Deep Learning can be leveraged to probabilistically infer release parameters from an unknown atmospheric source.

1 – 3: FLEXPART-WRF and GOF

- Single-run WRF output drives 20,000 member FLEXPART ensemble
- The STE searches for release locations everywhere within the search domain
- The goodness-of-fit between observations and a given ensemble member is computed with Spearman’s rank correlation, \( r \), and a modified \( f_1 \) score that allows for regression.

4 – 6: Deep Learning and Bayes’ Thm

A fully-connected NN is trained to map any combination of source parameters \( \theta \) to their cost \( J \). The architecture is dynamically optimized.

**CONCLUSIONS**

- The regression \( f_1 \) score and the Spearman rank \( r \) robustly and resiliently gauge the disparity between model and observational data.
- The inversion algorithm is robust and able to accurately estimate the source for the majority of the randomly configured sensor networks.
- The large ensemble of forward model runs and the extensive STE evaluation are both computationally expensive. The work would have been very difficult without the computational resources available at LLNL.

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