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The aerosol contribution to the rate of anthropogenic warming since 2000

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Successive IPCC reports have assessed the level of human-induced warming above preindustrial, but much less emphasis has been placed on quantifying the rate of anthropogenic warming, despite the rate of warming being a key variable for ambitious policymaking. The decadal global temperature anomaly trend can be considered a combination of the forced responses from the full range of radiatively-active pollutants, plus the additional trend introduced by natural variability over the previous decade.

The global temperature anomaly trend likely increased in the 2010s, following a temporary pause through the 2000s. Estimates of the globally averaged radiative forcing (RF) timeseries, which are used to attribute the anthropogenic contribution to this recent behaviour, suggest a 50% increase in the anthropogenic RF trend, which largely arises from aerosol RF trend changes since 2000. When these RF timeseries are used to complete a global temperature anomaly attribution (following the technique outlined in the IPCC's Special Report on the Global Warming of 1.5°C), they suggest that the attributed anthropogenic warming rate has increased by between 50 and 100% since 2000, pushing the estimated rate of net anthropogenic warming up to around 0.3°C/decade since 2010.

We study the global observational evidence supporting the aerosol trends presented in these RF datasets, and thus aim to determine the likely anthropogenic contribution to the perceived warming acceleration behaviour since 2000. We argue that while observations do support the claim that RF trends are partly responsible for the warming trend (and importantly do support the best-estimate RF trend estimates in this ensemble), observational evidence is circumstantial, with a counterhypothesis that aerosol RFs make only a small contribution to the warming trend since 2000 consistently failing to be disproven across the full ensemble of RFs.

This occurs because observed trends in radiative fluxes and global temperatures are significantly influenced by internal variability, principally ENSO and PDO, precluding a clearer assessment of the externally forced behaviour over the short global observational records we have. In light of this uncertainty, considerable caution is required in predictions or policy judgments that depend on the precise current anthropogenic warming trend, such as the time remaining to, or the outstanding carbon budget consistent with, a warming of 1.5°C, since these may be influenced

considerably by recent changes in aerosol forcing behaviour.