

**Seminar on Physics and Chemistry
of the Atmosphere
06.11.2020, WiSe 2020/2021, IUP Bremen**

Using novel sensing technologies, advanced computational methods and detailed health outcomes to investigate the underlying mechanisms of air pollution on health

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Abstract

Air pollution is now the leading environmental risk factor for non-communicable diseases resulting in millions of premature deaths and accelerating rates of chronic disease worldwide. Uncertainties still exist on the relationship between individual pollutant species and specific health responses partly due to poor exposure metrics employed by large-scale health studies which have primarily relied on fixed outdoor air quality monitoring networks and static populations. Taking advantage of recent advancements in sensor technologies and computational techniques, we developed a novel methodological approach that improves dose estimations of multiple air pollutants in large-scale health studies. We show the results of an intensive field campaign that measured personal exposures to gaseous pollutants and particulate matter of a health panel of 251 participants residing in urban and peri-urban Beijing with 60 personal air quality monitors (PAMs). Outdoor air pollution measurements were collected in monitoring stations close to the participants' residential addresses. The measurements were matched with repeated clinical examinations of each participant to investigate the underlying mechanisms of air pollution on cardio-pulmonary health outcomes. We found substantial differences between doses estimated from outdoor and personal air quality measurements. These differences introduced significant bias in health models stressing the importance of robust exposure metrics for scientific and policy purposes.