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Assessing the Impact of Pesticide Exposure on Population Health Using Large-Scale Data Integration and Modelling

Cyriaque Rousselot, Olivier Allais, Philippe Caillou, Julia Mink, Florian Yger

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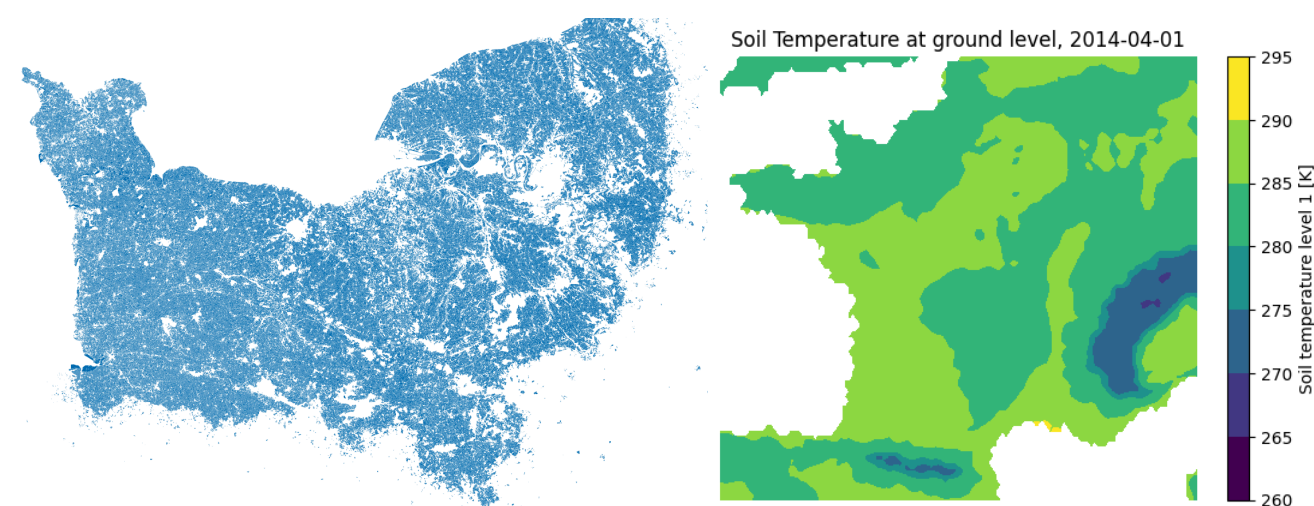
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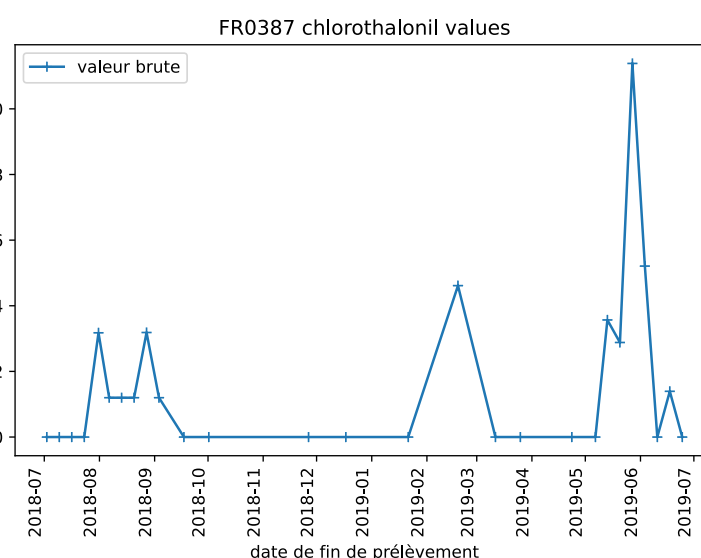
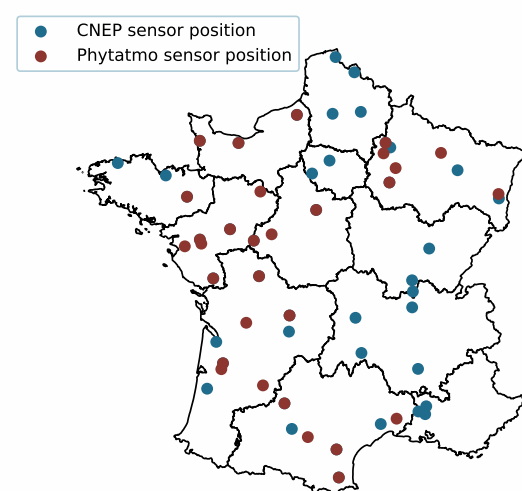
Abstract: Investigation of health impacts of non-occupational exposure to airborne pesticide residues, focusing on the effects of in-utero exposure on child health. Virtual sensors are developed to estimate exposure in areas lacking physical sensors by leveraging the geospatial and temporal characteristics of the residential areas of patients. A Difference-in-Differences approach is assessing the impact of pesticide exposure on health outcomes.

Data



Annual Land-use data from the **RPG** dataset (11m plots, 216 crop types).

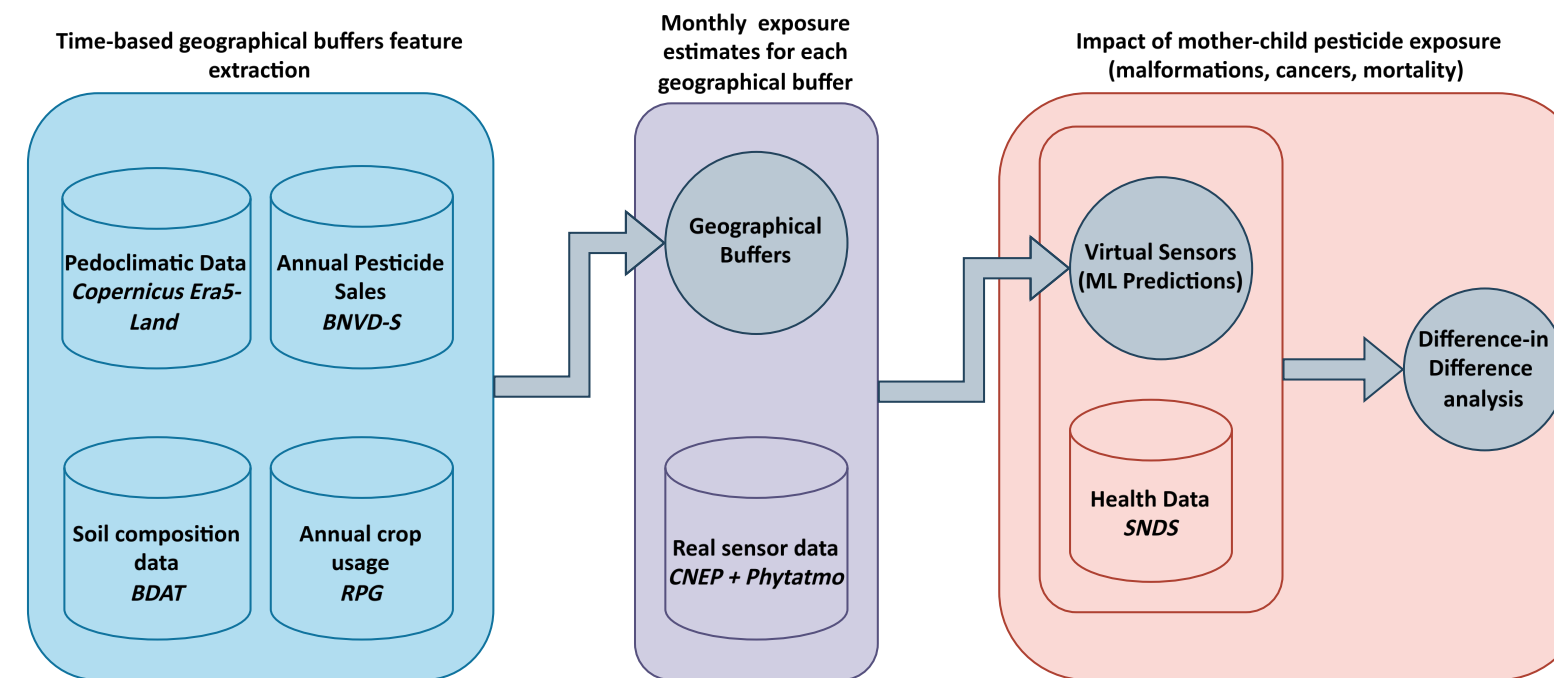
Pedoclimatic data from **Copernicus ERA5-Land** (50 features, 1.3m points).



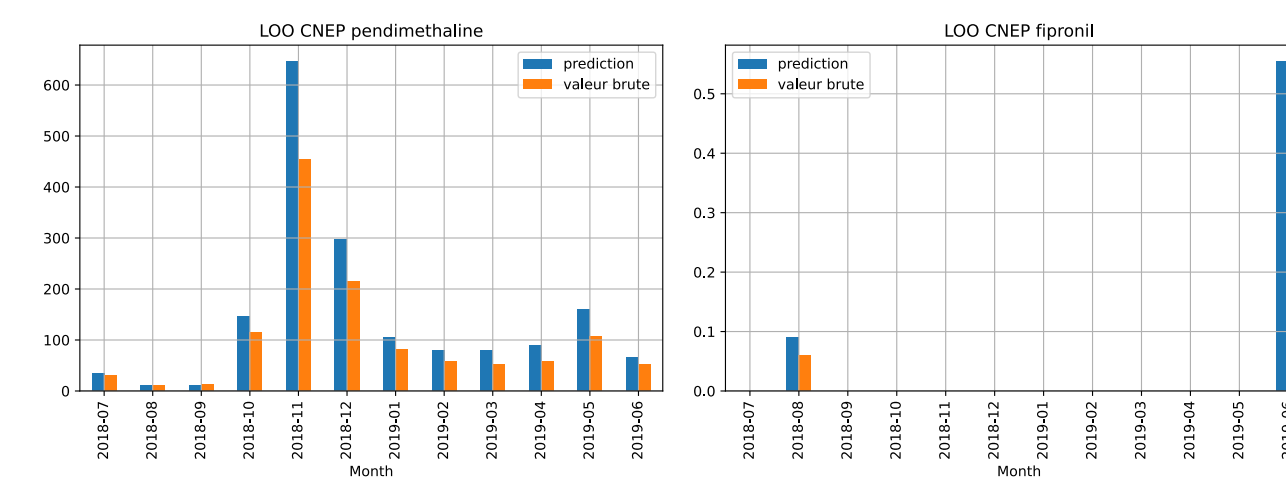
Monthly air quality measurements from **CNEP** and **Phytatmo** databases (70 substances, 50 sensors per year).

- Pesticide sales from **BNVD-S** (418 substances, annually).
- **Système National des Données de Santé** (SNDS):
 - ▶ 5 million children born between 2013 and 2019 and their mothers.

Methodology



1. **Geographical buffers** from spatio-temporal data for every municipality in France (34 000 buffers, monthly).

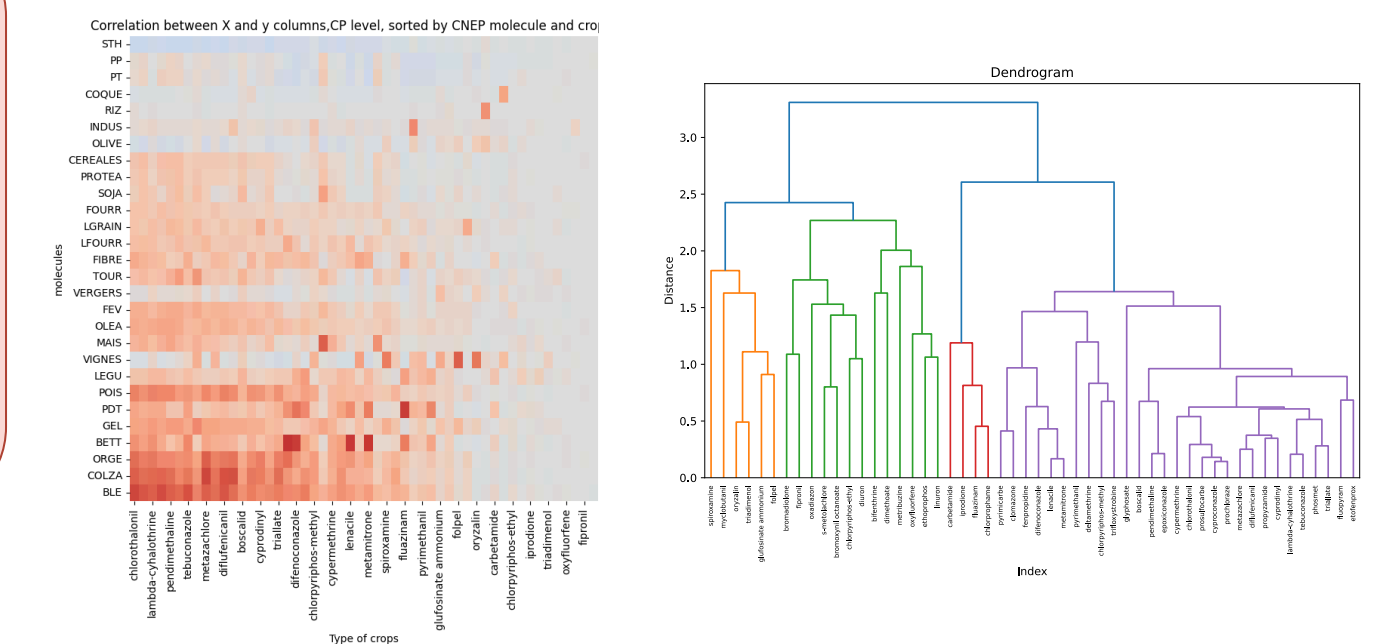


2. **Machine Learning Estimations** of pesticide exposure for every virtual sensor placed on the geographical buffer. Capture monthly variations and absolute quantities.

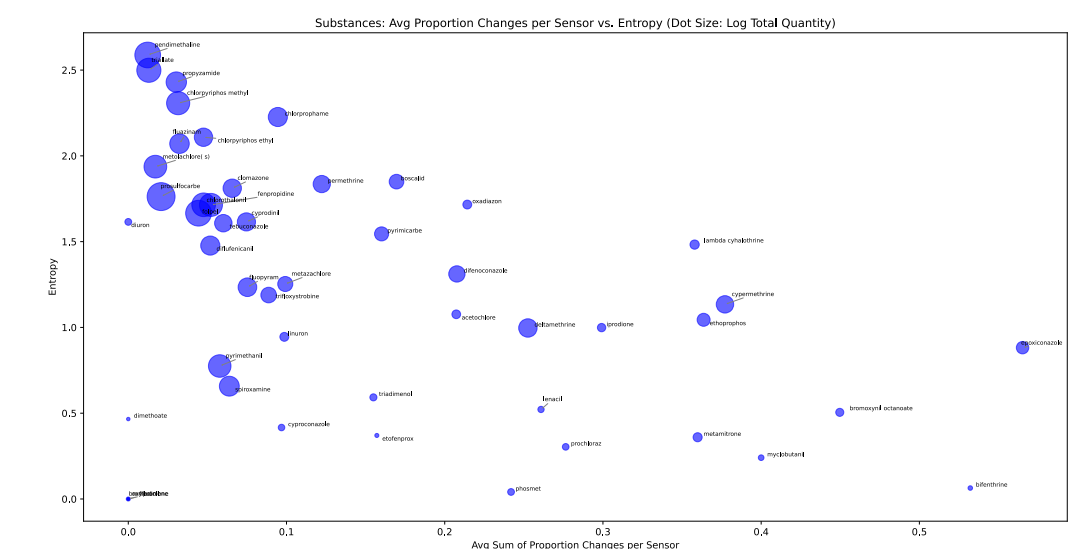
3. **Difference-in-Difference** analysis to assess the causal impact of pesticide exposure on health outcomes (risks of cancers, infant mortality, malformations).

Future Works

- Multivariate predictions for pesticides exposure using codependencies between crops types and pesticides.



(right) Hierarchical clustering of the CNEP molecules based on the codependencies (left) between crop types and substances.



Characterisation of molecules based on CNEP time series.

- Improvement of predictors with existing epidemiological studies for known pesticide impacts.

References

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