Understanding air pollution

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Summary

Motivation
Research concept
Motivation

Environmental Physics Laboratory | IPB
Atmospheric chemistry and physics
Environmental impact assessment

Unpredicted change in the environment
Geographical expansion and population growth, industry development, pollution generation, climate change
Unlimited set of interaction pathways, uncertainties, non-linearities, interconnectivities, etc.
Far beyond the patterns which sufficient description would consider simple starting points
Need for a deep understanding of the nature of the environmental complexity and of the responses it requires
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Our research
Towards environmental complexity recognition
Towards sophisticated and synergistic modeling
Motivation

Environmental Physics Laboratory | IPB
Atmospheric chemistry and physics
Environmental impact assessment
Statistical analysis
Machine learning
Explainable artificial intelligence
Artificial intelligence

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Environmental complexity recognition
“History”

Environmental science
- Laboratory experiments
- Case studies
- Monitoring
Environmental complexity recognition
Environmental complexity recognition
Environmental complexity recognition

- Total, low, medium, high cloud cover
- Categorial: rain, freezing rain, snow, ice
- Accumulated precipitation
- Ceiling height
- Wind speed
- Wind direction
- Momentum flux
- Planetary boundary layer height
- Visibility
- Relative humidity
- Dew point
- Temperature: surface, 2 m
- Pressure: surface, sea level
- Sensible heat flux
- Trend, hour, daylight, length of day, weekday, weekend, month, season
- Shortwave radiation
- Sunrise angle
- Convective available potential energy
- Best 4-layer lifted index
- Convective inhibition
- Standard lifted index
- Volumetric soil moisture
- Latent heat net flux
- VOCs
- NO, NO₂, NOₓ, CO, SO₂, O₃, PM₂.₅, PM₁₀

Questions:
- Lightning?
- Earthquakes?
- Hurricanes?
- Floods?
- Tsunamis?
- Tornadoes?
Environmental complexity recognition

Analyze the phenomenon in the context in which it occurs

Environmental complexity recognition

The complexity of the environmental phenomenon and the depth of its interpretation determine the complexity of the methods needed to be applied to represent the phenomenon and to formalize the principles being analyzed.
Environmental complexity recognition

Platform

- Easy access to raw data
- Data transformations
- Pollution models creation, execution, and explanation
- Rich visualizations
- Reporting tools for exploration and exploitation
Environmental complexity recognition

Which environmental conditions, how, and to what extent determine... in urban areas exposed to traffic... at low visibility... before, during, and after thunderstorms?
Conclusions

Shift in methodology and current approaches
Enhance the understanding of the global environmental fate
Thoughtful environmental protection practices, policies, and strategies

Facilitate
Access to environmental data
Data analysis
Exploration of the results
Increase efficiency, creativity, and productivity
Scale up data analysis
Support transdisciplinary
Thank you!