

Assessment of the Impact of The East Asian Summer Monsoon on the Air Quality Over China

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Air pollution is one of the most important environmental problems in developing Asian countries like China. In this region, studies showed that the East Asian monsoon plays a significant role in characterizing the temporal variation and spatial patterns of air pollution, since monsoon is a major atmospheric system affecting air mass transport, convection, and precipitation. Publicly available in situ observations cannot provide sufficient spatial coverage and high consistence in data quality for a long-term period. Therefore, knowledge gaps still exist in the understanding of Asian monsoon impact on the air quality in China under the background of global climate change. Satellite retrievals with high spatial coverage and high consistence for a long period can well document the change of air pollution with monsoon. In this project, we attempt to combine satellite observations throughout the troposphere with ozonesonde and aircraft measurements to provide a holistic view of the monsoon impact on tropospheric air pollutants over strongly affected regions of China. We apply multi-platform satellite observations by the GOME, SCIAMACHY, GOME-2, IASI, GOMOS, MIPAS and MOPITT instruments to analyze tropospheric ozone and CO, precursors of ozone (NO_x, HCHO and CH₄) and other related trace gases in this region. We will show the potential of using the current generation of satellite instruments to monitor air quality changes caused by the East Asian monsoon circulation. A global chemical transport model, MOZART-4, will be used to simulate the monsoon impact and compared with the satellite measurements. The potential impact of air pollutants over China on a regional climate change (the strength and tempo-spatial extension of the monsoon) will be also investigated by combining satellite, in situ and aircraft measurements with modelling calculations.

东亚夏季风对中国空气质量的影响评估研究

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空气污染是包括中国在内的东亚地区发展中国家所面临的重要环境问题。该地区的研究表明，由于东亚季风直接影响大气传输、对流和降水，对于空气污染的时空分布和变化特征扮演着非常重要的角色。然而该地区的地面观测数据非常有限，很难获得具有较高空间覆盖度和一致性的长时间尺度资料。因此，对于全球变化背景下东亚季风对于中国地区空气质量的影响研究仍然存在空白。卫星反演具有较高的空间分辨率和较长时间尺度上的一致性，可以很好地记录季风演变引起的空气污染的变化（尤其是年际变化）。在本项目中，我们将综合利用对流层卫星反演资料、臭氧探空资料和飞机观测资料系统认识季风对于东亚地区对流层空气污染的影响。我们将应用多平台卫星观测（包括GOME, SCIAMACHY, GOME-2, IASI, GOMOS, MIPAS 和MOPITT等）分析对流层臭氧、一氧化碳以及其它臭氧前体物和相关气体成分（NO_x, HCHO 和CH₄等）。我们将使用目前的卫星仪器测量东亚季风环流所引起的空气质量的变化，也将使用全球化学传输模型MOZART4模拟季风的影响并与卫星观测进行对比，同时也将尝试利用多种观测和模拟，研究空气污染的变化对于区域气候的潜在影响（包括季风强度和时空演变特征）。