EGU24-4997, updated on 11 Aug 2024
https://doi.org/10.5194/egusphere-egu24-4997
EGU General Assembly 2024

A Comprehensive Method to Unveiling Uncertainty in Multi-Factor Systems

Bishuo He[1] and Chunsheng Zhao[2]
[1]Peking University, school of physics, department of atmospheric and oceanic science, China (hebishuo@pku.edu.cn)
[2]Peking University, school of physics, department of atmospheric and oceanic science, China (zcs@pku.edu.cn)

The accurate assessment of influencing factors in multi-factor systems is crucial, but current methodologies face challenges in evaluating uncertainty comprehensively. In aerosol radiative forcing, existing methods may lack completeness, potentially leading to erroneous conclusions. This study introduces a universally applicable method for precise sensitivity analysis of influencing factors in multi-factor systems. Two measurement dimensions for sensitivity analysis methods are established: accurately expressing sensitivity and quantifying sensitivity. Combined utilization of different methods allows for a comprehensive analysis. The proposed method can simultaneously express and quantify sensitivity, including the analysis of nonlinear components unaffected by the absence of factors. In a sensitivity analysis on aerosol optical parameters, the aerosol shell complex refractive index (CRI_shell) emerges as the most sensitive factor. Calculations reveal substantial variability (5% to 91%) in the proportion of nonlinear components resulting from factor interactions. This emphasizes the importance of employing methods resistant to nonlinear influences, as susceptible methods may introduce significant biases. The proposed sensitivity analysis facilitates factor importance assessment at three levels: primary and secondary factors, sensitivity ranking, and quantified sensitivity. This method exhibits universality and holds promising prospects for practical applications in the field. Results provide a valuable reference for future model parameter settings and routine observations.