Geophysical Research Abstracts,
Vol. 11, EGU2009-2741-1, 2009
EGU General Assembly 2009

Dynamical analysis of four fraction of particulate matter and their content in Cd, Fe and Pb by using the Fisher-Shannon method

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The widespread distribution of heavy metals is a matter of continuous interest within the scientific community due to their interaction with different natural compartments (atmosphere, hydrosphere, soil) and the resulting toxic effects on the entire biosphere. Because they are predominantly associated with airborne particulate matter, in last years many efforts have been made to determine the particulate matter (PM) heavy metal content. PM dynamics are very complex due to its different sources (natural and/or anthropogenic), its irregular spatial and temporal distribution and this complexity also affects its chemical-physical and morphological composition.
In this work, we analyse the complex dynamics of the concentration data of four different fractions of particulate matter (TSP, PM10, PM2.5 and PM1) and their content in three heavy metals (Cd, Fe and Pb) collected at Tito site (40° 36' N; 15° 44' E, 760 m a.s.l.), located in a small industrial area 10 km far from the town of Potenza (Basilicata, Southern Italy).
In order to investigate the complex dynamics of these data, the Fisher-Shannon information plane (FS), defined by the Fisher information measure and the Shannon entropy, was used to quantify the degree of complexity or disorder.
Our findings point out to the correlation between the disorder degree of the particulate matter with the size of the particles and the type of emission source. This result could be put in relationship with the existence of multiple and complex dynamics (i.e., formation processes, source types, chemical composition, atmospheric lifetimes, transport distances) of the analysed PM fractions.