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# Pan-European-Gas-Aerosols-Climate-Interaction-Study - PEGASOS



## Objectives

The overall objective of the EU funded project PEGASOS is to quantify the magnitude of regional to global feedbacks between atmospheric chemistry and a changing climate and to reduce the corresponding uncertainty of the major ones. The Second overall objective is to identify mitigation strategies and policies to improve air quality while limiting their impact on climate change.

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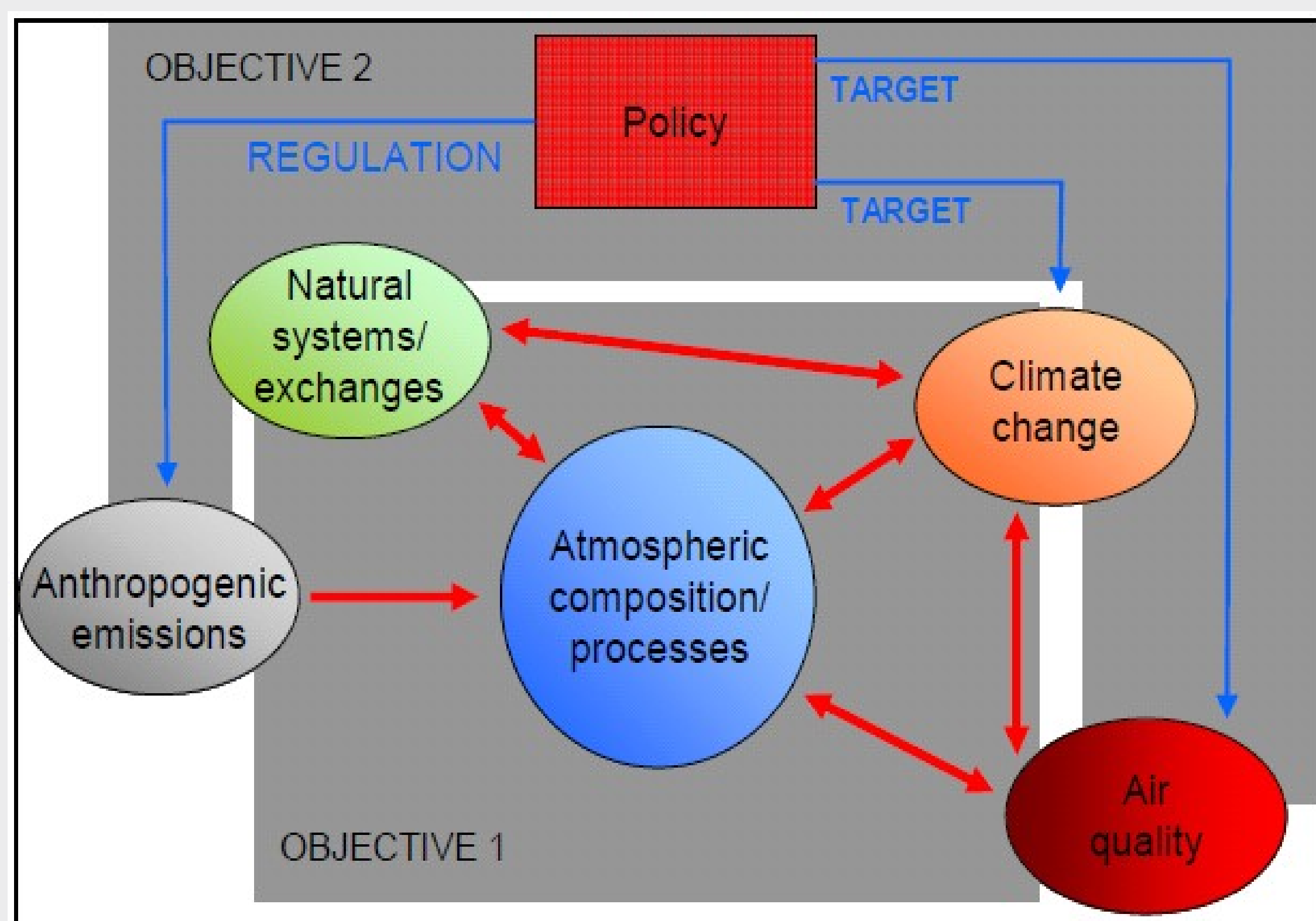


Figure 1: Schematic view of the air quality-climate change system and the two core PEGASOS objectives.

PEGASOS will target regional and local scales for the analysis of climate and pollution impacts and development of mitigation strategies, accounting for chemistry and climate feedbacks at the global scale.

## Methodology

A combination Laboratory studies, Field measurements over Europe using a Zeppelin combined with mobile and fixed ground platforms, air quality and climate models, policy analysis to achieve its objectives will be applied to answer the following scientific questions.

## Modeling

In the beginning of the project, the exact time periods and processes to be investigated will be agreed on together with the PEGASOS project partners. It is planned to do sensitivity studies on different climate-air-quality interactions in this phase of the project. Also, the aerosol-chemistry-part of the model will be improved during this phase in the frame of the project.

Simulations for seven three year long time-slices will be conducted under past and future climate conditions using the aero-chem version of REMO2009.

### Planned simulations

(using REMO\_aero\_chem):

- Hindcast using ERA-Interim as lateral forcing (three time-slices)
- Control-run using MPI-ESM-LR (two time slices)
- Climate projection using MPI-ESM-LR for RCP4.5

(using REMO-HAM driven by ECHAM-HAMMOZ):

- Control run using (one five years time-slice)
- Climate projection runs RCP45 and RCP8.5

## Scientific Questions

To reach its objectives PEGASOS will address the following scientific questions:

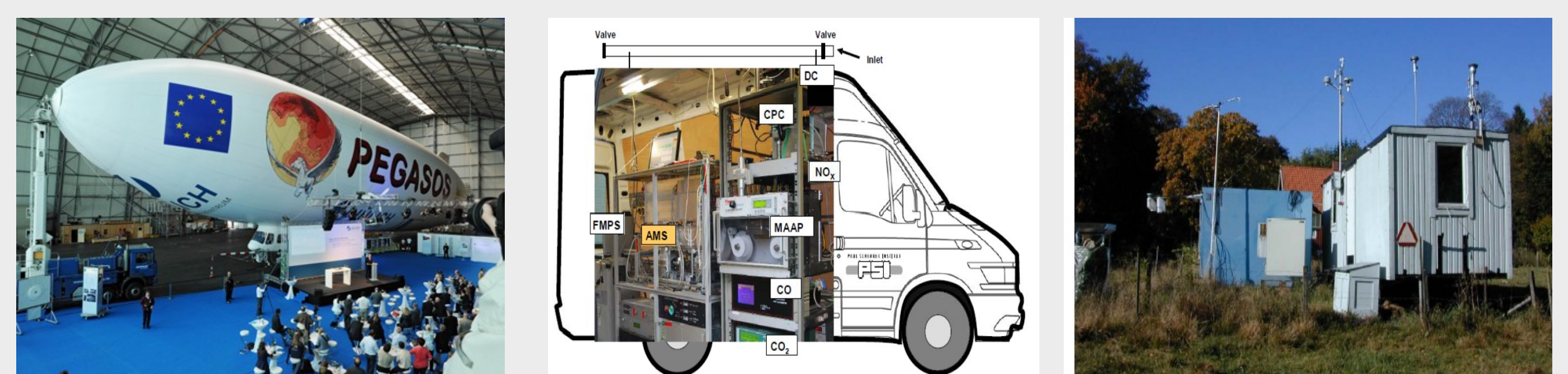
(Q1) How has past air quality policy inadvertently affected present day climate and, the corollary, how has climate change over the last decades affected Europe's ability to meet its air quality targets for ozone, particulate matter (PM), etc.? How will currently planned air quality regulations affect climate?

(Q2) How will emissions respond to a changing climate, shifts in biomes, and land use changes? What will be the effect of these changes on European air quality and climate?

(Q3) How will climate change affect the atmospheric self-cleansing capacity (hydrogen oxide radicals, HOx, budget and cycling), atmospheric aerosol concentrations (both number and mass) and how will this in turn feed back to climate? How will climate change affect the regional accumulation of pollutants (including aerosols) and the resulting air quality and its regulation in Europe on both regional and urban scales?

(Q4) What are the main missing processes in current air quality-climate models and how can these tools be improved for the simulation of multi-scale chemistry-climate interactions including local changes?

(Q5) Which policy-relevant metrics should be used to facilitate the consideration of short-lived species in international treaties dealing with climate-relevant compound regulations and the assessment of air quality and climate policies co-benefits or other interactions?



## Orography of model domain (within the frame of CORDEX)

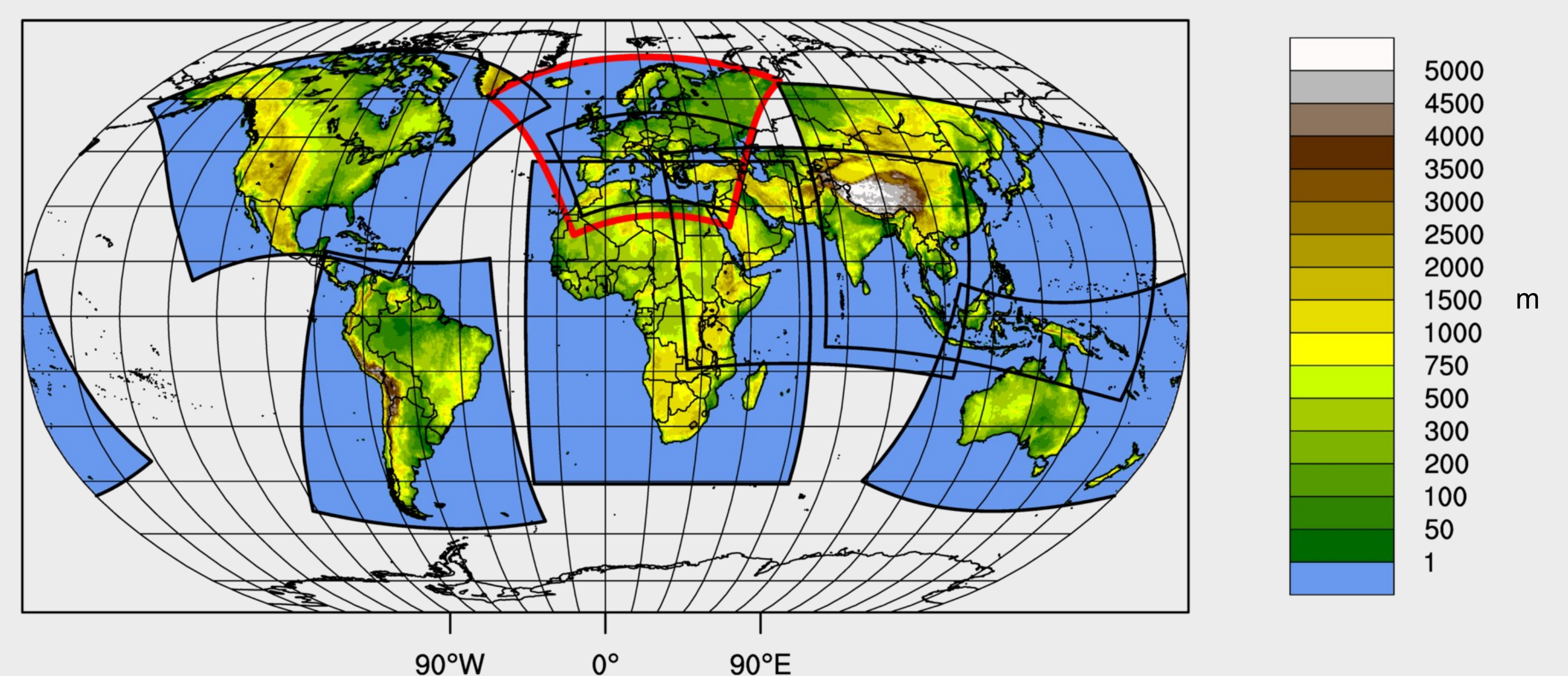


Figure 2: The orography of the REMO model domains downscaled within the frame of COordinated Regional climate Downscaling Experiment (CORDEX). The CORDEX-Europe (red border) region will be used for the regional PEGASOS-simulations.

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