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Anthropogenic aerosols as drivers of Mexican and Central American climate

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The region of Mexico and Central America is undergoing rapid climate change, with important implications for human activities and ecosystems. A projected near-future water shortage is expected to negatively impact hydropower generation and agricultural activities. Among all the factors driving climate change, greenhouse gases (GHG) and aerosols play the most critical role. Although aerosol emissions have been declining, identifying and quantifying aerosols is essential as they can mask a large fraction of the GHG-related warming. It is thus important to disentangle the effects of one from the other. The picture is, however, complicated by many complex factors associated with the interactions between aerosols and climate, including clouds and atmospheric circulation.

In this work, we make use of transient coupled experiments with the Community Earth System Model (CESM) to investigate the role of anthropogenic aerosols emitted from the midlatitude regions of US and Europe on the climate of Mexico and Central America during the period 1950-2000. Aerosols from both regions peaked in the 1970s, and successively declined due to air quality regulations. Aerosol emissions from both regions play an important role in modulating precipitation and temperature in Mexico and Central America, via changes in the atmospheric circulation, moisture transport and variations in sea surface temperature in the sub-tropical Atlantic. The two pathways and the overall aerosol impact are thoroughly examined and implications for future regional climate variations are discussed.