Development of a high-fidelity emulator of a full physics model for dense observing systems in atmospheric science

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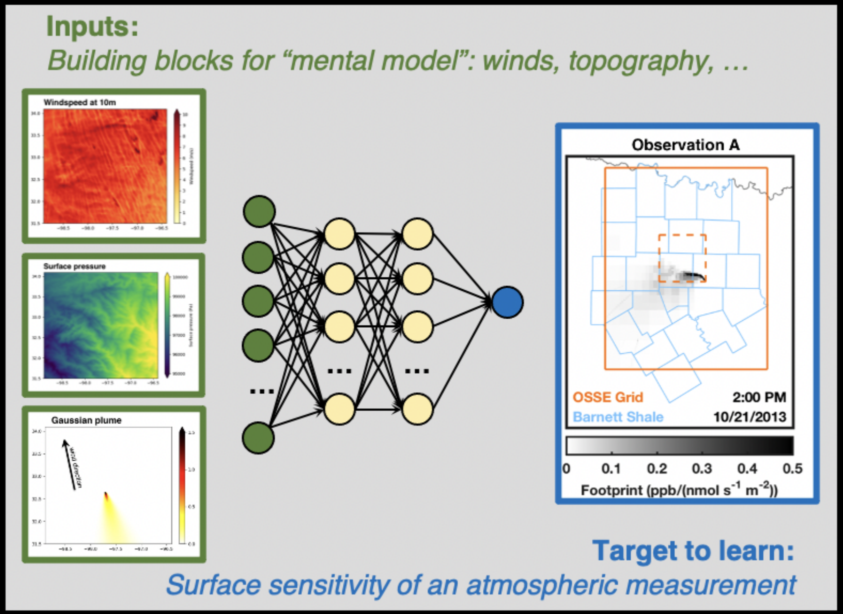
Research Objectives

- *Goal:* Develop a neural network with an encoder and decoder to predict the surface sensitivity of an atmospheric measurement.
- *Innovation:* This research will help interpret dense atmospheric measurements from next-generation observing systems. It may allow researchers to use these measurements to study important phenomena such as greenhouse gases point sources.
- *SOA:* Currently researchers run a (slow) full-physics model, this becomes computationally intractable for dense observing systems.
- *TRL:* Project is starting at TRL 1, this grant will bring the work to TRL 3.

Problem: *It is computationally expensive to compute the surface sensitivity of measurements from dense observing systems*



Result: *An emulator for surface sensitivities of dense observing systems (e.g., geostationary satellites and urban networks)*

Approach

This work will use the weather research and forecasting model (WRF) and the Stochastic Time Inverted Lagrangian Transport (STILT) model for the full-physics model. It will use a neural network with an encoder and decoder. It will be evaluated with k-fold cross validation.

Potential Impact

There has been a proliferation of dense observing systems such as geostationary satellites. Determining their surface sensitivity (i.e., *"what is the spatial region that influences our measurement?"*) is quickly becoming a computational bottleneck in using these measurements. Our work will advance the tools needed to interpret dense observations. This will allow researchers to address evolving scientific questions about emissions from point sources.