

Supporting Information for

Advancing Organized Convection Representation in the Unified Model: Implementing and Enhancing Multiscale Coherent Structure Parameterization

Zhixiao Zhang¹, Hannah M. Christensen¹, Mark R. Muetzelfeldt², Tim Woollings¹, Robert S. Plant², Alison J. Stirling³, Michael A. Whitall³, Mitchell W. Moncrieff⁴, Chieh-Chieh Chen⁴, and Zhe Feng⁵

¹Department of Physics, University of Oxford, Oxford, Oxfordshire, UK.

²Department of Meteorology, University of Reading, Reading, Berkshire, UK.

³Met Office, Exeter, Devon, UK.

⁴Climate and Global Dynamics Division, National Center for Atmospheric Research, Boulder, Colorado, USA.

⁵Atmospheric, Climate, and Earth Sciences Division, Pacific Northwest National Laboratory, Richland, Washington, USA.

Corresponding author: Zhixiao Zhang (zhixiao.zhang@physics.ox.ac.uk)

Contents of this file

Figures S1 to S4

Introduction

Figures S1–S4 are referenced in the manuscript and shown here. They are of secondary importance to Figures in the manuscript but provide useful context to results and conclusions in the study.

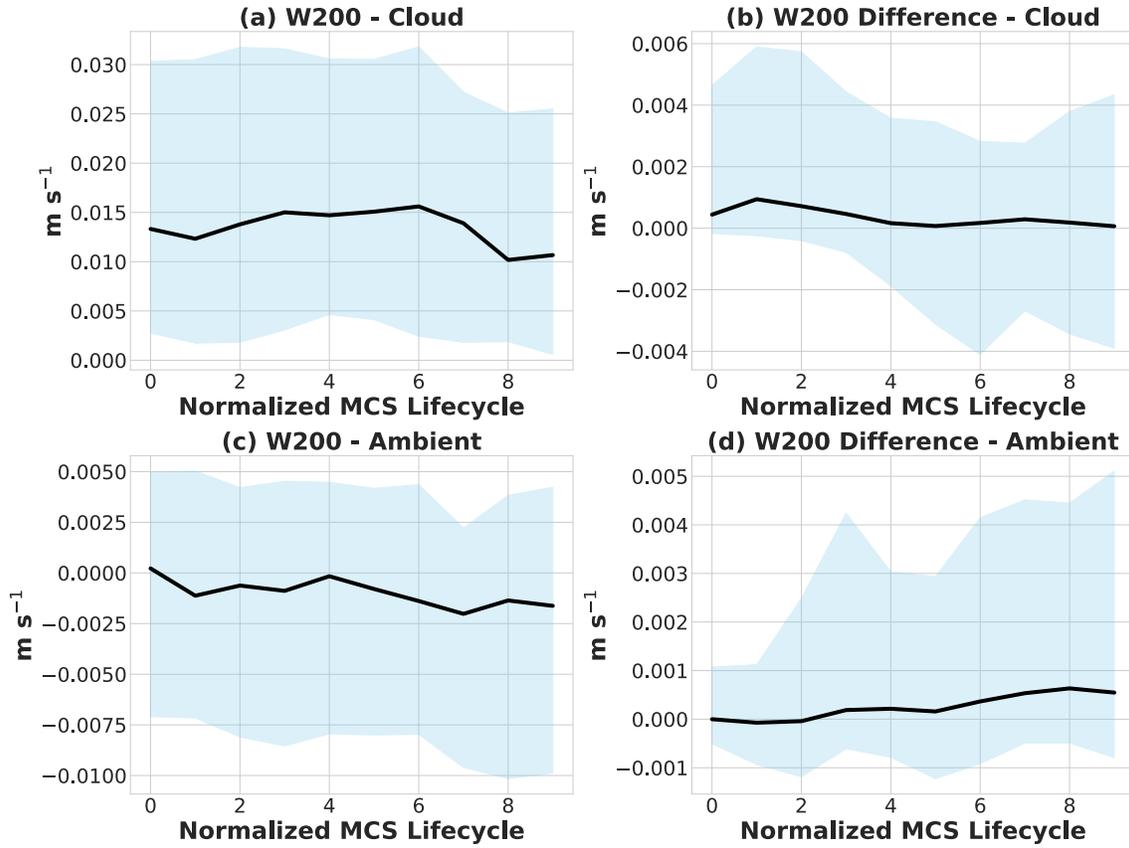


Figure S1. Similar to Figure 6 in the main paper. (a, c) 200 hPa vertical velocity in the control runs and (b, d) their changes following PRIME-MCSP activation, where a positive velocity indicates upward motion. Shaded areas and line conventions are as described in Figure 4b. Simulations span July 1st, 2020, 03Z to July 3rd, 2020, 03Z.

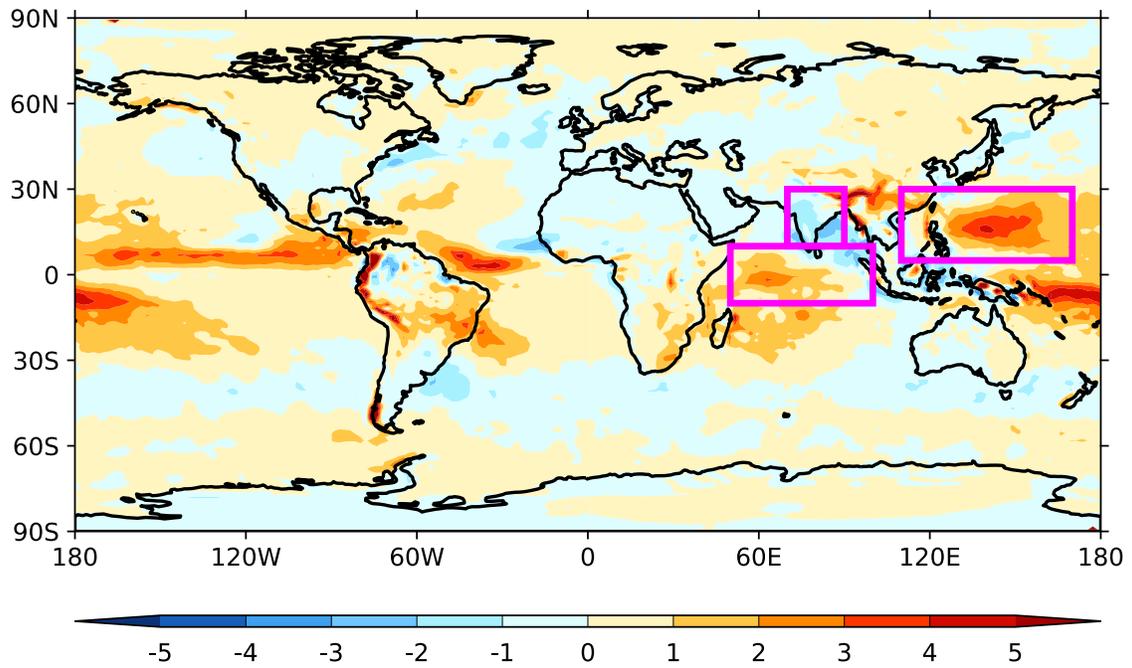


Figure S2. Rainfall difference between the PRIME-MCSP variable α run and GPCP. The simulations and observations span September 1988 to August 2008.

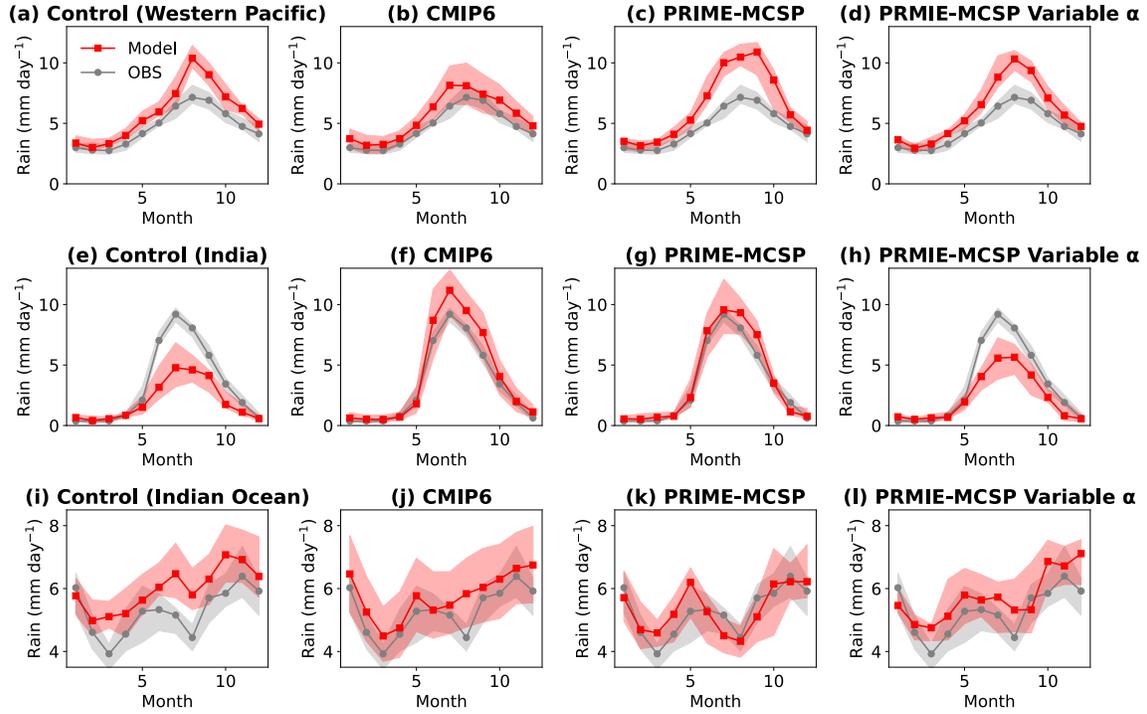


Figure S3. Similar to Figure 12 in the main paper. Simulated (red) and GPCP retrieved (grey) annual cycles of precipitation in the (a, e, i) control, (b, f, j) CMIP6, (c, g, k) PRIME-MCSP and (d, h, l) PRIME-MCSP variable α runs. The bands and lines indicate the IQR ranges and median values respectively. The Western Pacific (a–d), Indian (e–h) and Indian ocean (i–l) regions are shown by the magenta boxes in Figure 10. All simulations and observations span September 1988 to August 2008.

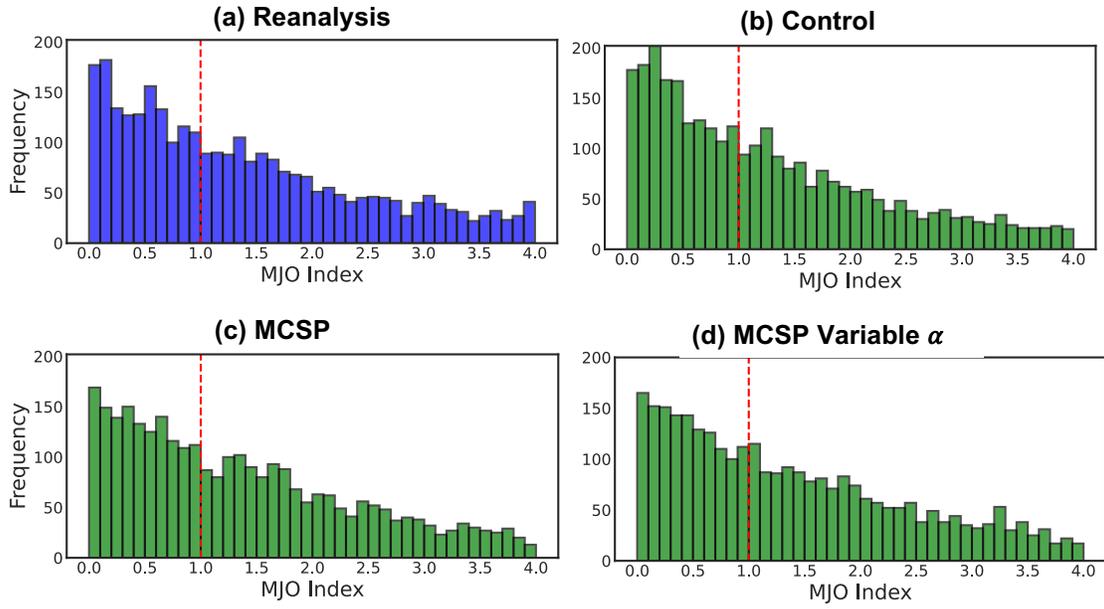


Figure S4. MJO index histogram distribution in (a) reanalysis data, (b) the control run, (c) the PRIME-MCSP run, and (d) the PRIME-MCSP variable α run. All simulations and reanalysis span September 1988 to August 2008.