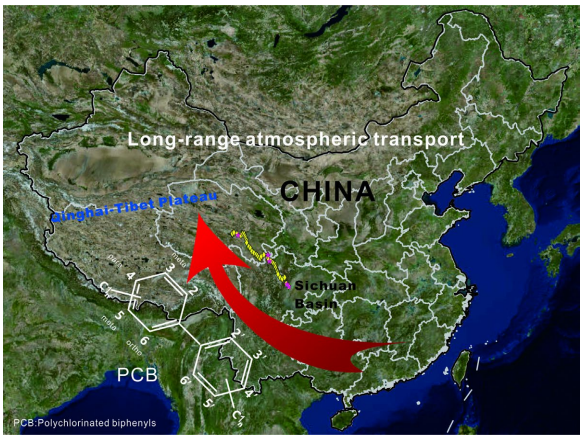
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Long-range atmospheric transport of UP-PCBs to the Tibetan Plateau

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In recent years, significant unintentional emissions of polychlorinated biphenyls (PCBs) have been detected in economically developed urban areas of Eastern China, primarily stemming from industrial activities and improper waste disposal. These emissions pose a serious environmental threat, particularly as they are transported westward to the Qinghai-Tibet Plateau by the southeast monsoon, drawing considerable scientific attention. To better understand PCB presence in remote plateau regions and evaluate atmospheric transport mechanisms such as cold-trapping and vegetation-filtering, this study analyzed 208 PCBs in soil and seasonal atmospheric samples along a transect from the Sichuan Basin to the plateau. PCB concentrations in soil and air ranged from 69.3 to 708 pg/g and 4.17 to 39.1 pg/m³, respectively, with di- and tri-chlorinated PCBs being the most abundant, accounting for 69.0% and 54.5% on average in soil and air. This distribution offers valuable insights into PCB characteristics in the region.Using advanced analytical techniques like PMF and PCA+MLRA models, the study identified long-range atmospheric transport from southeastern China as the dominant source of PCBs. The westward transport and distribution of PCBs were influenced by a combination of cold-trapping and vegetation-filtering effects, with cold-trapping being the dominant mechanism, contributing an average of 70.3%. This underscores the significant role of temperature in PCB transport and fate. Fugacity calculations further revealed consistent net deposition of PCBs from the atmosphere to the soil across all four seasons, indicating potential long-term soil accumulation.Although current ecological risks from PCBs are relatively low, their continuous deposition and accumulation in the plateau region cannot be ignored. This highlights the need for ongoing monitoring and mitigation efforts to address potential environmental impacts. Effective strategies must be developed to mitigate PCB-related risks and protect the unique and fragile ecosystem of the Qinghai-Tibet Plateau.