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Discrimination of Urban and Industrial Pollution Sources by Integrated Assessment of Magnetic Parameters from Road Dust Samples in the Basaltic Environment of the Mega-City of Mumbai, India

Ulrich Blaha (1), Basavaiah Nathani (2), and Prasanta Kumar Das (2)

(1) ERDS-tec Environmental Solutions, P.O. Box 1404, 72004 Tuebingen, Germany (ulrich.blaha@erds-tec.de), (2) Indian Institute of Geomagnetism, New Panvel, Navi Mumbai 410218, India (bas@iigs.iigm.res.in; pkdasdkl@gmail.com)

Magnetic parameters have the potential to be powerful tools for indirect assessment of harmful anthropogenic pollution loads in an environment with high magnetic background values. The Mega-city of Mumbai with both multiple pollution sources and various pollution types, additionally being located in the Deccan Trap basalt area with its high natural magnetic values, requires a specific focus on adequate assessment methods of environmental magnetic parameters. Fast characterization of the spatial distribution pattern of harmful particulate matter in road dust samples is achieved and well represented by magnetic susceptibility (χ) analysis of bulk samples (grain size <2 mm). The magnetic data (χ, SIRM and χARM) of the 262 sample set from the "Bombay Arc" –the investigation area that stretches bow-like from Mumbai peninsula until the eastern margin of Navi Mumbai, covering 6 independent areas of in total $\sim$110 km^2 with rather heterogeneous settlement structures- reflect the impact of specific road traffic, industrial activity as well as the natural contribution. The types of urban settlement structures along the "Bombay Arc" range from residential areas over mixed areas to pure industrial zones including all categories of minor and major roads. A qualitatively better defined pollution source discrimination than solely χ analysis, is achieved by combined assessment of χ, SIRM and χARM data from bulk material. A still high quality of interpretable χ distribution maps for the entire investigation area is achieved through χ analysis of the grain size fraction of <44 μm. Heavy metal analyses of e.g., Pb, Zn, and Cu from the grain size fraction of <44 μm reveal very similar distribution patterns as obtained from the magnetic parameters. Results point out that magnetic proxy screening in a Mega-city like Mumbai with highly diverse pollution sources, a high magnetic background environment and complex settlement structures can contribute a lot for identification, reliable assessment as well as discrimination of areas prone to increased health risk.