Ma:** Nonlinear effects of the stratospheric Quasi-Biennial Oscillation and ENSO on the North Atlantic winter atmospheric circulation
- B32. Neal Butchart:** QBO extratropical teleconnections in nudged and free-running experiments
- B33. Hiroaki Naoe:** Teleconnections of the quasi-biennial oscillation in multi-model QBOi-ENSO simulations
- B34. Vinay Kumar:** QBO modulations in surface climate of high latitudes during boreal winter

Links:

Book of Abstracts:  Abstracts_book.pdf

Presentation upload:

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