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The Impacts of a 2-Degree Rise in Global Temperatures upon Gas-Phase Air Pollutants in Europe

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The 15th session of the Conference of Parties (COP 15) in 2009 ratified the Copenhagen Accord, which "recognises the scientific view that" global temperature rise should be held below 2 degrees C above pre-industrial levels in order to limit the impacts of climate change. Due to the fact that a 2-degree limit has been frequently referred to by policy makers in the context of the Copenhagen Accord and many other high-level policy statements, it is important that the impacts of this 2-degree increase in temperature are adequately analysed. To this end, the European Union sponsored the project IMPACT2C, which uses a multi-disciplinary international team to assess a wide variety of impacts of a 2-degree rise in global temperatures. For example, this future increase in temperature is expected to have a significant influence upon meteorological conditions such as temperature, precipitation, and wind direction and intensity; which will in turn affect the production, deposition, and distribution of air pollutants. For the first part of the air quality analysis within the IMPACT2C project, the impact of meteorological forcings on gas phase air pollutants over Europe was studied using four offline atmospheric chemistry transport models. Two sets of meteorological forcings were used for each model: reanalysis of past observation data and global climate model output. Anthropogenic emissions of ozone precursors for the year 2005 were used for all simulations in order to isolate the impact of meteorology and assess the robustness of the results across the different models. The differences between the simulations that use reanalysis of past observation data and the simulations that use global climate model output show how global climate models modify climate hindcasts by boundary conditions inputs: information that is necessary in order to interpret simulations of future climate. The baseline results were assessed by comparison with AirBase (Version 7) measurement data, and were then used as a reference for an analysis of future climate scenarios upon European air quality. The future scenarios included two types of emission data for the year 2050: one set of emission data corresponding to a current legislation scenario and another corresponding to a scenario with a maximum feasible reduction in emissions. The future scenarios were run for the time period that corresponds to a 2-degree increase in global temperatures; a time period that varies depending on which global climate model is used. In order to calculate the effect of climate change on emission reduction scenarios, the “climate penalty”, the future simulations were compared to a simulation using the same future emissions but with current (2005) climate. Results show that climate change will have consequential impacts with regards to the production and geographical distribution of ozone and nitrogen oxides.