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Volcanic forcing and climate variability during the Common Era

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Radiative forcing resulting from major explosive eruptions is a dominant natural driver of climate variability. Understanding the reasons for climate variability therefore relies on accurate information regarding the timing, magnitude and location of major volcanic eruptions, and the radiative properties of the resulting volcanic stratospheric aerosols. Here, we report on recent progress on these fronts, including the construction of the eVolv2k forcing data set based on ice cores covering the past 2500 years, and new methods used in the construction and implementation of volcanic radiative forcing in climate models. The new eVolv2k volcanic forcing data set is directly compared with hemispheric and continental temperature reconstructions, validating the improvement of the forcing data compared to earlier reconstructions. In particular, higher correlation between volcanic forcing and Northern Hemisphere temperatures prior to 1400 CE–compared to earlier reconstructions–implies that a larger amount of preindustrial climate variability will be attributable to volcanic forcing. Specific cases of strong volcanic forcing will be explored in detail, including the early 19th Century and mid-15th Century, incorporating the new estimates of volcanic forcing as well as their associated uncertainties.