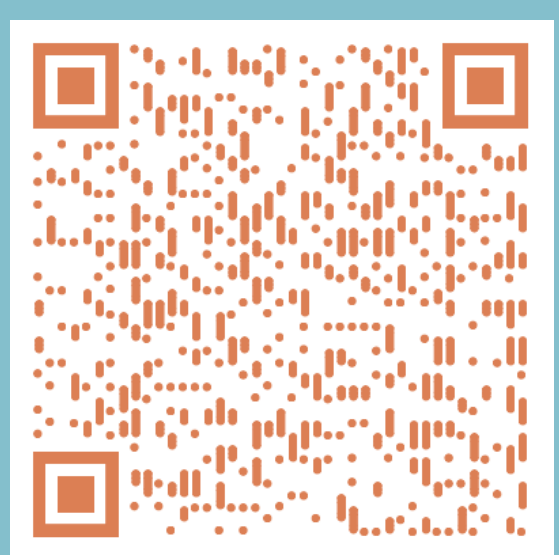
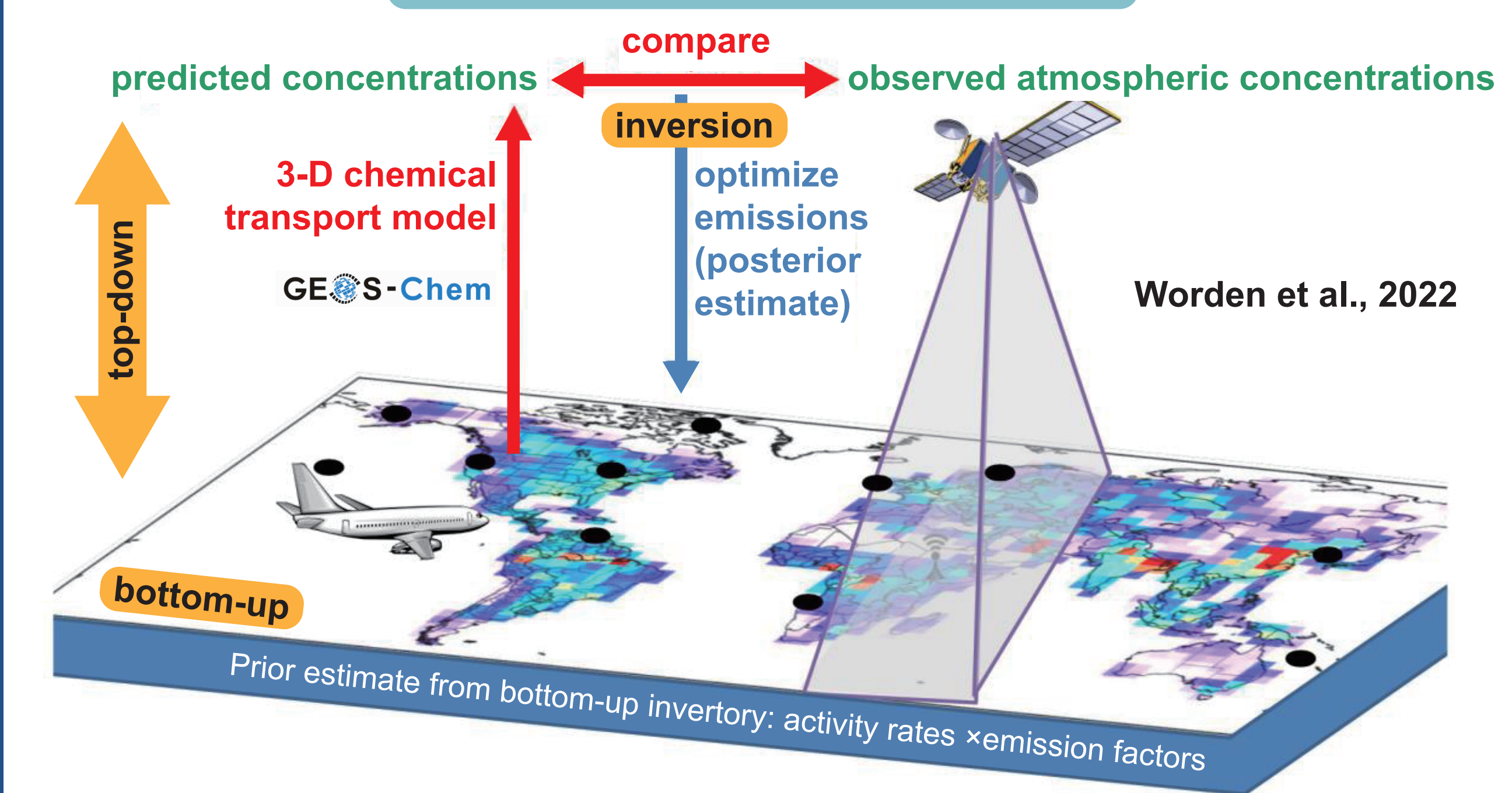


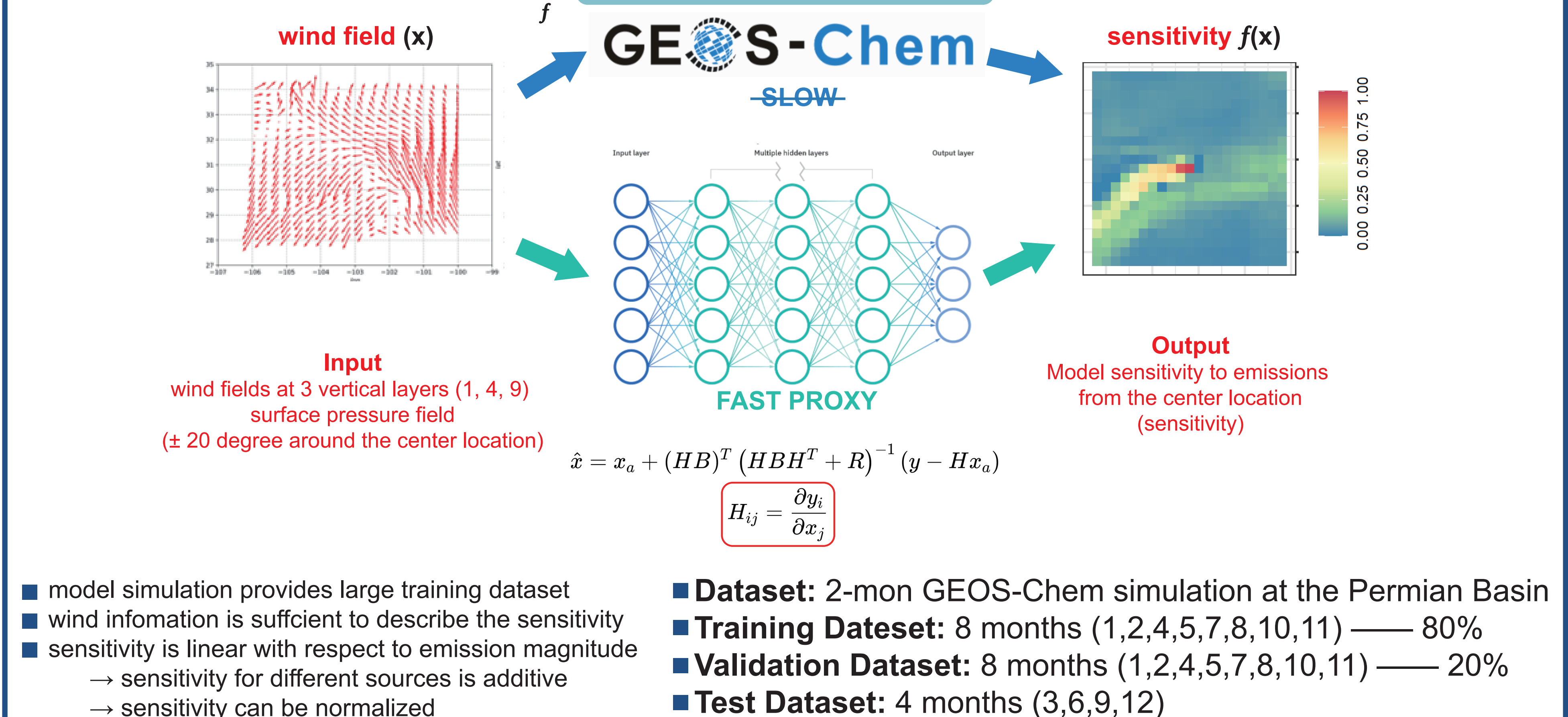


Research Background



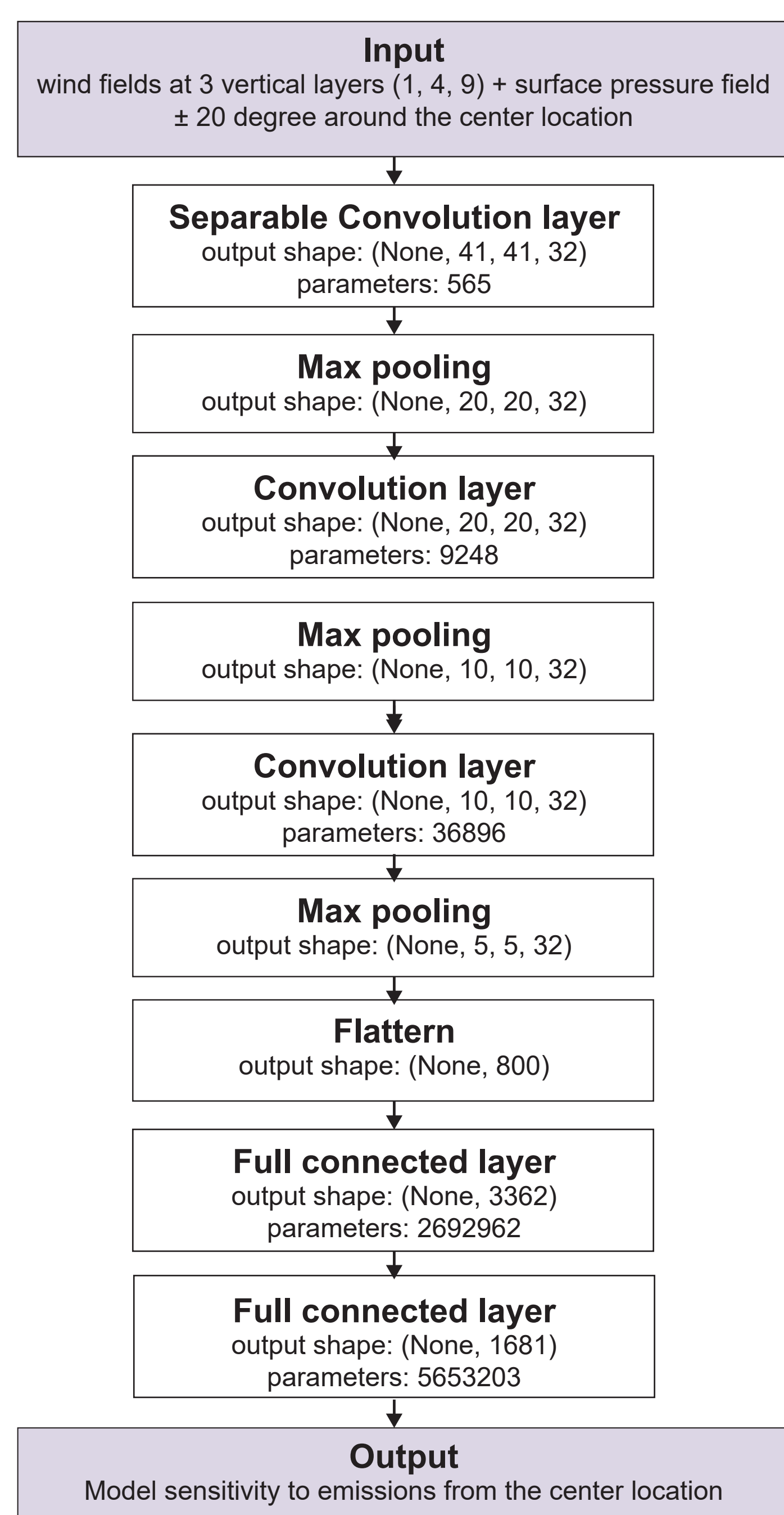
- Large volume of satellite data
- However, current methods still have some computational limitations.
- Jacobian matrix calculation:
computing resources↑, storage space↑, inversion speed↓

Method and Data

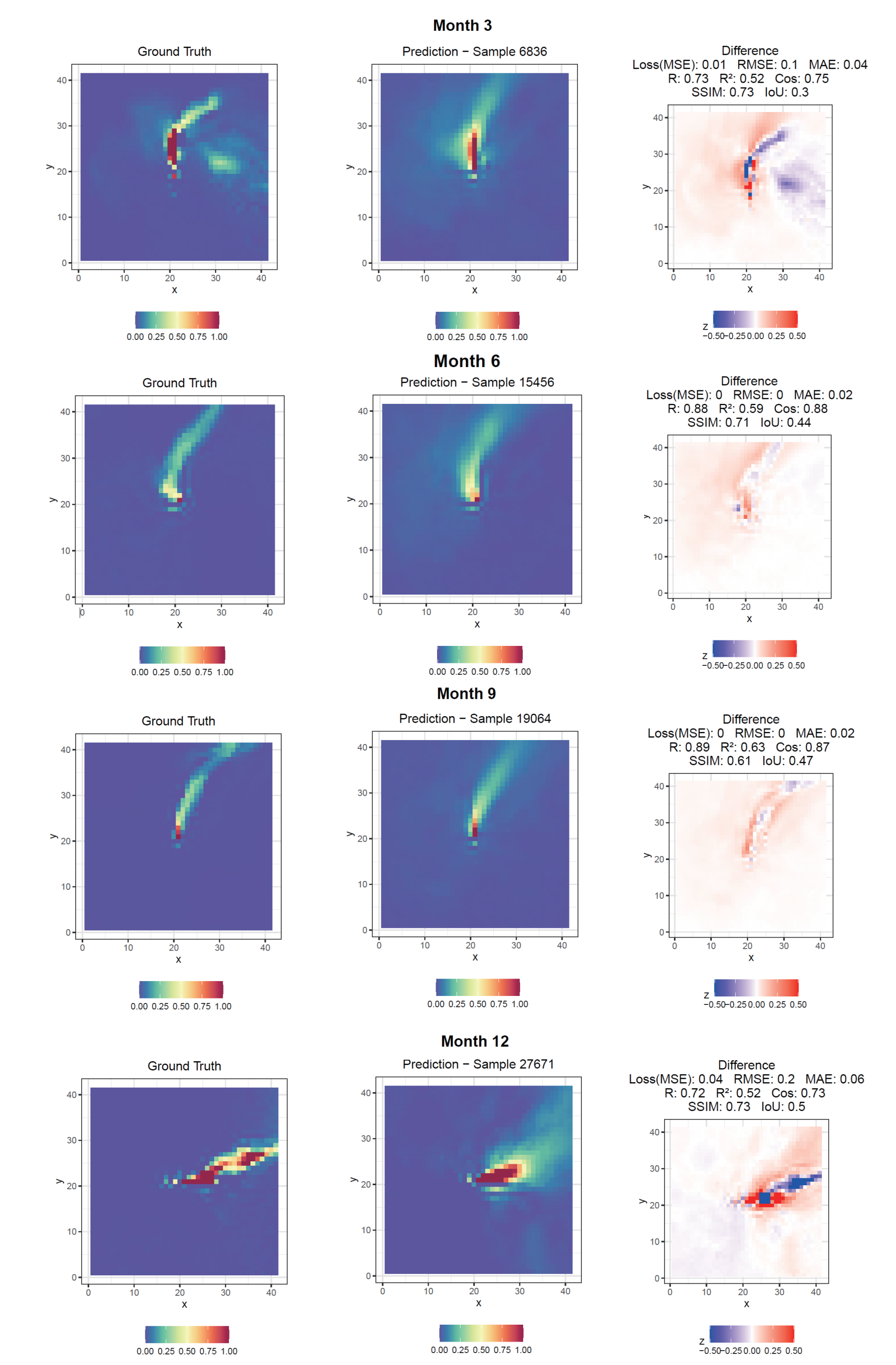
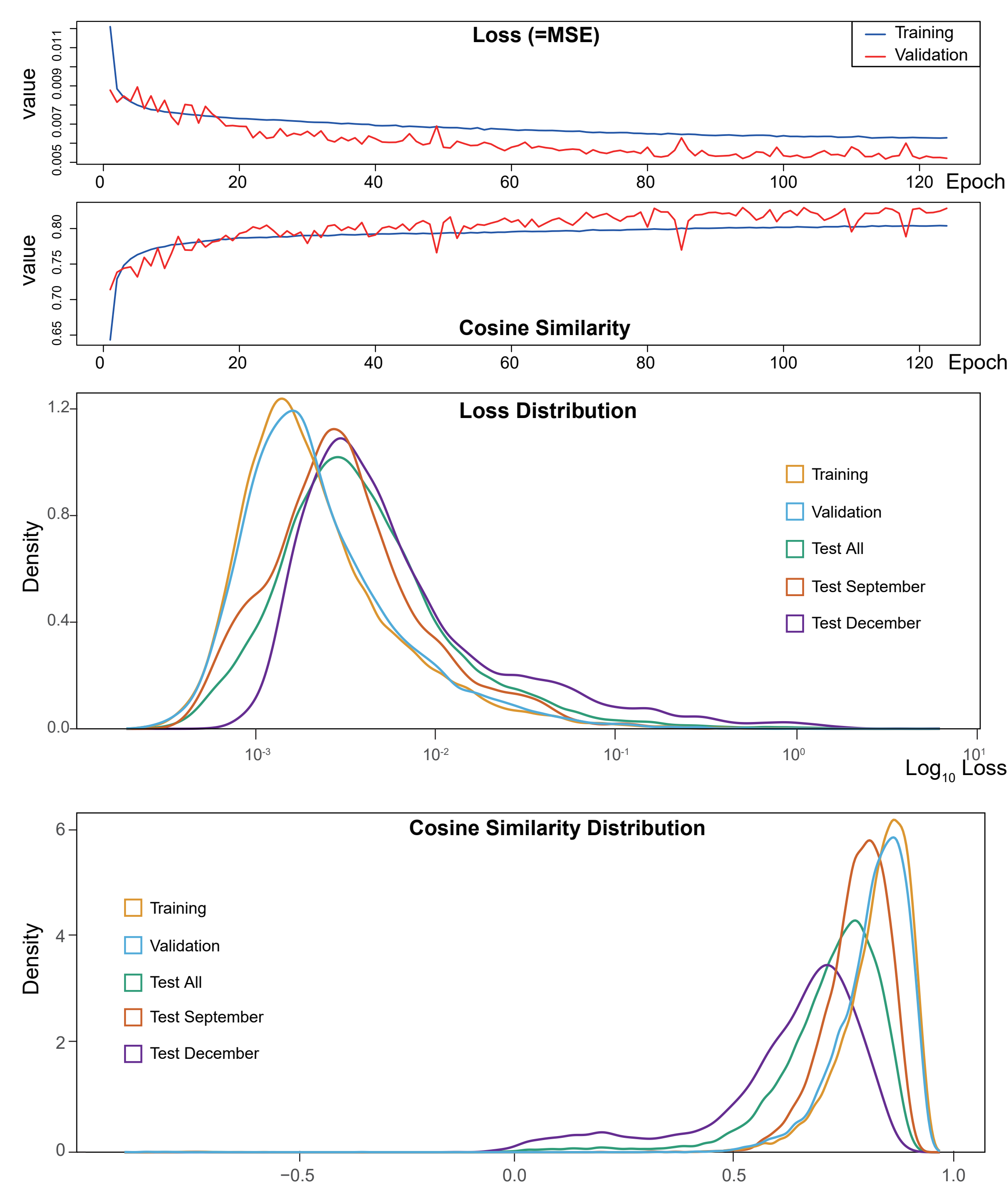


- model simulation provides large training dataset
- wind information is sufficient to describe the sensitivity
- sensitivity is linear with respect to emission magnitude
 - sensitivity for different sources is additive
 - sensitivity can be normalized
- Dataset: 2-mon GEOS-Chem simulation at the Permian Basin
- Training Dataset: 8 months (1,2,4,5,7,8,10,11) — 80%
- Validation Dataset: 8 months (1,2,4,5,7,8,10,11) — 20%
- Test Dataset: 4 months (3,6,9,12)

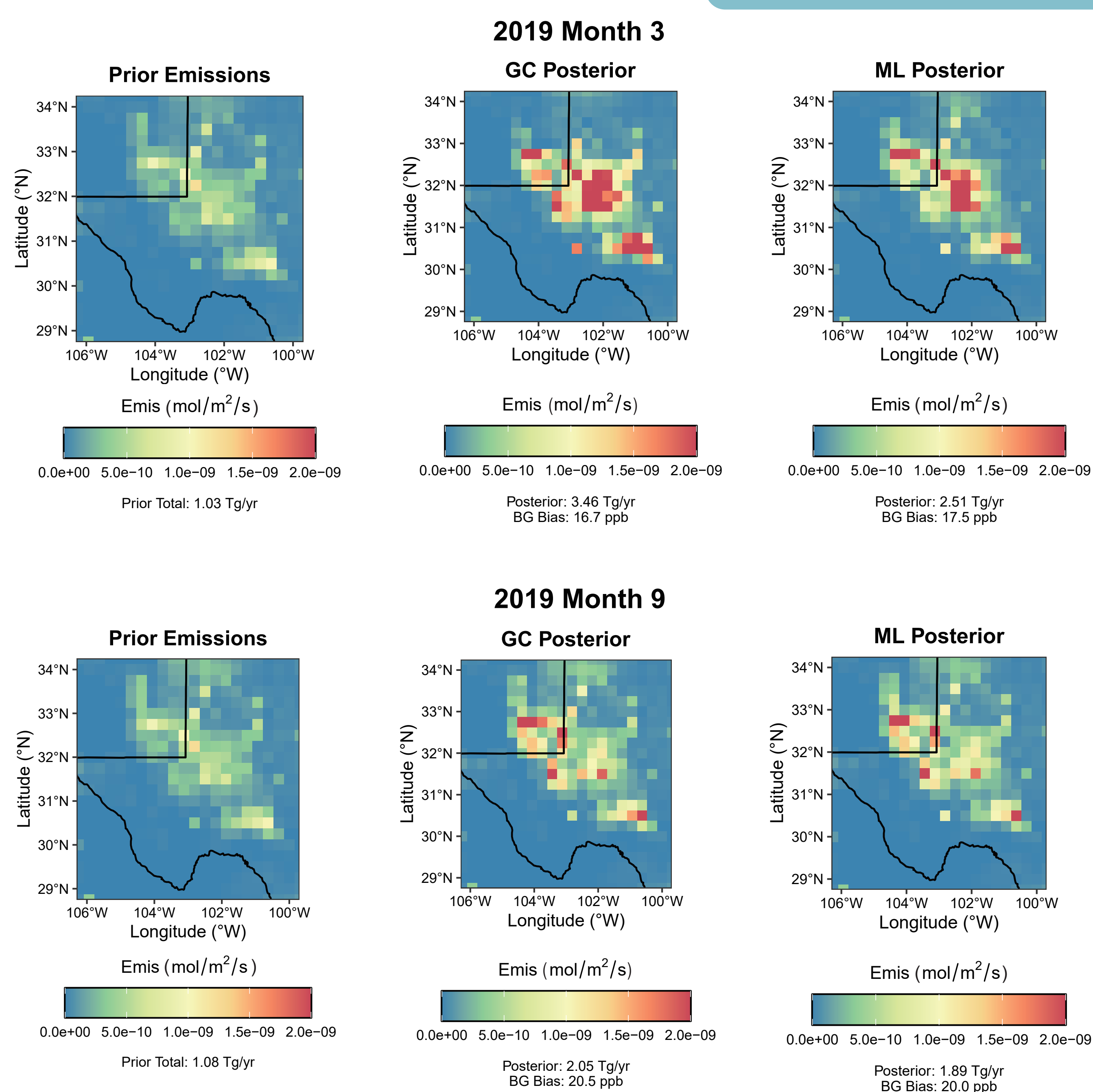
Machine Learning Framework



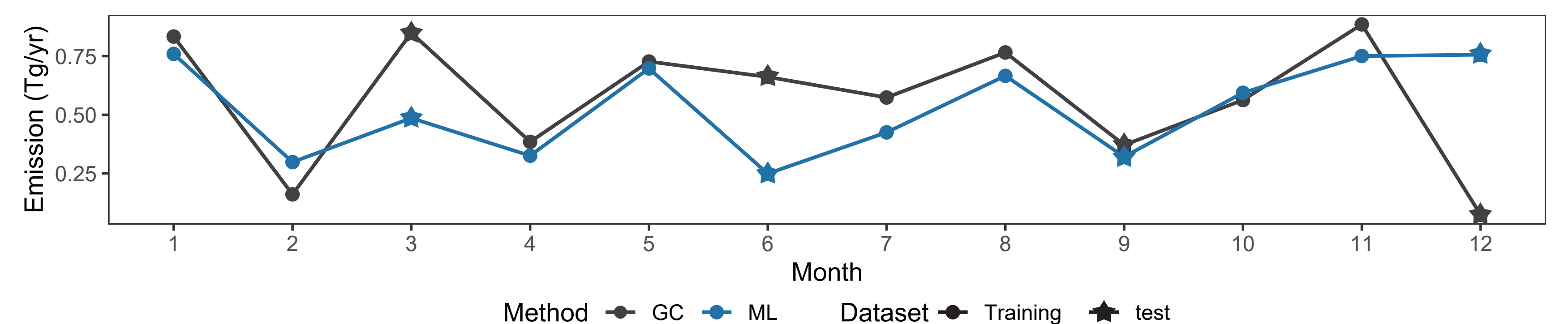
Model Performance



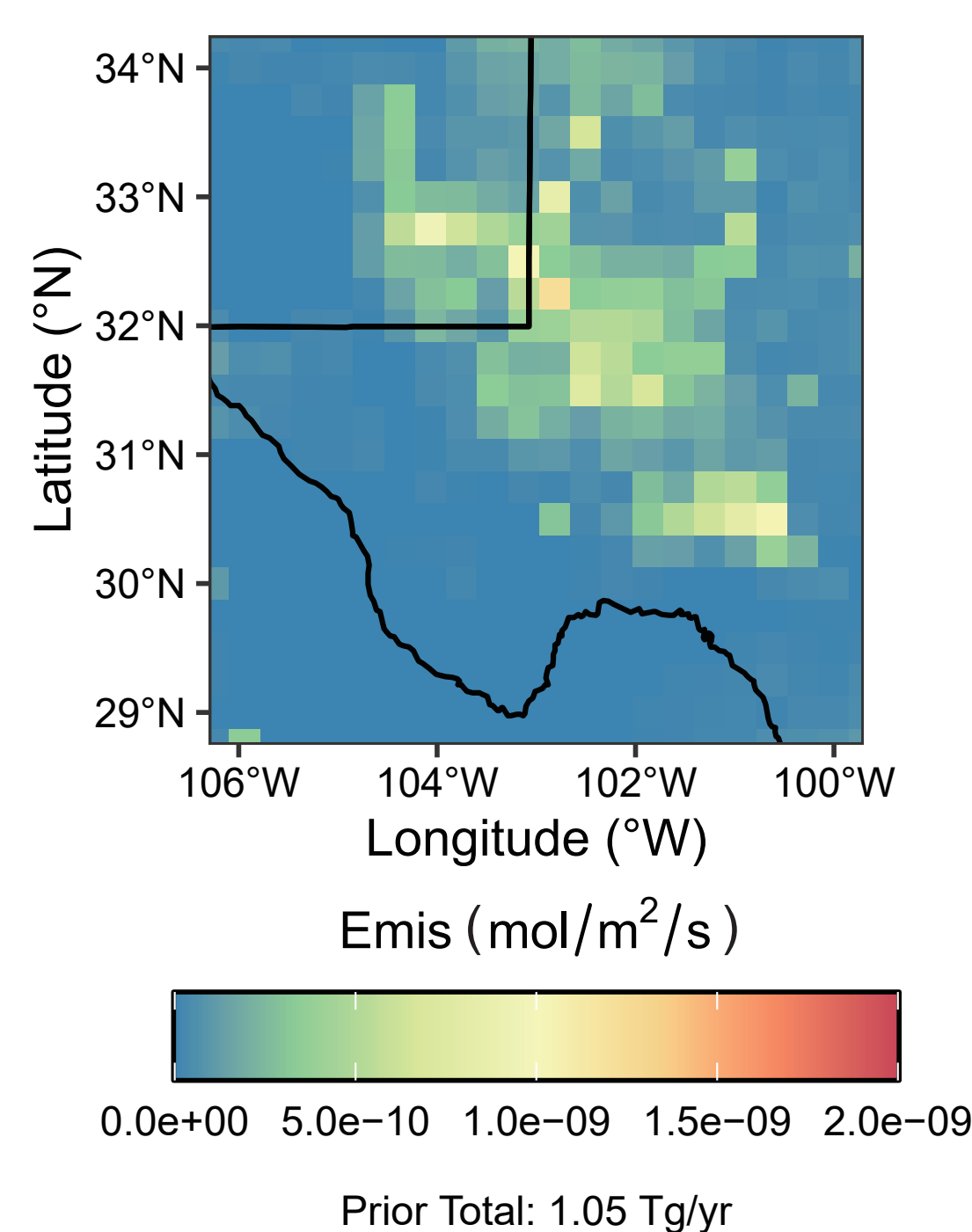
Comparison of Inversion Results between GC and ML



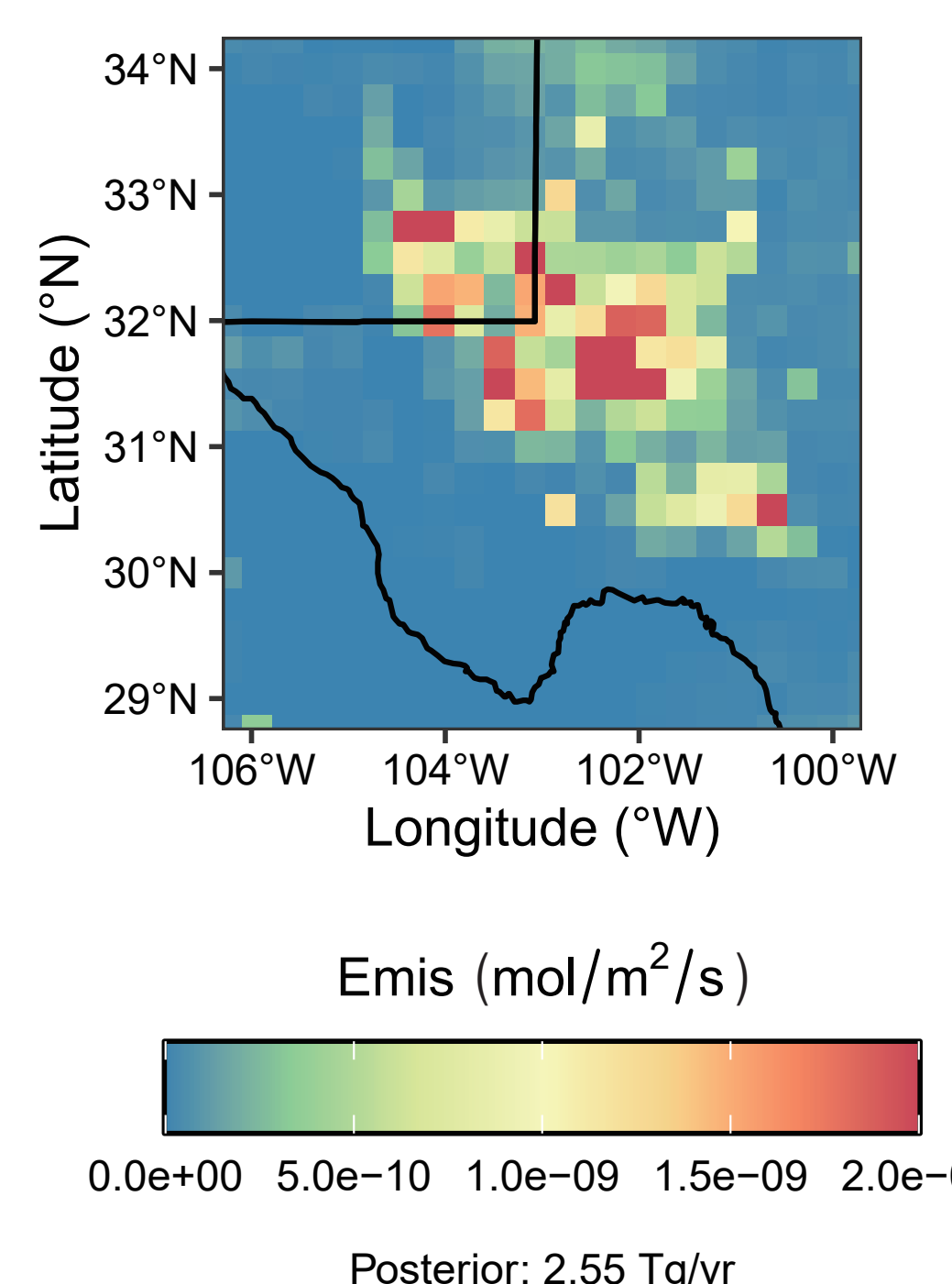
Monthly Methane Emissions (2019) Permian Basin Inversion Results



Annual Mean Prior Emissions



Annual Mean GC Posterior



Annual Mean ML Posterior

