

This manuscript describes a bottom-up estimation of methane emissions caused by a gas leak in the Nord Stream pipeline system. Given the methane's climate-forcing aspect and current geopolitical situation, it addresses a relevant topic. It can contribute to advancing the field of emergency management for large-scale events, particularly for atmospheric releases not yet described in scientific literature. The approach makes use of available concepts and tools to provide emission estimations and set up a dataset for evaluating atmospheric dispersion simulations for assessing the impact of such releases.

General comments:

The manuscript is well-written and thoroughly describes the steps and caveats of estimating the methane emissions leaking from the pipes. However, the discussion needs to compare the emission estimates by the method described and other estimations available in the literature, such as the referred Sanderson (2022) and other work not referred to in the text, such as Jia et al. (2022). The conclusions are vague, not providing the values obtained when applying this methodology and how much it deviates from the observations used to validate this study.

Some aspects needing consideration are described in the specific comments below.

Specific comments:

- Section 2.1 needs to include the SILAM model's spatial (including vertical) and temporal resolution. The different set-ups of the model are described in Section 6, but it may be worth describing it here instead.
- Section 2.3 When describing the stations, add the abbreviation to be shown in the figures, etc., making it easier to identify the stations. The authors should use these abbreviations in Section 6.
- Section 3, Figure 2 presents similar colours for 2m and 96 h.
- Section 6:
  - Figure 8 has much valuable information in a very condensed way. However, it can be challenging to distinguish the deltas from the different injection heights, making it hard to understand the performance of FRP vs prescribed heights. The Figure caption is missing something at the end.
  - Add the short name of the model set-up to the captions of Figures 9-11.
  - line 296: is the term cloud correct here?
  - line 299: "in the morning 29.9", do you mean 27.9?
  - line 319: "excess methane at 30 m", do you mean 50 m?
  - How much will the difference in the spatial domain in VHires affect the recirculation of the plumes?
- Section 7:
  - Why 3x95,000 tons and not 285 000 or 285kT?
  -

Reference: Jia et al (2022) <https://www.sciencedirect.com/science/article/pii/S2666498422000667>