Software for constraining dust emission and bringing a dust model into optimal agreement with observations

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In the absence of routine three-dimensional measurements of aerosol species and mass fraction, researchers calculate the global and regional dust burden using aerosol models. These models calculate the aerosol cycle using a combination of physical and empirical laws, with the model fidelity evaluated by comparison to observations. However, key parameters remain only approximately known, such as the amount of dust aerosol created by a given gust of wind. In practice, dust emission in many global models is adjusted to bring the aerosol concentration or optical thickness into agreement with available observations downwind of source regions. When the criteria for agreement are qualitative, this adjustment can be laborious. Here, we describe software (available from the author) that adjusts the amplitude of the model dust cycle, objectively bringing the model into optimal agreement with observations selected by the user. The software is designed to be flexible and has been run using output from a number of aerosol models submitted to the AEROCOM archive along with a number of diverse data sets. Execution time is on the order of seconds, which is convenient when the model winds are constantly being updated, for example during the course of AGCM development, or when the sensitivity of the dust cycle to different reanalysis winds is of interest.