

Using generative AI for data analysis and scientific writing

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Generative AI in Science

- Supports data exploration and pattern discovery
- Assists in drafting manuscripts and improving clarity
- Enhances productivity and access to knowledge



Challenges of AI-Generated Text

Opportunities come with risks

- **Risk of fabricated or shallow content**
- **Blurred boundary between human and AI authorship**
- **AI text often looks polished but lacks depth**
- **Academic integrity & transparency**



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Clues for AI-Generated Text

- Perplexity
- Variation
- Sentence Openings
- Syntactic Repetition

Clues for AI-Generated Text – Syntax and Style

- Uniform sentence structure
- Lack of variation
- No tangents or flow breaks
- Formulaic phrases
- List of three



Clues for AI-Generated Text – Language and Tone

- Overly polished
- No hedging
- Generic vocabulary
- Neutral, “safe” tone



Clues for AI-Generated Text – Style

- **Verbose redundancy**
- **Lack of personal voice**
- **Surface-level detail**
- **Vague or fabricated references**
- **Consistent style across topics**



Content & Argumentation

- **Surface-level claims**
- **Predictable phrasing**
- **Missing authorial voice**



Example

1. Health Impacts Focus

Particulate matter (PM) pollution is a critical public health concern due to its ability to penetrate deep into the respiratory tract and enter the bloodstream. Fine particles ($PM_{2.5}$) and inhalable particles (PM_{10}) have been strongly associated with increased incidences of respiratory illnesses, cardiovascular disease, and premature mortality. In addition, PM often carries adsorbed toxic compounds such as heavy metals and polycyclic aromatic hydrocarbons, exacerbating its health risks. Long-term exposure has been linked to chronic obstructive pulmonary disease (COPD), reduced lung function, and heightened vulnerability to infectious diseases, underscoring the urgent need for comprehensive mitigation measures.

2. Climate Implications Focus

Beyond its direct effects on human health, particulate matter (PM) pollution plays a pivotal role in climate processes. Fine particles can alter atmospheric radiation balance by scattering and absorbing sunlight, while also influencing cloud condensation nuclei and precipitation dynamics. Black carbon, a major PM component, contributes to atmospheric warming by absorbing solar radiation, whereas sulfate aerosols exert a cooling effect through scattering. This dual role complicates climate projections, particularly in regions where emission sources are heterogeneous. Understanding PM's contribution to radiative forcing is therefore essential for integrated strategies addressing both air quality and climate change mitigation.

3. Monitoring and Policy Focus

Effective management of particulate matter (PM) pollution requires robust monitoring, accurate source apportionment, and evidence-based policy interventions. PM originates from a wide range of anthropogenic activities, including industrial emissions, transportation, and agricultural practices, as well as natural sources such as dust and wildfires. This diversity complicates regulatory frameworks, as strategies must balance economic activity with public health protection. Advances in remote sensing, low-cost sensors, and receptor modeling are improving the resolution of PM monitoring, enabling policymakers to design targeted interventions. However, consistent international standards and cross-border collaboration remain crucial, given the transboundary nature of PM pollution.



Thank you!



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