



# **Precipitation frequency in MED and EURO-CORDEX ensembles from 0.44° to convective permitting resolution: what explains the differences?**

Minh Ha, Sophie Bastin, Philippe Drobinski, Lluís Fita, Marjolaine Chiriaco, Jan Polcher, Olivier Bock

## **► To cite this version:**

Minh Ha, Sophie Bastin, Philippe Drobinski, Lluís Fita, Marjolaine Chiriaco, et al.. Precipitation frequency in MED and EURO-CORDEX ensembles from 0.44° to convective permitting resolution: what explains the differences?. EGU21, the 23rd EGU General Assembly, Apr 2021, Online, Unknown Region. <10.5194/egusphere-egu21-8843>. <insu-03560948>

**HAL Id: insu-03560948**

**<https://insu.hal.science/insu-03560948v1>**

Submitted on 7 Feb 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

EGU21-8843

<https://doi.org/10.5194/egusphere-egu21-8843>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



## Precipitation frequency in MED and EURO-CORDEX ensembles from 0.44° to convective permitting resolution: what explains the differences?

**Minh Ha-Truong<sup>1</sup>**, Sophie Bastin<sup>1</sup>, Philippe Drobinski<sup>2</sup>, Lluís Fita<sup>3</sup>, Marjolaine Chiriaco<sup>1</sup>, Jan Polcher<sup>2</sup>, Olivier Bock<sup>4,5</sup>, and the model providers from FPSCONV community\*

<sup>1</sup>Laboratoire ATMosphere Milieux Observations Spatiales (LATMOS)/Institut Pierre Simon Laplace (IPSL), Guyancourt, France (minh.ha@latmos.ipsl.fr, Sophie.Bastin@latmos.ipsl.fr, Marjolaine.Chiriaco@latmos.ipsl.fr)

<sup>2</sup>Laboratoire de Météorologie Dynamique (LMD), IPSL, Palaiseau, France (philippe.drobinski@lmd.polytechnique.fr, Jan.Polcher@lmd.jussieu.fr)

<sup>3</sup>Centro de Investigaciones del Mar y la Atmósfera (CIMA), CONICET-UBA, CNRS UMI-IFAECI, Buenos Aires, Argentina (lluis.fita@cima.fcen.uba.ar)

<sup>4</sup>Université de Paris, Institut de physique du globe de Paris, CNRS, IGN, F-75005 Paris, France (Olivier.Bock@latmos.ipsl.fr)

<sup>5</sup>ENSG-Géomatique, IGN, F-77455 Marne-la-Vallée, France (Olivier.Bock@latmos.ipsl.fr)

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

Dynamical models are a major tool for studying climate variability and its evolution. But despite the refinements in resolution and efforts to revise the dynamical and physical processes, rainfall extremes are still poorly represented, even at regional scales. Recent studies using convection-permitting simulations have demonstrated the improvement in representing heavy rainfall. In this study, we investigate the impacts of different model resolutions and convection representations (parameterized vs. explicit) in simulating precipitation frequency over Europe and the Mediterranean and try to explain the difference between model ensembles by focusing on triggering processes. For this purpose, we used a multi-model data-set with three different resolutions (0.44°, 0.11° and 0.0275°) produced in the context of the MED and EURO-CORDEX and the CORDEX Flagship Pilot Study on convection (FPSCONV). At 0.0275°, deep convection is explicitly represented while at 0.44° and 0.11°, it is parameterized with different schemes. In addition, to partially separate the impact of the higher resolution and convective schemes, we remapped the outputs of resolution 0.0275° to the 0.11° grid. To explain the difference in simulating precipitation frequency, a multi-variate approach is applied, in which precipitation is considered in the statistical relationship with tropospheric temperature and humidity - derived from colocated observations at the supersite SIRTa near Paris and some GPS stations. The results show that precipitation frequency in the higher resolution simulations is reduced because of a lower probability to exceed the critical value of integrated water vapor (IWV<sub>cv</sub>) over which precipitation picks up for different temperature bins. At low temperature, the probability decreases mostly due to a different humidity distribution in high resolution simulations, but for the temperature bins where the dominant precipitation type changes to convective precipitation, the decrease of probability to exceed IWV<sub>cv</sub> is mainly explained by a higher value of IWV<sub>cv</sub>. In these bins, the differences

between  $0.0275^\circ$  and  $0.44^\circ$ ,  $0.11^\circ$  resolutions become larger over southern Europe and the Mediterranean. This is not clear over mountain areas, where processes of triggering are more linked to orography than convection. Our results also suggest a decrease of model spread at higher temperature, and a stronger impact of switching off convective schemes than increasing resolution.

**model providers from FPSCONV community:** Danijel Belusic(6), Cecile Caillaud(7), Jesus Fernandez(8), Klaus Goergen(9), Oivind Hodnebrog(10), Stergios Kartsios(11), Eleni Katragkou(11), Alvaro Lavin-Gullon(12), Torge Lorenz(13), Josipa Milovac(8), Hans-Juergen Panitz(14), Stefan Sobolowski(13), Heimo Truhetz(15), Kirsten Warrach-Sagi(16), Volker Wulfmeyer(16), Andreas Dobler(17)