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Mapping the airborne distribution of caesium-137 in the Asia-Pacific region using data from the Comprehensive Nuclear Test-Ban Treaty

(2025) *Radiation Physics and Chemistry*, 234, art. no. 112768, .

DOI: 10.1016/j.radphyschem.2025.112768

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Abstract

Recent global events, such as North Korea's nuclear tests and the Fukushima nuclear accident, have heightened concerns about the dispersion of radioactive materials into the atmosphere. This study maps the dispersion of airborne Cs-137 in the Asia-Pacific region, with a focus on its impact on the Malaysian environment. Cs-137 concentration data were collected from the Comprehensive Nuclear-Test-Ban Treaty Organization radionuclide online database, covering the Northeast and Southwest Monsoon seasons from 2009 to 2023. The data, sourced from 12 International Monitoring System stations across the Asia-Pacific, Central Asia (China), and Australia, were analyzed using ArcGIS Pro software to create maps illustrating the spread of Cs-137 for each season of the selected years. The maps reveal the atmospheric distribution of Cs-137 over time, with the highest concentration recorded at 2985 $\mu\text{Bq}/\text{m}^3$ at Japan's JPP38 station in March 2011, following the Fukushima nuclear disaster. Generally, the dispersion shows an outward pattern within the region, but it gradually diminishes, returning to a very low concentration of less than 500 $\mu\text{Bq}/\text{m}^3$ as the years approach 2023. © 2025 Elsevier Ltd

Author Keywords

137Cs; Atmospheric transport and dispersion modeling; CTBTO radionuclide data; Environmental monitoring; Fukushima accident

Index Keywords

Atmospheric movements, Atmospheric radioactivity, Atmospheric thermodynamics, Nuclear explosions; 137cs, Asia Pacific region, Atmospheric dispersion models, Atmospheric transport and dispersions, Atmospheric transport model, Caesium-137, Comprehensive Nuclear-Test-Ban Treaty, CTBTO radionuclide data, Environmental Monitoring, Fukushima accidents; Nuclear reactor accidents; cesium, radioactive material, radioisotope; airborne bacterium, Article, atmosphere, data base, data visualization, disaster, Fukushima nuclear accident, geographic information system, mathematical analysis, nonhuman, nuclear test ban treaty, radiation exposure, spatial analysis

Chemicals/CAS

cesium, 7440-46-2

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Publisher: Elsevier Ltd

ISSN: 0969806X

CODEN: RPCHD

Language of Original Document: English

Abbreviated Source Title: *Radiat. Phys. Chem.*

2-s2.0-105002115388

Document Type: Article

Publication Stage: Final

Source: Scopus

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