Climate change impact on particulate matter source contributions to the air quality in Aveiro Region

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Background & Goal:

Air quality is strongly dependent on meteorological conditions, and it is therefore sensitive to climate change that will have complex effects on chemistry, transport and deposition of local air pollutants. Nowadays, the Aveiro Region is recognized as one of the regions affected by poor air quality, being particulate matter (PM), the most critical air pollutant, threatening human health. This highlights the need of studies that assess the future climate change effects in the air quality of Aveiro Region, at a high-resolution level, which can allow the identification of early climate adaptation strategies.

Goal: Develop a new air quality modelling approach, including a source apportionment tool, for the quantification of different source activities contributions to future air quality under climate change scenarios.

Methods & Results:

A modelling setup which includes the Weather Research and Forecasting Model (WRF) and the Comprehensive Air Quality Model with Extensions (CAMx), with the Particulate Source Apportionment Tool (PSAT), was applied to Aveiro Region, at a high-resolution level (1km x 1km), for two temporal periods, one statistically representative of the recent-past (1986-2005) and other statistically representative of the medium-term future climate (2046-2065), according to the following steps:

WRF	
Forcing model:	MPI-ESM-LR
Emission scenario:	RCP8.5

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CAMx	
Chemical mechanism:	CB06
Emissions:	TNO_MACC_II
Initial/boundary conditions:	MOZART

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PSAT	
Source groups:	• Transboundary (TBD) • Residential/commercial combustion (RES) • Road transport (TRP) • Industrial processes/combustion (IND) • Others (OTH)

Main results shown in figs 1 and 2. :

- Climate
  - i. increase in mean temperatures;
  - ii. increase in accumulated precipitation associated with a reduction of the number of precipitation days;
- Air quality
  - i. increase of up to 18% of PM concentrations;
  - ii. great influence of the emissions from urban sources like road transport, residential/commercial combustion and industrial processes/combustion, for reference and future;
  - iii. influence of transboundary transport due to dust from the Sahara desert, for reference and future.

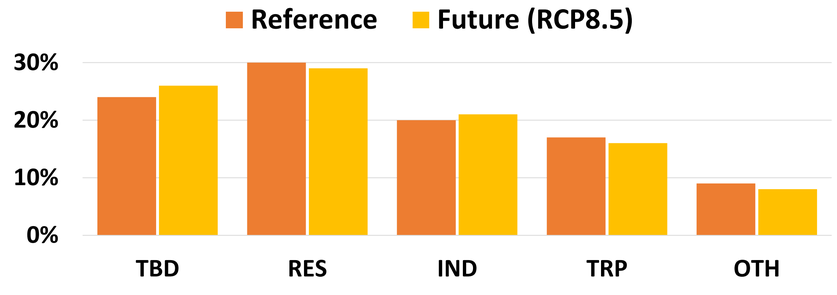

Fig. 1. *Average contributions of each source group for PM concentrations, for a winter month, for reference and future climate scenario.*

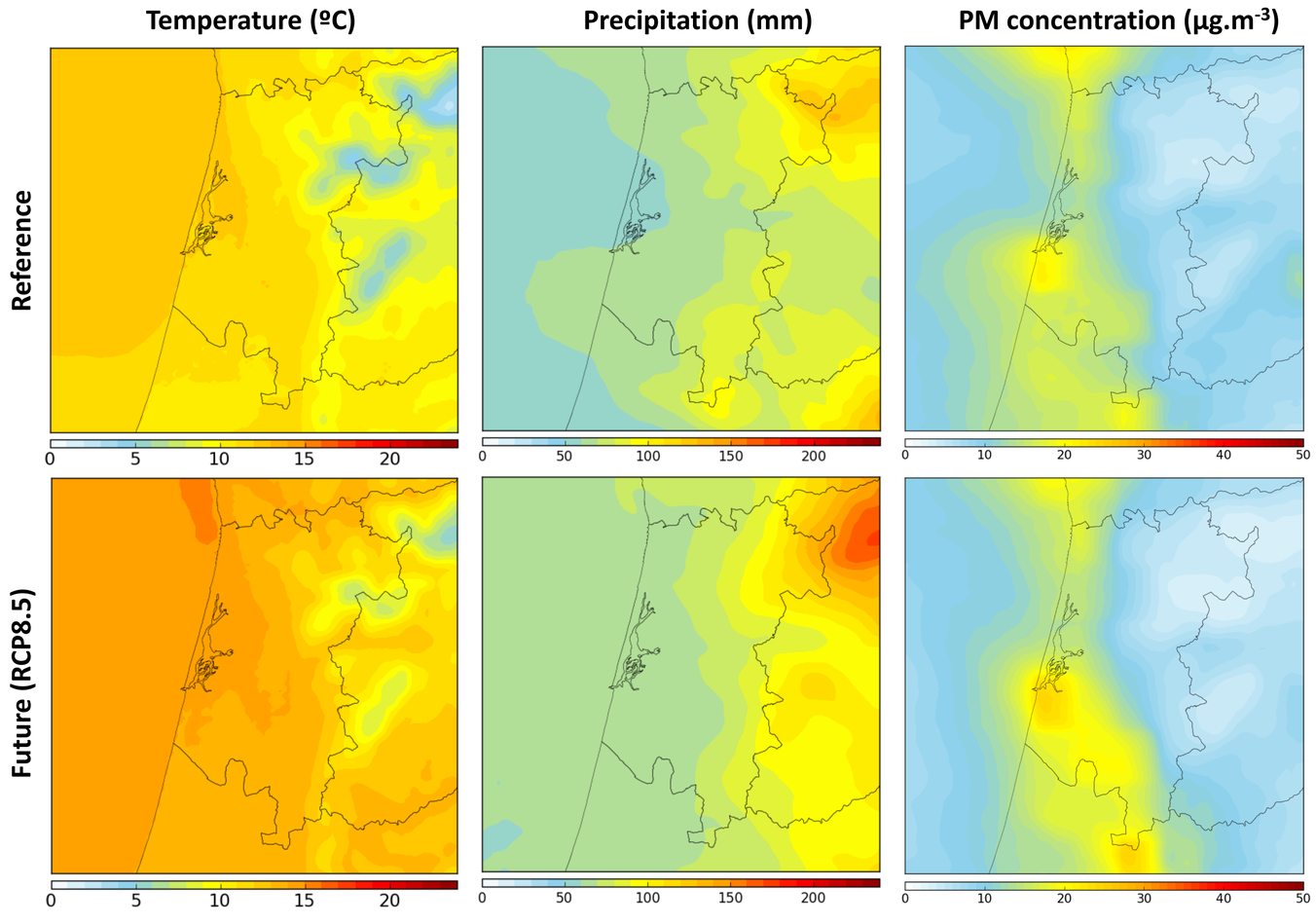

Fig. 2. *Spatial distribution of temperature, precipitation and PM concentrations, for a winter month, for reference and future climate scenario.*

Conclusions & Future Work:

- The applied approach constitutes an added-value in the evaluation of climate change and its impacts in the air quality, as well as on the contributions of different source activities to PM concentrations.
- This information can be useful in understanding the potential benefits of reducing emissions from a particular source category and in designing integrated climate change and air quality management strategies.
- Future work includes: (i) update the results for the new climate scenarios, the shared socioeconomic pathways; (ii) calculate health impacts; and (iii) define the win-win guidelines for air quality and climate change.

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