Machine learning-based NO2 estimation from seagoing ships using TROPOMI/S5P satellite data

Kurchaba, S.

Propositions

accompanying the thesis

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by Solomiia Kurchaba

1. Focusing on the larger emitters will increase the efficiency of the application and accuracy of ship emission monitoring using the TROPOMI instrument. (Chapter 3)
2. The size of the dataset is what primarily constrains the accuracy of currently determined detection limits, rather than the methodology or the sensor. (Chapter 3)
3. A plume is a far more abstract concept than “cats and dogs” that we usually encounter in visual machine learning. Therefore, to be able to detect it with a machine-learning algorithm, we first need to define it. (Chapter 5)
4. The application of multivariate data representation is essential for the task of ship plume detection. Information from the image domain, even though important, can be sacrificed. (Chapter 4)
5. The dispersion, chemical transformation, and non-rigid structure of an emission plume invariably result in some of its segments being under the visible detection limit of the combination of the TROPOMI instrument and the retrieval algorithm, intensifying the challenge of data labeling.
6. In contrast to expectations, only a limited subset of geographical locations is suitable for ship emissions monitoring with satellite-based technologies.
7. The application of satellite data for the selection of ships that should undergo inspection is a substantial technological advancement, as satellite-based measurements are the only available tools that can assess ships over time regularly and remotely.
8. The efficiency of operations of local authorities with regard to the enforcement of IMO regulations is highly dependent on the availability of measurements of real-world emissions from individual ships.
9. An attentive attitude toward scientific results is what differentiates effective policymaking institutions from “Mickey Mouse” organizations. (Reviewer-inspired)
10. The call for collaboration and collective efforts to address air pollution underscores the societal responsibility to protect the well-being of our planet and its inhabitants.

Solomiia Kurchaba
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