

Title: Causal Inference Visualization of Meteorological Measurements with CoURAGE data

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Abstract:

Recent advances of causal attribution have been developed with the use of **Structural Causal Models** (SCM), simple models that give you the direction of a cause+effect relationship. Our research uses SCM to identify the causal relation of meteorological processes at the surface level and develop visualizations for a broader audience. We are studying the interactions among rain, temperature, specific humidity, aerosols, and CO₂. Data obtained from the **CoURAGE** project, three (3) mobile stations located in the urban, rural, and bay area of Baltimore. We use 1 minute interval data for analysis of the relationship among the variables of rainy events and only data that contains precipitation. For the relation with CO₂, we use 30 minute intervals, separating data by daytime and nighttime. We perform a time series analysis using **Tigramite** python tools. With these causal tools, we perform **Causal Discovery** to uncover the robust physical relations in the SCM created. We then use the Wright's path estimation to find the causal effects from a given SCM doing interventions using 'do calculus'. Our findings suggest that specific humidity has a stronger causal relation with temperature and aerosols than with precipitation. Additionally, CO₂ tends to have a negative relation with temperature. Finally, we created a 'Marimo app' for the visualization of such results.