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Abstract title : **Use of Polyphemus Plume in Grid model to reproduce the full chemistry and physics of Particulate matter in industrial plumes. Applications and validation for Refinery during the TEMMAS project "Teledetection, Measure, Modeling of Atmospheric pollutants on industrial Sites"**

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Abstract text

The Polyphemus Plume-in-Grid (PinG) model, based on a 3D Eulerian model and a subgrid scaled Gaussian puff model was developed to represent the dispersion and transformation of air pollutants in industrial plumes. The PinG model computes the formation of secondary gases and PM in the plumes, resulting from the oxidation of emitted precursors in interaction with background pollutant concentrations. The model was improved to treat PM number concentrations, allowing a better representation of the ultra-fine fraction of PM concentrations. In comparison with the conventional CTM approach, this tool is able to provide a realistic assessment of the impacts of industrial sites in the first ten kilometers.

To improve the validation of the Plume In Grid Model, from the stack to the ground, a research project called TEMMAS (TEledetection, Measure, Modeling of Atmospheric pollutants on industrial Sites) was supported by the French environment agency (ADEME). The project included

two intensive measurement campaigns, which were conducted around a refinery in the south of France. The aim of these campaigns were to study the refinery PM microphysical signatures and its evolution with distance to the source in the first kilometers. During the campaigns different observation protocols of PM were deployed :

- sample collection inside the principal stacks and around the refinery.
- online measurements of microphysical properties of PM and trace gas concentrations;
- optical measurement : airborne hyperspectral imagery in the reflective domain,

According to the different techniques, two types of models were used, with different spatial resolutions, meteorological input (meso-scale meteorology or local measurements), and chemical transformations representations:

- The Polyphemus Plume-in-Grid (PinG) model, which results are compared to measured PM in the vicinity of the refinery in terms of gas, PM mass and number concentrations, as a function of particle sizes and PM chemical compositions.

- The Safety LAgrangian Model (SLAM), a lagrangian non reactive dispersion model using pre calculated CFD winds fields. The fine resolution (meter) allows to reproduce complex flows in industrial installations. This approach is better fitted for the comparison of the local scale plume dispersion with optical imaging.

Motivation

The Motivations for the presentation are multiple :

- Have the most complete evaluation possible of an industrial site impact by integrating all pollutants (primary and secondary).
- With a Chemical Transport Model, be on a scale representative of the impact of a site.
- to improve and validate the evolutions of modelizations close to the sources of emission which are compatible with the means of measurements (ground, remote sensing …).
- More specifically for particles, model information in mass, nature and number in industrial plumes that are validated by measurements.

Theses topics are in Model evaluation and quality assurance : model validation & reduction of uncertainties.
The global objective is to improve the Environmental impact assessment.