



Study of temporal dynamics of aerosols at Hsin-Chuang supersite in Taipei (Taiwan) using dynamic factor analysis and correlation dimension method

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Numerous studies have shown that airborne particulate matter (PM) are dangerous to human health. Since 1994, the Environmental Protection Agency in Taiwan (TWEPA) has established air quality monitoring stations throughout Taiwan, recording the six criteria air pollutants. For air quality control, it is necessary to understand the underlying mechanisms behind the genesis of the air pollutants and the composition of the particulate matter. Recent studies investigating the PM compositions reveal direct evidence of the impact to human health and are better than those using only PM measures. Due to economic and operational reasons, the PM aerosols have been observed at Hsin-Chuang supersite station in Taipei area only since 2003. The present study investigates the temporal dynamics of aerosols observed during 2004–2009 at Hsin-Chuang supersite using both linear stochastic and nonlinear deterministic methods. The dynamic factor analysis (DFA) is considered as a representative linear stochastic method, while the correlation dimension (CD) as a representative nonlinear deterministic. The DFA method analyzes the cross-covariance in the aerosols and characterizes the multivariate time series by their common trends, representing the self-interacting process in the aerosols, as well as the external driving forces which significantly dominate their temporal features. The CD method analyzes the temporal observations through phase space reconstruction of the aerosol time series and can reveal the underlying nonlinear deterministic patterns. The results show that both these methods identify the number of significant driving forces for the aerosol dynamics. Among them, the close interactions are shown among the time series of sulfur dioxide, ozone, PAH and sulfate resulting from strong photochemical reactions in the study area.