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Modeling the "Year without summer 1816" with the CCM SOCOL

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The “Year without summer” 1816 had profound social and environmental effects, and although the cataclysmic eruption of Mt Tambora is now commonly known to have largely contributed to the negative temperature anomalies of the summer 1816 in Europe and North America, lots of uncertainties remain.
The eruption of Mt. Tambora in April 1815 is the largest within the last 500 years. A crucial parameter to assess in order to simulate this eruption is the aerosol size distribution, which strongly influences the radiative impact of the aerosols (changes in albedo and residence time in the stratosphere, among others) and the impacts on dynamics and chemistry. The representation of this major forcing is done by using the AER-2D aerosol model which calculates the size distribution of the aerosols formed after the eruption.
The modeling of the climatic impacts is then done by the state-of-the-art Chemistry-Climate model (CCM) SOCOL. The importance of stratospheric processes for the study of the "Year without summer" 1816 justifies the choice of a CCM which allows a precise analysis of the radiative, dynamical and chemical impacts of the Tambora eruption.

The 1810’s decade is an interesting period as it combines both a strong signal to noise ratio for the study of the impacts of the volcanic forcing, and an availability of several high resolution climate proxies allowing a credible reconstruction of interesting climatic components like Sea Surface Temperatures (SST) which are forced in the CCM . This can particularly provide a realistic description of the inter-annual variability linked to the major atmosphere/ocean coupled oscillations such as ENSO. Reconstructions based on inland natural proxies and early instrumental records can then be used to validate the simulated climate.

I will present the characteristics of the Tambora eruption and show some results from simulations made using the aerosol model/CCM, with an emphasis on the radiative and chemical implications of the large aerosol sizes produced by the Mt. Tambora 60-80MT SO2 release. For instance, the specific absorption/scattering ratio of Mt.Tambora aerosols induced a very large stratospheric warming which will be analyzed.
The climatic impacts will also be discussed in regards of the high sedimentation rate of Mt. Tambora aerosols, leading to a fast decrease of the atmospheric optical depth in the first two years after the eruption.