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The first multi-model ensemble of regional climate simulations at kilometer-scale resolution, Part I: Evaluation of precipitation

Nikolina Ban, Erwan Brisson, Cécile Caillaud, **Erika Coppola**, Emanuela Pichelli, Stefan Sobolowski, Marianna Adinolfi, Bodo Ahrens, Antoinette Alias, Ivonne Anders, Sophie Bastin, Danijel Belusic, Ségolène Berthou, Rita Cardoso, Steven Chan, Ole Christensen, Jesus Fernandez, Lluís Fita, Thomas Frisius, Klaus Goergen, and the Erika Coppola

A full list of authors appears at the end of the abstract

Here we present the first multi-model ensemble of climate simulations at kilometer-scale horizontal resolution over a decade long period. A total of 22 simulations, performed by 21 European research groups are analyzed. Six different regional climate models (RCMs) are represented in the ensemble. The simulations are compared against available high-resolution precipitation observations and coarse resolution (12 km) RCMs with parameterized convection. The model simulations and observations are compared with respect to mean precipitation, precipitation intensity and frequency, and heavy precipitation on daily and hourly timescales in different seasons.

The results show that kilometer-scale models produce more realistic representation of precipitation than the coarse resolution RCMs. The most significant improvements are found for heavy precipitation and precipitation frequency on both daily and hourly time scales in the summer season. In general, kilometer-scale models tend to produce more intense precipitation and reduced wet-hour frequency compared to coarse resolution models. Although differences between the model simulations at the kilometer-scale and observations exist, it is evident that they are superior to the coarse-resolution RCMs in the simulation of precipitation in the present-day climate, and thus offer a promising way forward for investigations of climate and climate change at local to regional scales.

Erika Coppola: Nikolina Ban (nikolina.ban@uibk.ac.at), Department of Atmospheric and Cryosphere Sciences, University of Innsbruck, Austria Erwan Brisson (erwan.brisson@meteo.fr), CNRM, CNRS Université de Toulouse, Meteo-France, Toulouse, France Cécile Caillaud (cecile.caillaud@meteo.fr), CNRM, CNRS Université de Toulouse, Meteo-France, Toulouse, France Erika Coppola (coppolae@ictp.it), International Centre for Theoretical Physics (ICTP), Trieste, Italy Emanuela Pichelli (epichell@ictp.it), International Centre for Theoretical Physics (ICTP), Trieste, Italy Stefan Sobolowski (stso@norceresearch.no), NORCE Norwegian Research Centre, Bjerknæs Centre for Climate Research, Bergen, Norway Marianna Adinolfi (marianna.adinolfi@cmcc.it), Regional Models and geo-Hydrological Impacts, Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy Bodo Ahrens (Bodo.Ahrens@iau.uni-frankfurt.de), Institute for Atmospheric and Environmental

Sciences, Goethe University Frankfurt a.M., Frankfurt, Germany Antoinette Alias (antoinette.alias@meteo.fr), CNRM, CNRS Universite de Toulouse, Meteo-France, Toulouse, France Ivonne Anders (Ivonne.Anders@zamg.ac.at), Zentralanstalt fuer Meteorologie und Geodynamik (ZAMG), Vienna, Austria Sophie Bastin (sophie.bastin@latmos.ipsl.fr), Laboratoire ATmosphere Milieux Observations Spatiales/Institut Pierre Simon Laplace (IPSL), UVSQ Universite Paris-Saclay, Sorbonne Universite, CNRS, Guyancourt, France Danijel Belusic (danijel.belusic@smhi.se), Swedish Meteorological and Hydrological Institute (SMHI), Norrköping, Sweden Ségolène Berthou (segolene.berthou@metoffice.gov.uk), Met Office Hadley Centre, Exeter, UK Rita M. Cardoso (rmcardoso@fc.ul.pt), Instituto Dom Luiz, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal Steven Chan (steven.chan@metoffice.gov.uk), Newcastle University, visiting scientist at Met Office Hadley Centre, Exeter, UK Ole B. Christensen (obc@dmi.dk), Danish Meteorological Institute (DMI), Copenhagen, Denmark Jesus Fernandez (jesus.fernandez@unican.es), Meteorology Group. Dept. Applied Mathematics and Computer Science. Universidad de Cantabria, Santander, Spain Lluís Fita (lluis.fita@cima.fcen.uba.ar), Centro de Investigaciones del Mar y la Atmósfera (CIMA), CONICET-UBA, CNRS UMI-IFAECI, Buenos Aires, Argentina Thomas Frisius (thomas.frisius@hzg.de), Climate Service Center Germany (GERICS), Helmholtz-Zentrum Geesthacht, Hamburg, Germany Klaus Goergen (k.goergen@fz-juelich.de), Institute of Bio- and Geosciences (IBG-3, Agrosphere), Research Centre Jülich, Jülich, Germany, Centre for High-Performance Scientific Computing in Terrestrial Systems, Geoverbund ABC/J, Jülich, Germany Jan Erik Haugen (jan.erik.haugen@met.no), Norwegian Meteorological Institute, Oslo, Norway Oivind Hodnebrog (oivind.hodnebrog@cicero.oslo.no), Center for International Climate and Environmental Research-Oslo (CICERO), Oslo, Norway Stergios Kartsios (kartsios@geo.auth.gr), Department of Meteorology and Climatology, School of Geology, Aristotle University of Thessaloniki, Greece Eleni Katragkou (katragou@auth.gr), Department of Meteorology and Climatology, School of Geology, Aristotle University of Thessaloniki, Greece Elizabeth J. Kendon (elizabeth.kendon@metoffice.gov.uk), Met Office Hadley Centre, Exeter, UK Klaus Keuler (Klaus.Keuler@b-tu.de), Chair of Atmospheric Processes, Brandenburg University of Technology Cottbus - Senftenberg, Germany Alvaro Lavin-Gullon (lavina@unican.es), Meteorology Group, Instituto de Física de Cantabria (IFCA), CSIC-Univ. Cantabria, Santander, Spain Geert Lenderink (geert.lenderink@knmi.nl), Royal Netherlands Meteorological Institute (KNMI), De Bilt, Netherlands David Leutwyler (david.leutwyler@mpimet.mpg.de), MPI Hamburg Max-Planck-Institute for Meteorology, Hamburg, Germany Torge Lorenz (tolo@norceresearch.no), NORCE Norwegian Research Centre, Bjerknes Centre for Climate Research, Bergen, Norway Paola Mercogliano (P.Mercogliano@cira.it), REgional Models and geo-Hydrological Impacts, Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy - CIRA Centro Italiano Ricerche Aerospaziali, Laboratory of Meteorology, Capua, Italy Josipa Milovac (milovacj@unican.es), Meteorology Group. Dept. Applied Mathematics and Computer Science. Universidad de Cantabria, Santander, Spain Hans-Juergen Panitz (hans-juergen.panitz@kit.edu), Karlsruhe Institute of Technology (KIT), Institute of Meteorology and Climate Research (IMK-TRO), Karlsruhe, Germany Mario Raffa (mario.raffa@cmcc.it), REgional Models and geo-Hydrological Impacts, Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy Armelle R. Remedio (armelle.remedio@hzg.de), Climate Service Center Germany (GERICS), Helmholtz-Zentrum Geesthacht, Hamburg, Germany Christoph Schär (schaer@env.ethz.ch), Institute for Atmospheric and Climate Science, ETH-Zurich, Switzerland Pedro M.M. Soares (pmsouares@fc.ul.pt), Instituto Dom Luiz, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal Birthe M. Steensen (birthe.steensen@cicero.oslo.no), Center for International Climate and Environmental Research-Oslo (CICERO), Oslo, Norway Paolo Stocchi (p.stocchi@isac.cnr.it), Institute of Atmospheric Sciences and Climate, National Research Council of Italy, CNR-ISAC Merja H. Tölle (merja.toelle@univie.ac.at), Department of Meteorology and Geophysics, University of Vienna, Vienna, Austria Heimo Truhetz (heimo.truhetz@uni-graz.at), Wegener Center for Climate and Global Change (WEGC), University of Graz, Graz Austria Jesus Vergara-Temprado (jesus.vergara@env.ethz.ch), Institute for Atmospheric and Climate Science, ETH-Zurich, Switzerland Hylke de Vries (hylke.de.vries@knmi.nl), Royal Netherlands Meteorological

Institute (KNMI), De Bilt, Netherlands Kirsten Warrach-Sagi (kirsten.warrach-sagi@uni-hohenheim.de), Institute of Physics and Meteorology, University of Hohenheim, Stuttgart, Germany Volker Wulfmeyer (volker.wulfmeyer@uni-hohenheim.de), Institute of Physics and Meteorology, University of Hohenheim, Stuttgart, Germany Marjanne J. Zander (marjanne.zander@deltares.nl), Inland Water Systems, Deltares, Delft, the Netherlands, Department of Environmental Sciences, Wageningen University and Research, Wageningen, the Netherlands