

Revisiting the mystery of recent stratospheric temperature trends

Amanda C. Maycock¹, William J. Randel², Andrea K. Steiner^{3,4}, Alexey Yu Karpechko⁵, John Cristy⁶, Roger Saunders⁷, David W. J. Thompson⁸, Cheng-Zhi Zou⁹, Andreas Chrysanthou¹, N. Luke Abraham^{10,11}, Hiderahu Akiyoshi¹², Alex T. Archibald^{10,11}, Neal Butchart¹³, Martyn Chipperfield¹, Martin Dameris¹⁴, Makoto Deushi¹⁵, Sandip Dhomse¹, Glauco Di Genova¹⁶, Patrick Jöckel¹⁴, Douglas E. Kinnison², Oliver Kirner¹⁷, Florian Ladstädter^{3,4}, Martine Michou¹⁸, Olaf Morgenstern¹⁹, Fiona O'Connor¹³, Luke Oman²⁰, Giovanni Pitari²¹, David A. Plummer²², Laura E. Revell^{23,24,25}, Eugene Rozanov^{24,26}, Andrea Stenke²⁴, Daniele Visioni^{16,21}, Yousuke Yamashita^{27, †}, Guang Zeng¹⁹

¹ School of Earth and Environment, University of Leeds, UK

² Atmospheric Chemistry, Observations and Modeling Laboratory, National Center for Atmospheric Research, Boulder, USA

³ Wegener Center for Climate and Global Change, University of Graz, Graz, Austria

⁴ Institute for Geophysics, Astrophysics, and Meteorology/Institute of Physics, University of Graz, Austria

⁵ Finish Meteorological Institute, Helsinki, Finland

⁶ Earth System Science Center, University of Alabama in Huntsville, USA

⁷ Met Office, Exeter, UK

⁸ Department of Atmospheric Science, Colorado State University, Fort Collins, USA

⁹ National Oceanographic and Atmospheric Administration, Washington, USA

¹⁰ Department of Chemistry, University of Cambridge, Cambridge, U.K.

¹¹ National Centre for Atmospheric Science, U.K.

¹² Center for Global Environmental Research, National Institute for Environmental Studies, Tsukuba, Japan

¹³ Met Office Hadley Centre, Exeter, UK

¹⁴ Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany

¹⁵ Meteorological Research Institute, Tsukuba, Japan

¹⁶ Center of Excellence CETEMPS, Università dell'Aquila, Italy

¹⁷ Steinbuch Centre for Computing, Karlsruhe Institute of Technology, Karlsruhe, Germany

¹⁸ Météo-France/CNRS, Toulouse, France

¹⁹ National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand.

²⁰ NASA Goddard Space Flight Center, Greenbelt, USA

²¹ Department of Physical and Chemical Sciences, Università dell'Aquila, 67100 L'Aquila, Italy

²² Climate Research Branch, Environment and Climate Change Canada, Montreal, QC, Canada.

²³ Bodeker Scientific, Christchurch, New Zealand

²⁴ Institute for Atmospheric and Climate Science, ETH Zurich, Zurich, Switzerland

²⁵ School of Physical and Chemical Sciences, University of Canterbury, Christchurch, New Zealand

²⁶ Physikalisch-Meteorologisches Observatorium Davos/World Radiation Center, Davos, Switzerland

²⁷ National Institute of Environmental Studies (NIES), Tsukuba, Japan

† Now at Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan

Corresponding author: Amanda C. Maycock (a.c.maycock@leeds.ac.uk)

Contents of this file

Figures S1 to S2

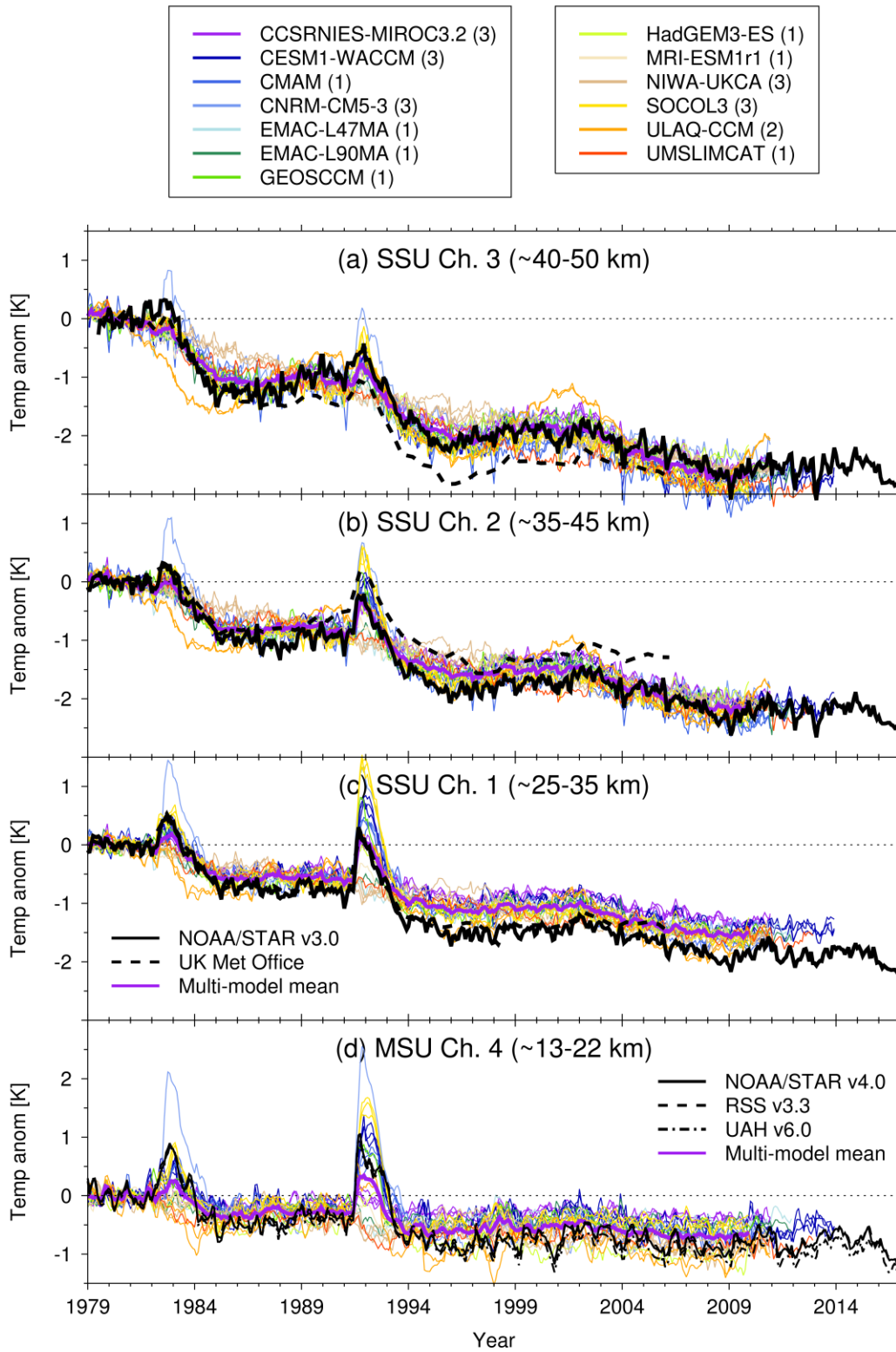


Figure S1. As in Figure 1 of the main text, but showing the CCMI refC1 simulations compared to satellite stratospheric temperature measurements.

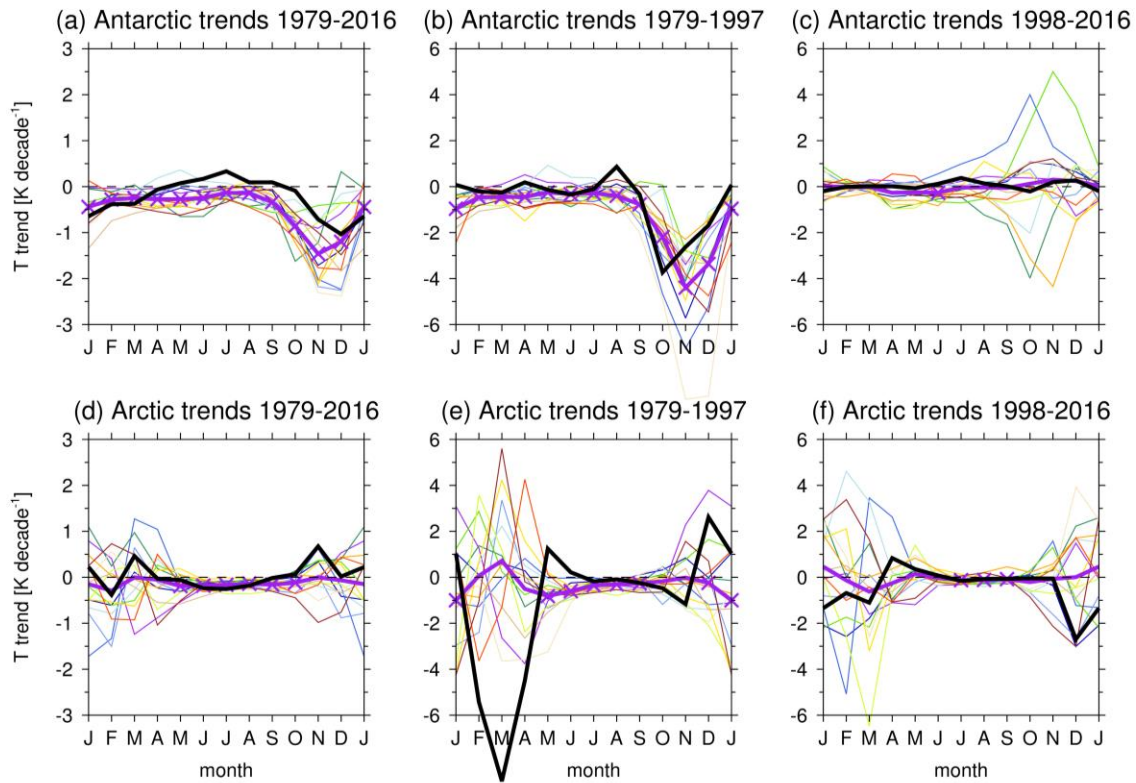


Figure S2. Lower stratospheric (MSU_4 , $\sim 13\text{-}22$ km) temperature trends [$K\text{ decade}^{-1}$] by month for the (a-c) Antarctic ($70\text{-}90^\circ\text{S}$) and (d-f) Arctic ($70\text{-}90^\circ\text{N}$) for the periods 1979-2016 (a,d), 1979-1997 (c,e) and 1998-2016 (c,f). Black shows the NOAA/STAR v4.0 MSU-AMSU-A dataset. Colours show refC2 simulations from the CCMI models (see Figure 1 for colour legend). The thick purple line shows the trend in the multi-model mean. Purple crosses denote months where at least 10 of the 14 models ($\sim 70\%$) agree on the sign of the trend.