

报告

基于遥感方法的大气质量监测

Remote Sensing for Air Quality monitoring

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讲者介绍 Biography

黄教授于 2009 年在香港理工大学获得遥感及地理信息系统博士学位，2005 年获得遥感及地理信息系统硕士学位，2003 年获得土地测量及地理资讯学学士学位。从 2005 年，他加入 LSGI 担任兼职研究员，于 2011 年晋升为高级研究员，并于 2012 年担任助理教授，2018 年担任副教授，2021 年担任教授。2006 年至 2007 年，他曾作为富布赖特学者在马里兰大学的地球系统科学跨学科中心工作。目前，他是香港两个 AERONET 观测站的站点经理。黄教授在他的研究领域建立了紧密的联系，并正在领导一些项目，包括：城市热岛效应、植被和生态系统、气溶胶反演、遥感技术应用于水质监测、在智慧城市树木管理中使用地理信息系统技术、使用 iBeacon 技术提升学习体验。他获得了许多奖项，包括日内瓦国际发明展 2021 年金奖，以及 2021 年智能 50 (智能城市连接)。

Prof. Wong received his PhD in Remote Sensing and GIS in 2009, MPhil in Remote Sensing and GIS in 2005 and BSc in Land Surveying and Geo-Informatics in 2003 from The Hong Kong Polytechnic University. In 2005, he joined LSGI as part-time Research Fellow, then stepped up to be Senior Research Fellow in 2011, Assistant Professor in 2012, Associate Professor in 2018, and Professor in 2021. He was a Fulbright scholar at the Earth System Science Interdisciplinary Center of the University of Maryland, College Park from 2006 to 2007. At present he is the official site manager for two AERONET stations in Hong Kong.

Prof. Wong has established a strong connection in his research areas and is leading a number of projects on the use of Remote Sensing in Urban Heat Island Effect, Vegetation and Ecosystems, Aerosol Retrieval, Water Quality Monitoring; GIS in Smart City Tree Management; and iBeacon technology for engaging Learning experiences. He received the numerous awards, including International Exhibition of Inventions of Geneva (Geneva Inventions Expo) Gold Medal 2021, and 2021 Smart 50 (Smart Cities Connect).

报告摘要 Abstract

大气质量的监测对人类健康以及可持续发展至关重要。本研究团队基于卫星以及地面遥感数据，模型模拟数据开发了一系列监测人为和自然产生的气溶胶的方法。这些方法分别可应用于城市地区，东北亚地区以及全球范围。针对较高反射率的城市地表，我们提出了最小反射率的方法，并利用该方法结合 MODIS 和 HJ-CCD 卫星数据反演了香港和大湾区上空的气溶胶厚度。另外，我们也提出了一种简易的从能见度数据推导气溶胶厚度的方法。我们还开发

了一个空气质量可视化的地理信息系统平台，主要可显示气溶胶厚度和能见度的垂直结构。为了分析全球气溶胶时空变化趋势，我们引入了总体经验模态分解法（EEMD）。相比于传统的线性分析方法，该方法能揭示更加显著的气溶胶分布特征。除了反演人为气溶胶性质外，本团队还致力于东亚地区沙尘气溶胶的监测和反演。我们不仅开发了基于物理意义的模型还开发了基于机器学习的模型。通过这些模型应用于静止卫星，我们实现了近实时沙尘气溶胶反演数据的获取。并且沙尘的传输路线也可以通过 HYSPLIT 模型模拟得到。较重要的一点是我们还以香港为研究对象，特别的分析了在沙尘天气下的大气污染跟死亡率之间的关系，并发现极端的大气污染会比较显著的增加死亡率。团队的这些研究成果可以给环境和气候的研究以及决策者提供较可靠的支撑和决策数据。

Monitoring air quality plays a critical part in human health and sustainable development. Our research team has developed a series of methods for monitoring both anthropogenic and natural aerosols in urban areas, East Asia, and globally using remote sensing data (i.e., ground-based and satellite-based data) and model-simulated data. We developed a Minimum Reflectance Technique (MRT) to retrieve AOT over bright urban surfaces (e.g., Hong Kong, Great Bay Area) from satellite measurements (e.g., MODIS, HJ-CCD). The predetermined single scattering optical properties in the retrieval were derived from local AERONET stations, maintained by our research team. Besides, a simplified method for AOT derivation was also developed by constructing the regression relationship between AOT and visibility. A GIS platform was developed for three-dimensional air quality data (AOT and visibility) visualization over the urban landscape. To analyze the global spatiotemporal trend of aerosol, an ensemble empirical model decomposition (EEMD) method was implemented, which reveals more significant aerosol trends than traditional linear regression-based methods. Additionally, our research team has been working on dust aerosol monitoring and retrieval. Both physical-based and machine-learning-based methods have been developed for dust storm monitoring and dust aerosol optical properties retrieval. The application on geostationary satellites (e.g., MTSAT, Himawari) makes near-real-time dust storm detection and retrieval achievable. An HYSPLIT model was also applied to simulate the trajectories of dust storms. Importantly, we also analyzed air pollution and mortality during dust events and found that extreme air pollution events significantly increased mortality in Hong Kong. Our team has been devoted on the environment and climate researches, and provide scientific evidence for policymakers.

有兴趣合作之项目 Interested topics for future collaboration

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