

The Impact of Changing Policies on Aerosol Pollution in China from 2000 to 2022

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INTRODUCTION

- China implemented air pollution policies to address particulate aerosols, but their temporal effectiveness remains unclear; this study investigates policy impacts on aerosol pollution across seven regions from 2000 to 2022.
- The study period is divided into four stages, analyzing AOD changes, aerosol vertical distribution, and long-range transport using CALIPSO, MERRA2, and AERONET data..
- The period from 2000 to 2022 was divided into four intervals (2000 - 2007, 2008 - 2014, 2015 - 2017, and 2018 - 2022) to analyze AOD changes, aerosol type vertical distribution changes in the seven geographical regions, and changes in aerosol long - range transport at five stations..

RESULTS & DISCUSSION

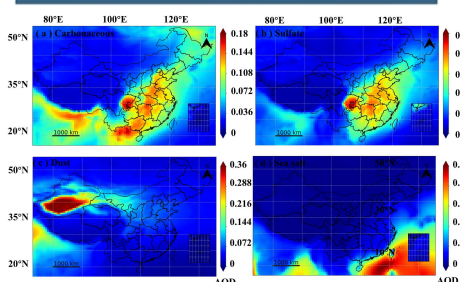


Figure 3. Average AOD map of four types of aerosols in China from 2000 to 2022

RESULTS & DISCUSSION

Spatial and Temporal Variation of AOD in China from 2000 to 2022

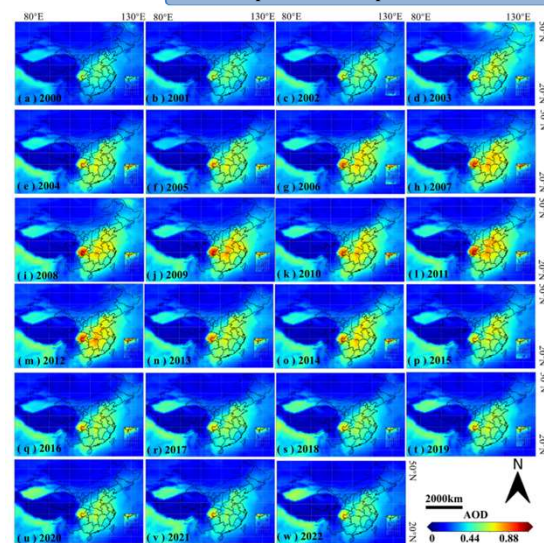


Figure 1. Annual average AOD map from 2000 to 2022

- Carbonaceous and sulfate aerosol AOD is higher east of the Hu Line and mainly distributed in southwestern China's Sichuan Basin and central and eastern China. Carbonaceous aerosol AOD is also high in southern China. Dust aerosol AOD mainly concentrates in the Tarim Basin of northwest China.

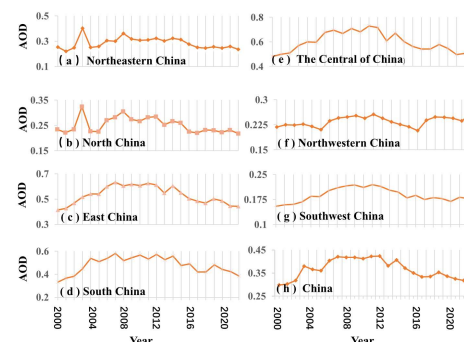


Figure 2. Annual average AOD changes over the years from 2000 to 2022 in seven major geographical regions

- There are significant spatial differences in China's aerosol AOD distribution. High AOD areas are mainly in the Tarim Basin in Northwest China and east of Hu Huanyong Line.
- The annual AOD variation in China from 2000 to 2022 is linked to the high - value areas east of Hu Huanyong Line. Both regions show an annual AOD trend of initial increase, followed by stability and then decline
- According to Figures 1 and 2, the study divided the period from 2000 to 2022 into four phases: 2000-2007, 2008-2014, 2015-2017, and 2018-2022, to analyze the impact of policies on aerosols.

RESULTS & DISCUSSION

CONCLUSION

Aerosol studies based on different time periods

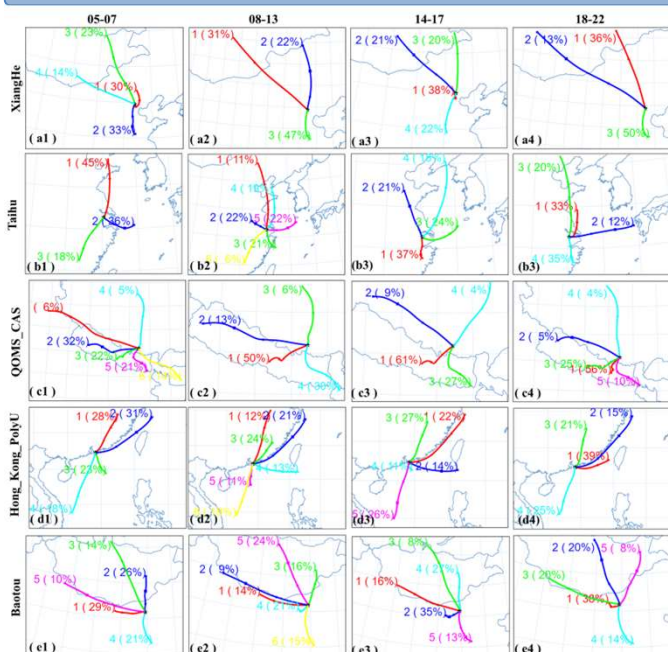


Figure 4. Backward trajectories for four time periods at five stations (Xianghe, Taihu, QOMS_CAS, Hong_Kong_PolyU, Baotou) from 2005 to 2022

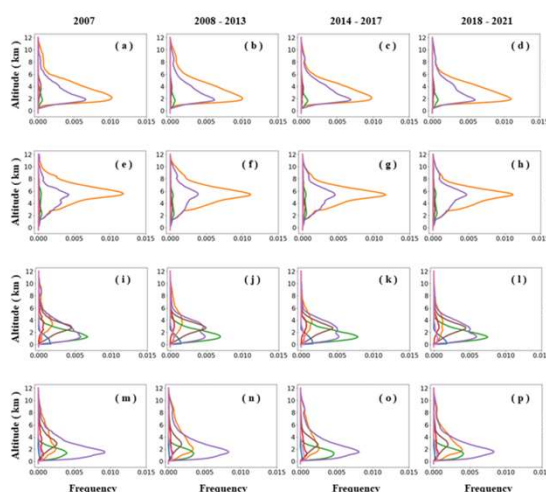


Figure 5. Vertical distribution frequency of different aerosol types in four regions from 2007 to 2021

- The backward trajectories of the five sites show little difference across different time periods, while the vertical distributions of different aerosol types exhibit disparities between the SEC and NEC regions.

- China's AOD rose (2000–2007), stabilized (2008–2013), declined (2014–2017), and stabilized again (2018–2022), with higher aerosol levels in eastern China.
- Western China is dominated by dust aerosols, with varying peak altitudes in the northwest and Tibetan Plateau, while eastern China primarily features polluted dust and continental aerosols at 1–2 km altitude, with less frequent dust aerosols.
- Carbonaceous AOD peaks in spring/winter, dust AOD in spring/summer, sulfate AOD peaks in summer (Beijing-Tianjin-Hebei) and autumn/winter (north/central China), with minimal seasonal variation in sea salt AOD.