PM_{10} Concentrations in Istanbul

A Comparative Analysis of 2024 and 2025

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Hüseyin Toros
toros@itu.edu.tr

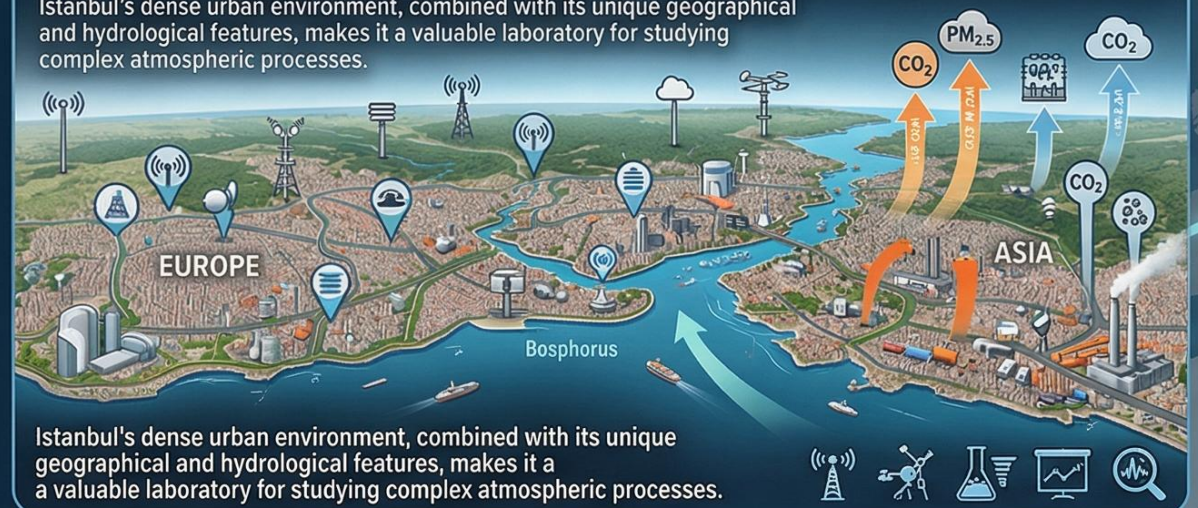
Presentation Outline

- Istanbul as a megacity laboratory and the 2024-2025 monitoring network.
- Diurnal cycles and seasonal shifts in PM10 concentrations.
- Identifying pollution hotspots and clean air zones across the Bosphorus.
- Assessing the 2025 air quality trends relative to 2024.
- Future research opportunities within the PEEX network.

Megacity Dynamics: Istanbul's Unique Challenges for Atmospheric Research

ISTANBUL: A UNIQUE LABORATORY FOR ATMOSPHERIC RESEARCH

Istanbul's dense urban environment, combined with its unique geographical and hydrological features, makes it a valuable laboratory for studying complex atmospheric processes.



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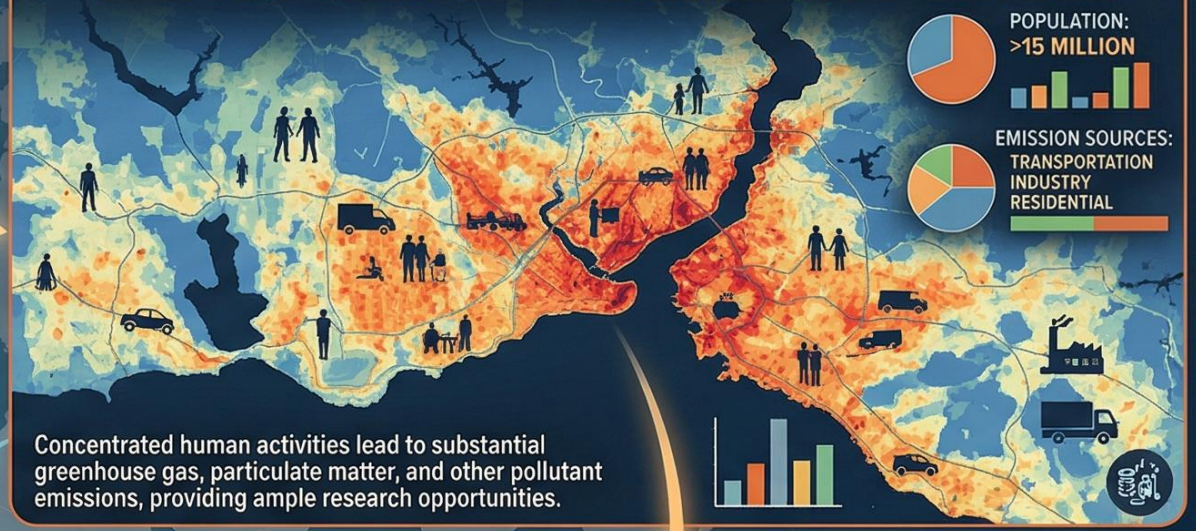
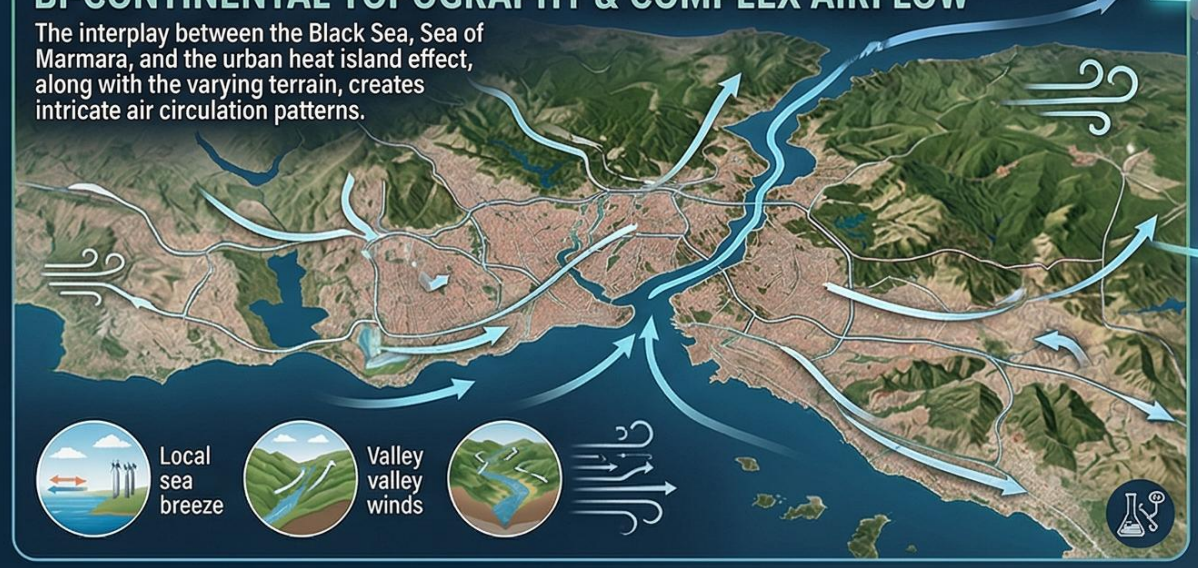
HIGH POPULATION DENSITY & ANTHROPOGENIC EMISSIONS



Concentrated human activities lead to substantial greenhouse gas, particulate matter, and other pollutant emissions, providing ample research opportunities.

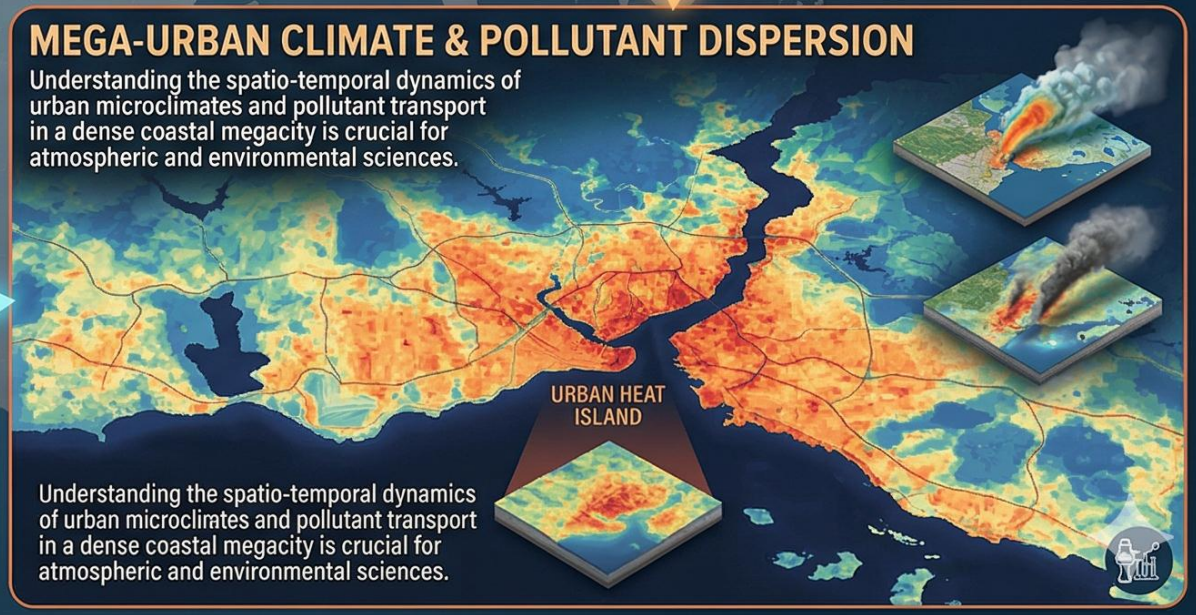
BI-CONTINENTAL TOPOGRAPHY & COMPLEX AIRFLOW

The interplay between the Black Sea, Sea of Marmara, and the urban heat island effect, along with the varying terrain, creates intricate air circulation patterns.



MEGA-URBAN CLIMATE & POLLUTANT DISPERSION

Understanding the spatio-temporal dynamics of urban microclimates and pollutant transport in a dense coastal megacity is crucial for atmospheric and environmental sciences.



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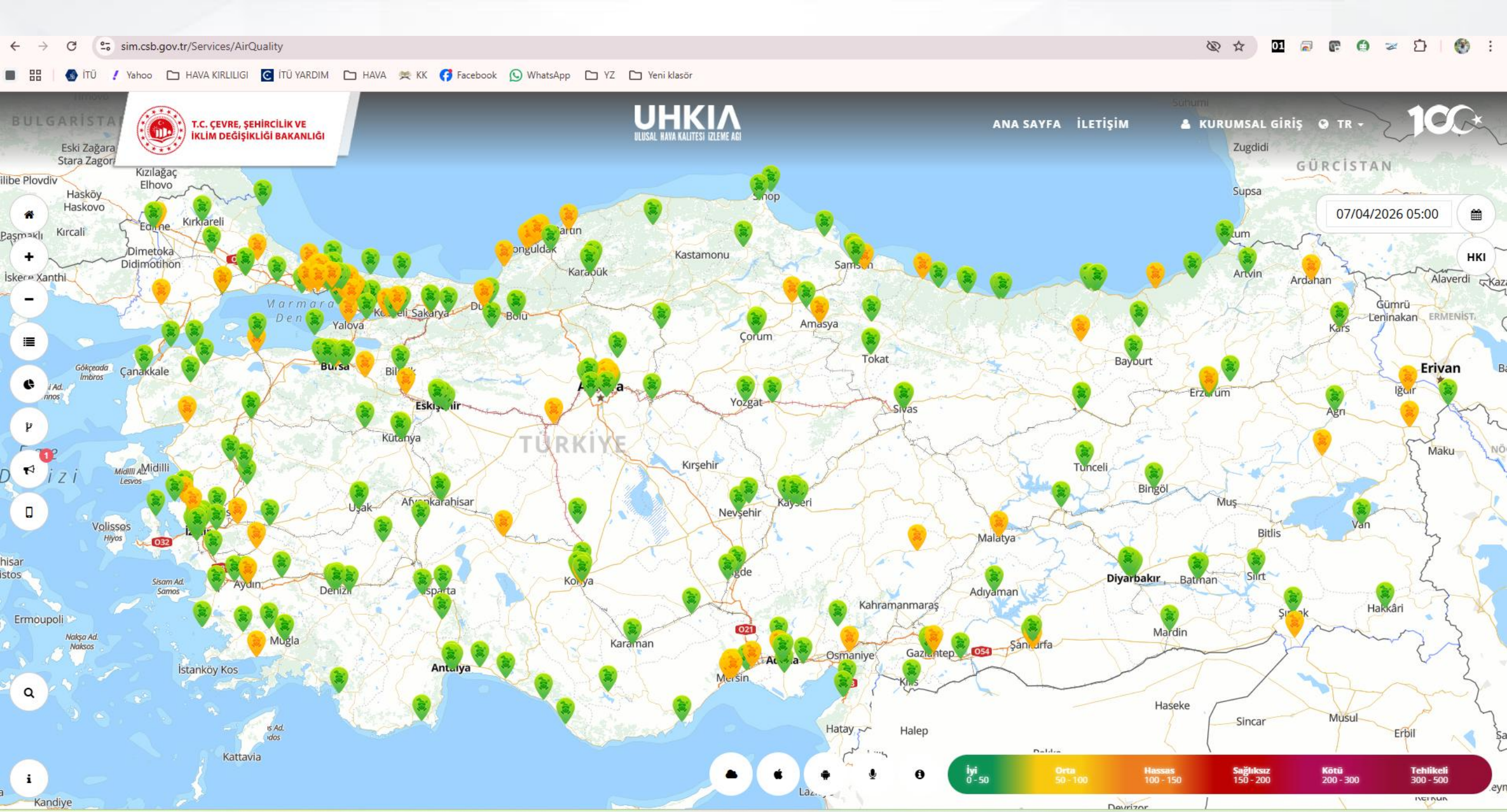
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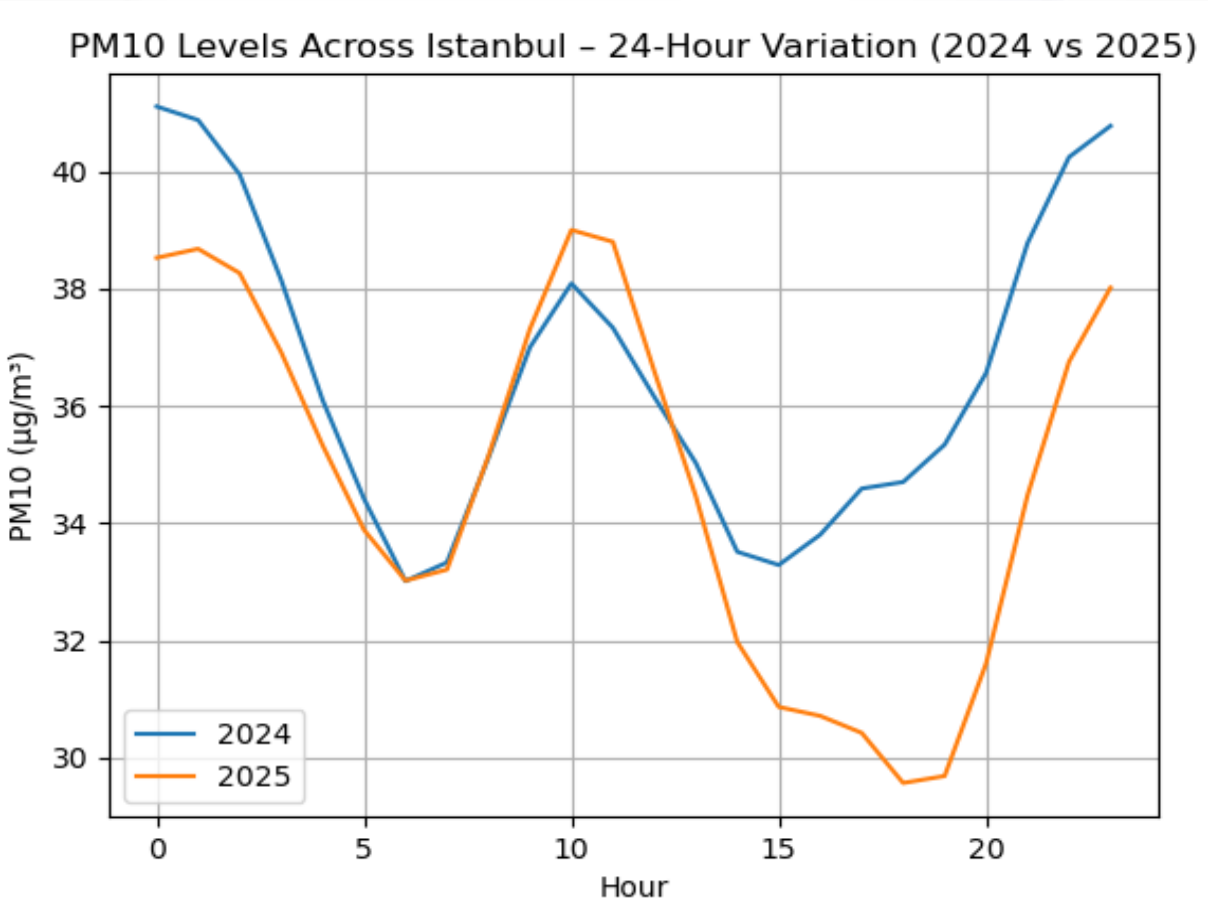
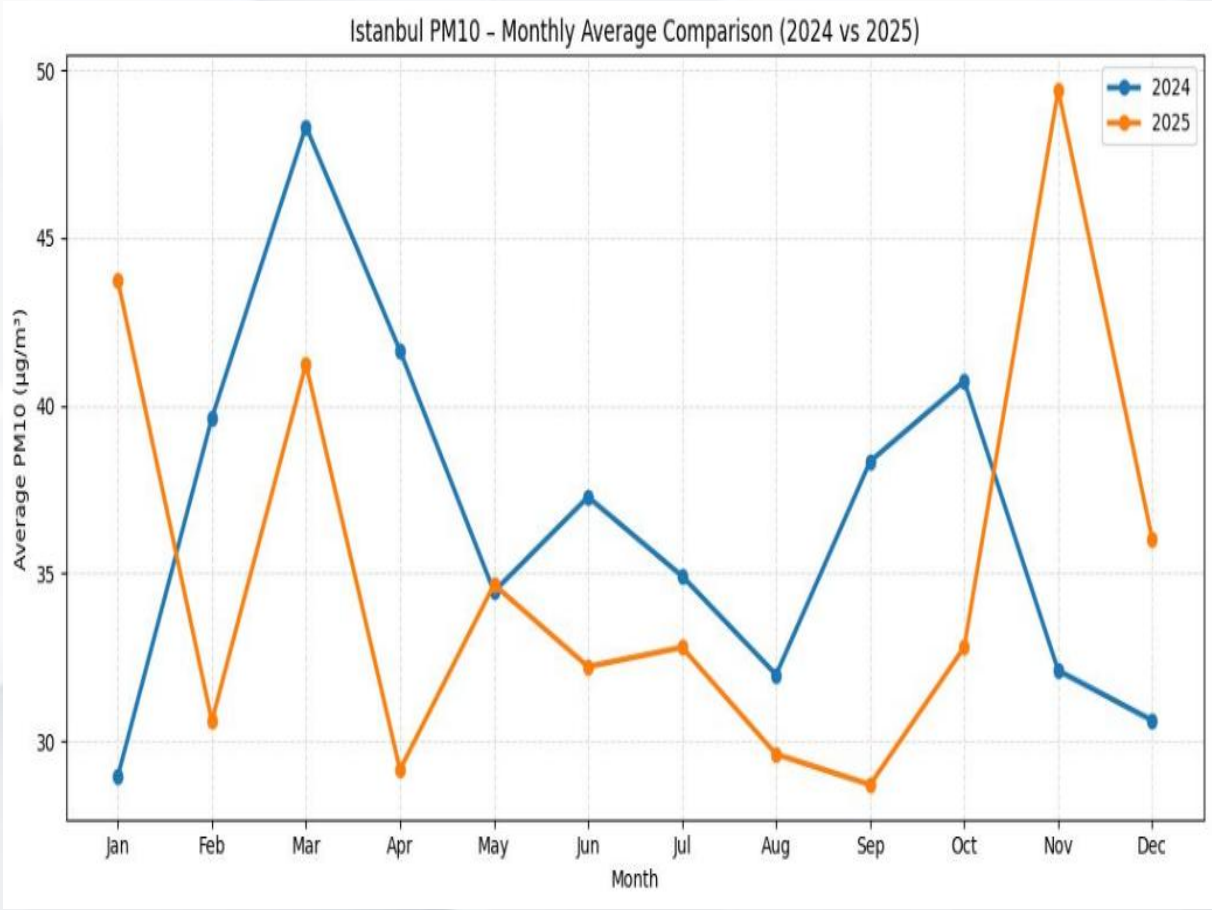
Küllerinden doğan şehir İSTANBUL, artık hava kirliliğini değil hava kalitesini ölçüyor.

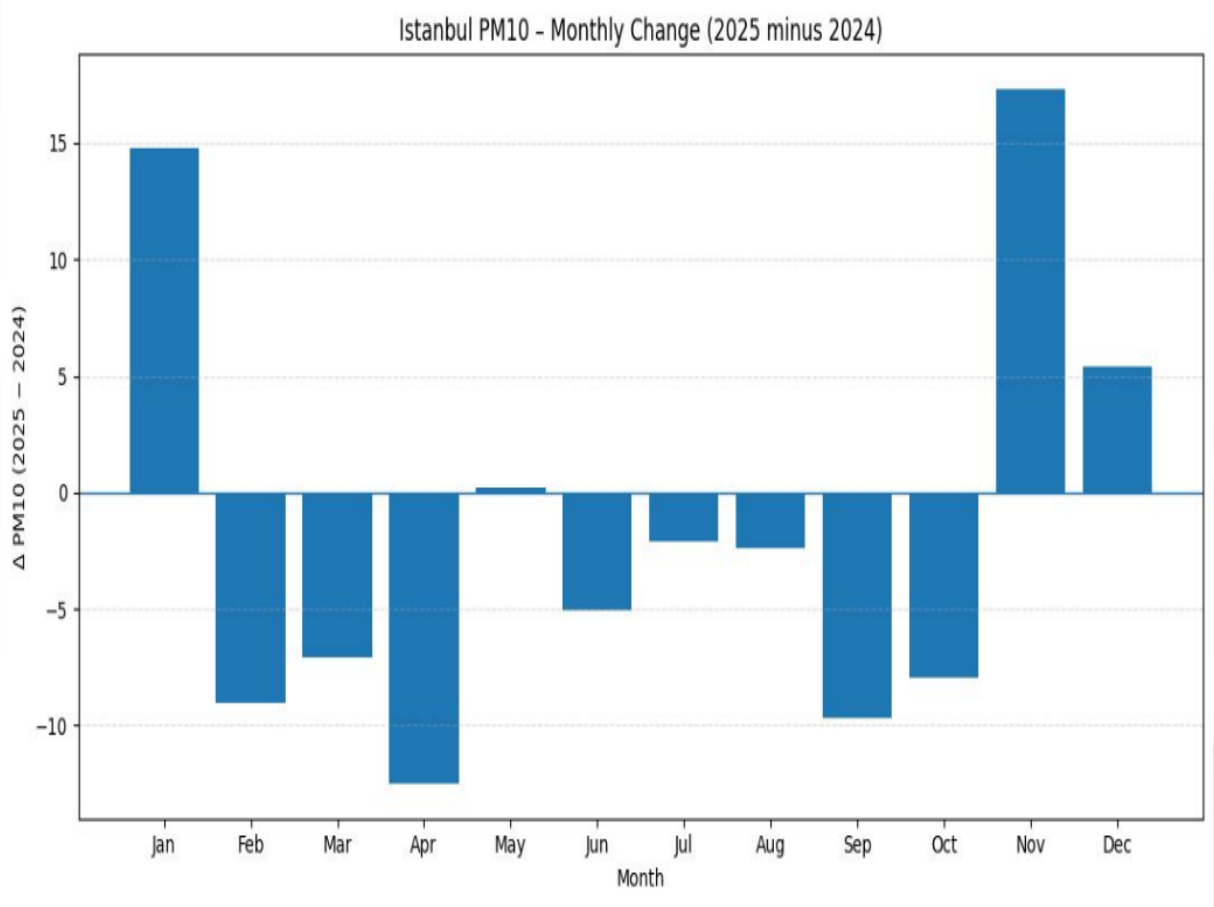
1950'lı yıllardan günümüze kirliliğin değişim grafiği



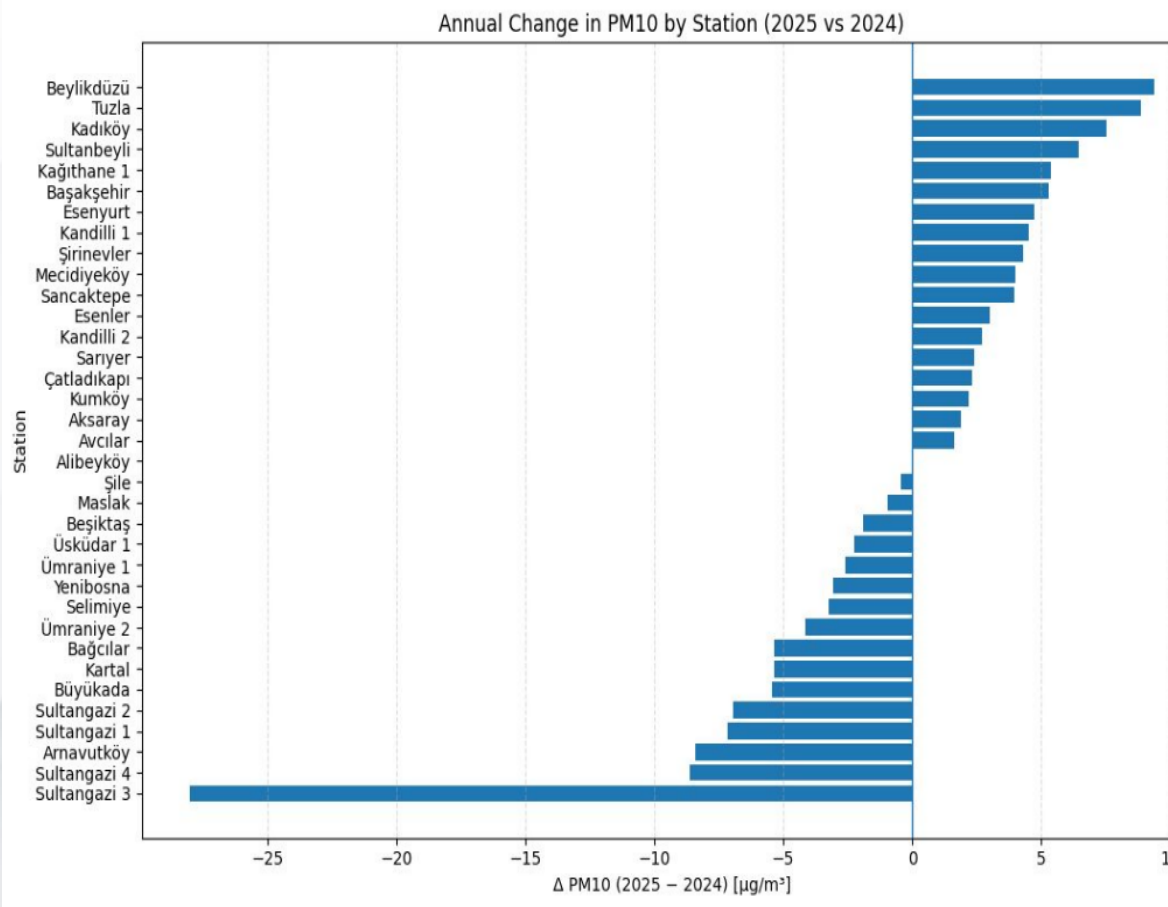
Hourly mean PM_{10} concentrations in Istanbul



Monthly mean PM_{10} concentrations in Istanbul both 2024 and 2025



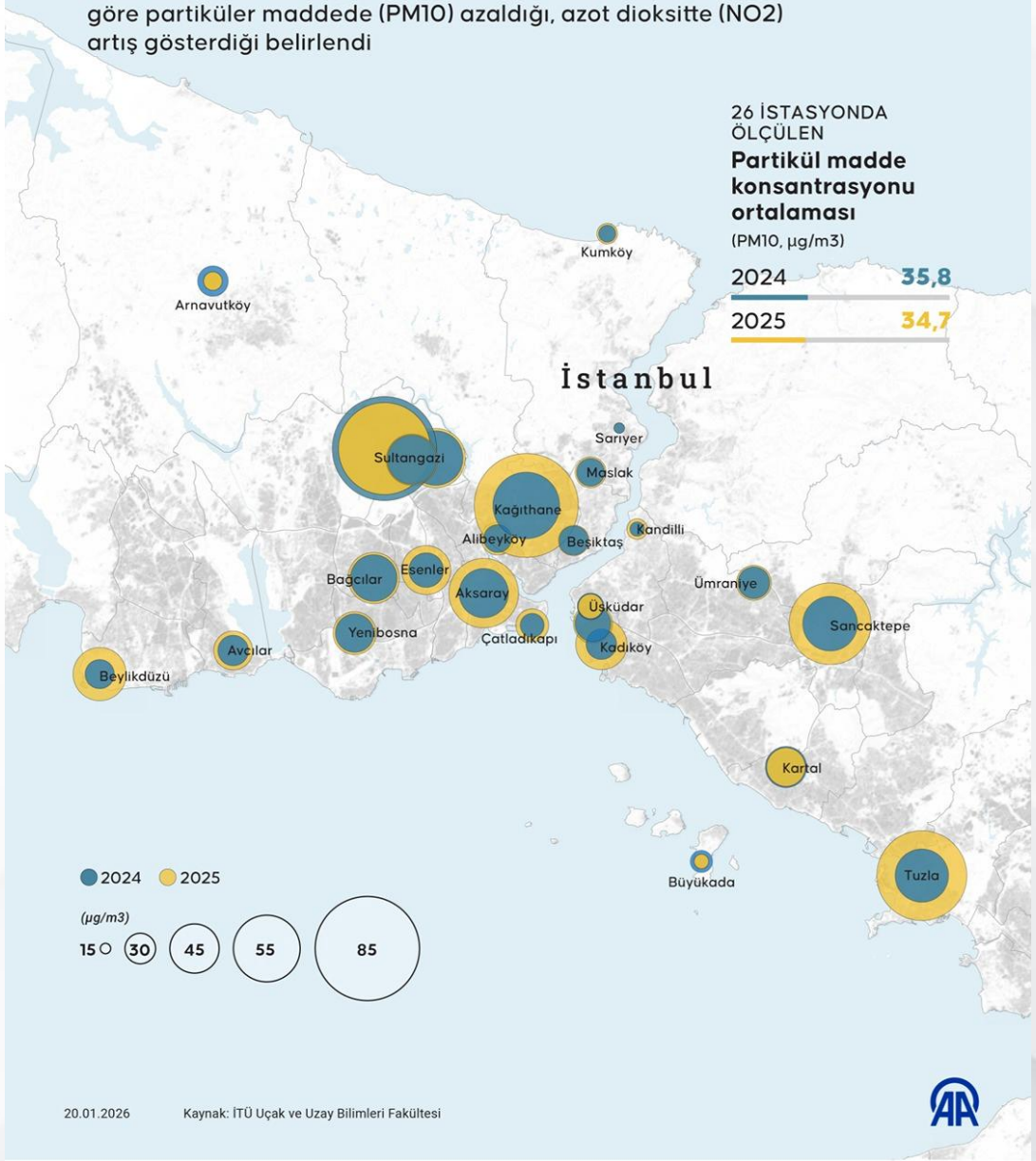
Monthly mean PM_{10} (2025 minus 2024) concentrations in Istanbul



. *Annual changes in PM10 by station (2025 vs 2024)*

İstanbul'da hava kirliliği partiküler madde ortalaması

İstanbul'da hava kirliliği değerlerinin 2025'te bir önceki yıla göre partiküler maddede (PM10) azaldığı, azot dioksitte (NO2) artış gösterdiği belirlendi



Conclusion

- InterannualTrend: A slight decrease in average PM10 levels from 35.8 μg/m³ (2024) to 34.7 μg/m³ (2025).
- Seasonal Impact: Winter and spring remain the most critical periods due to heating emissions and atmospheric stability.
- Spatial Heterogeneity: Clear contrast between ventilated coastal areas (e.g., Sarıyer) and industrial/high-traffic inland hotspots (e.g., Sultangazi).
- Meteorological Influence: Short-term PM10 fluctuations are heavily driven by the complex wind patterns of the Bosphorus.

Future Outlook

- Modeling Partnership: Invitation to use Istanbul's high-resolution data for validating atmospheric models
- AI & Forecasting: Opportunities to develop joint machine learning models for early air quality warning systems.
- Health & Ecology: Collaborative research on the impact of PM10 on public health in megacities.
- Joint Projects: Seeking partners for Horizon Europe, Erasmus+, and PEEX-related regional initiatives.
- Educational Exchange: Open to student and researcher exchange programs to share expertise in meteorological engineering.

İTÜ

Thank you for your attention

Special Thanks: Ministry of Environment, Urbanization and Climate Change, and Istanbul Metropolitan Municipality for providing air quality monitoring data.

Contact Information:

Hüseyin Toros
Climate Science and Meteorological Engineering Dept., İTÜ
toros@itu.edu.tr, https://akademi.itu.edu.tr/en/toros/

Looking forward to building a cleaner future together within the PEEX network.