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GEMS and TEMPO Bias Correction with TROPOMI

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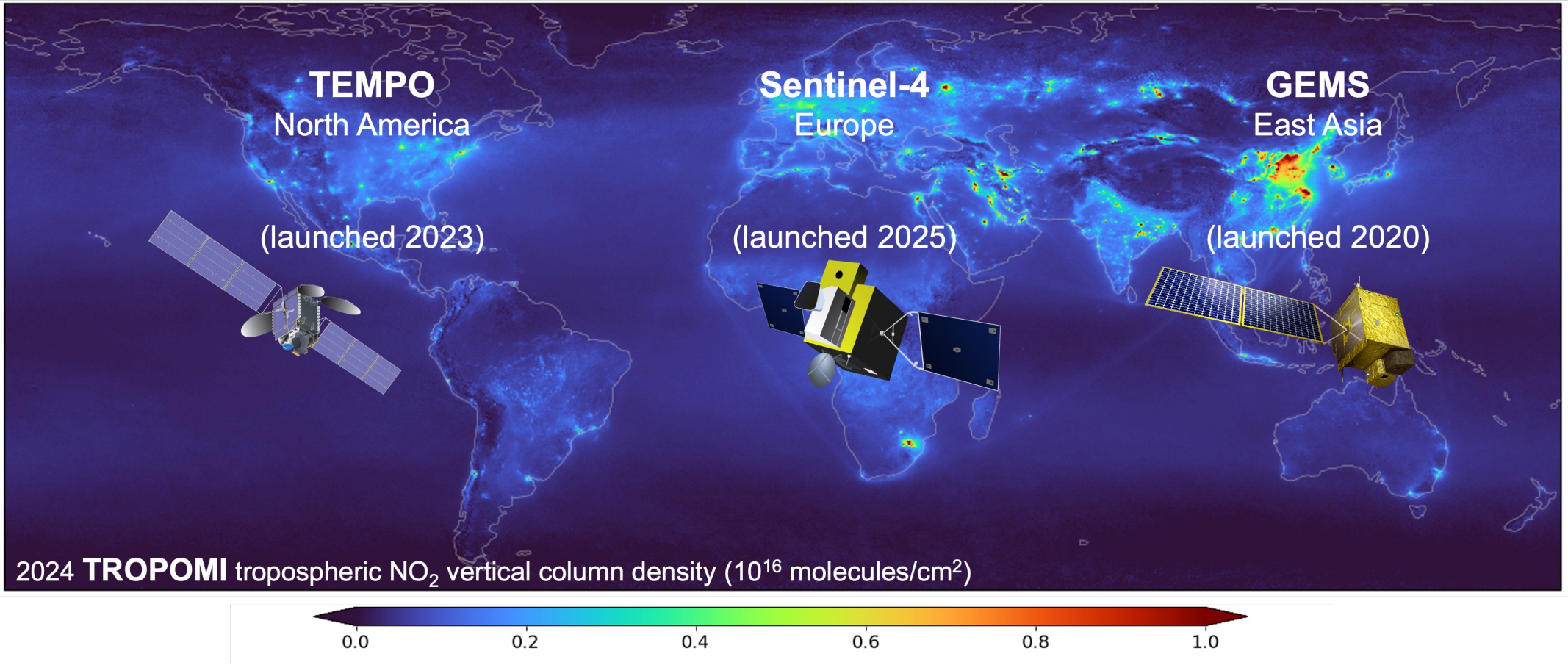
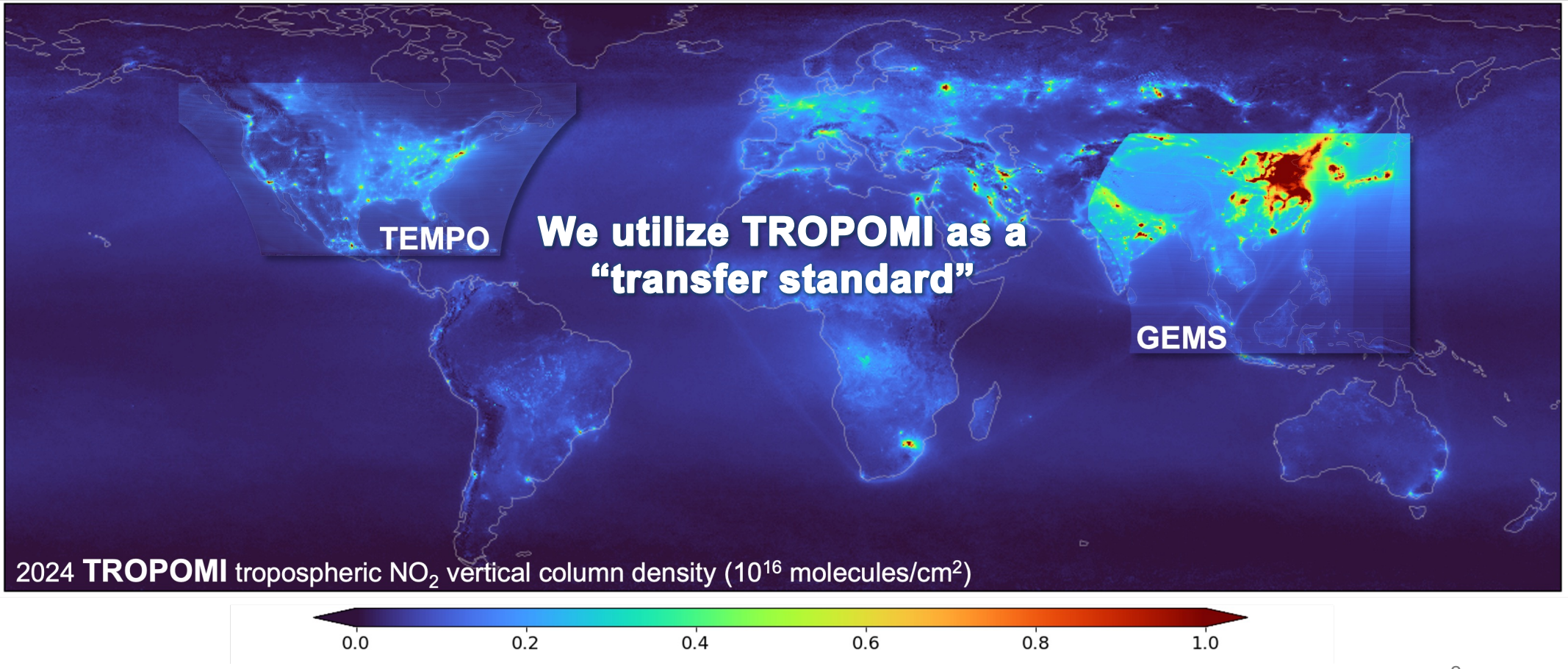
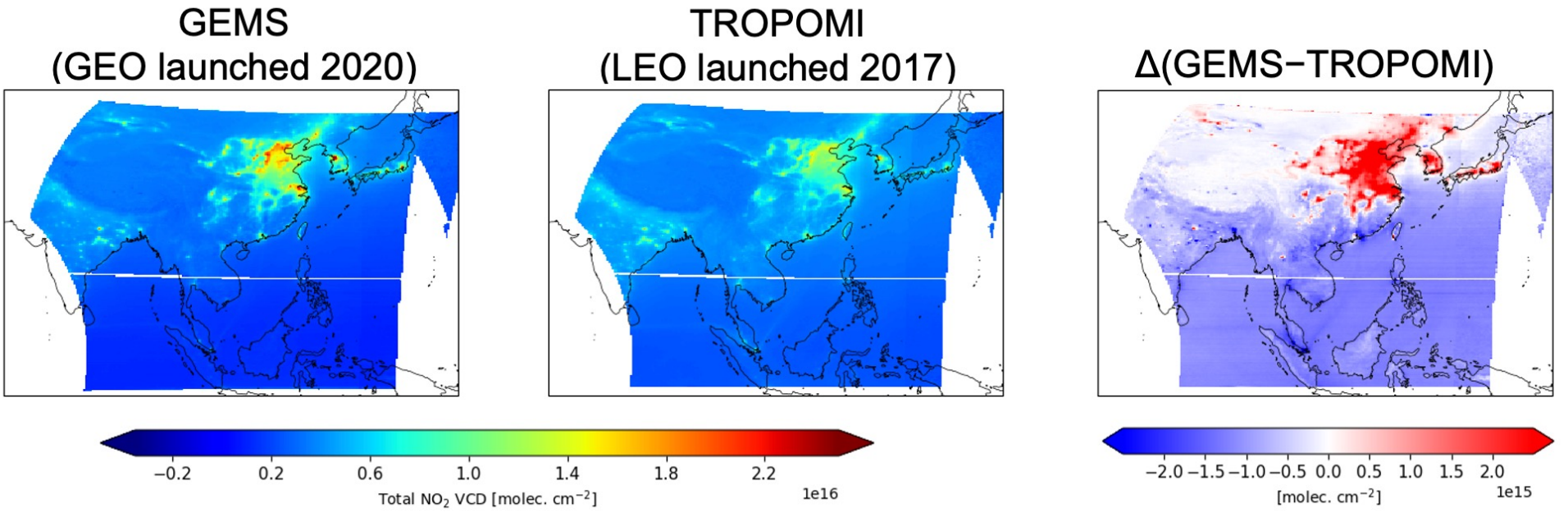
GEO ring for air quality monitoring now covers most of NH



Inter-mission consistency is important, but new satellite algorithms take some time to mature



Improving and calibrating new satellite retrievals to mature instruments using machine learning (ML)

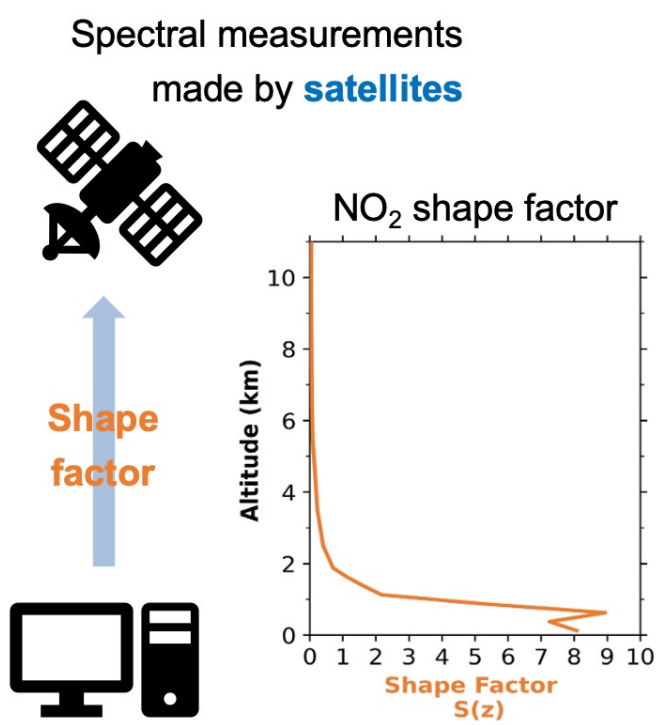


GEMS has greater observation density (hourly 08:00-16:00 LT) than TROPOMI (daily 13:30 LT) but retrievals are less mature

Local Time (LT)

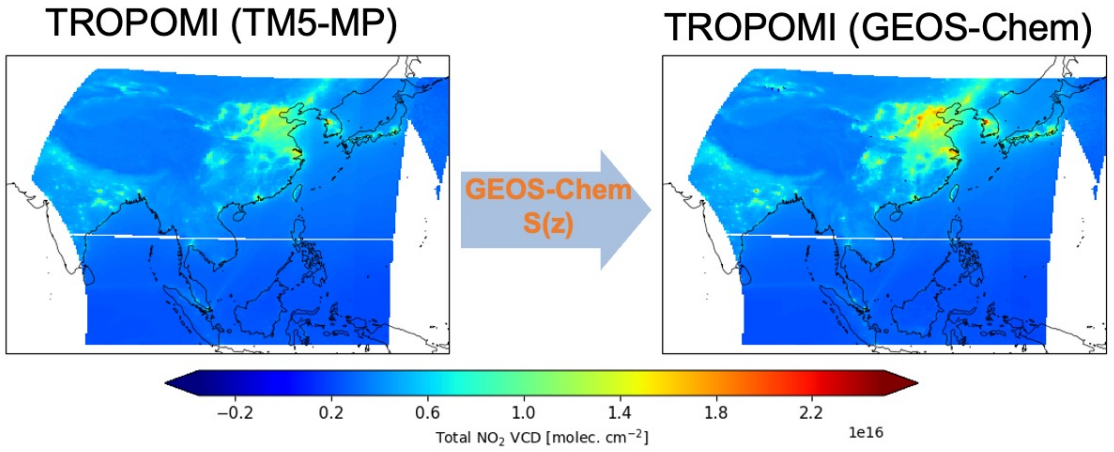
Oak et al. (2024), *AMT*

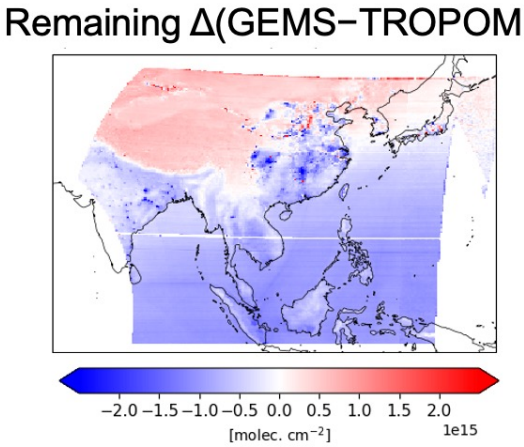
First step is to use consistent vertical profile information for satellite retrievals (reprocessing AMF)



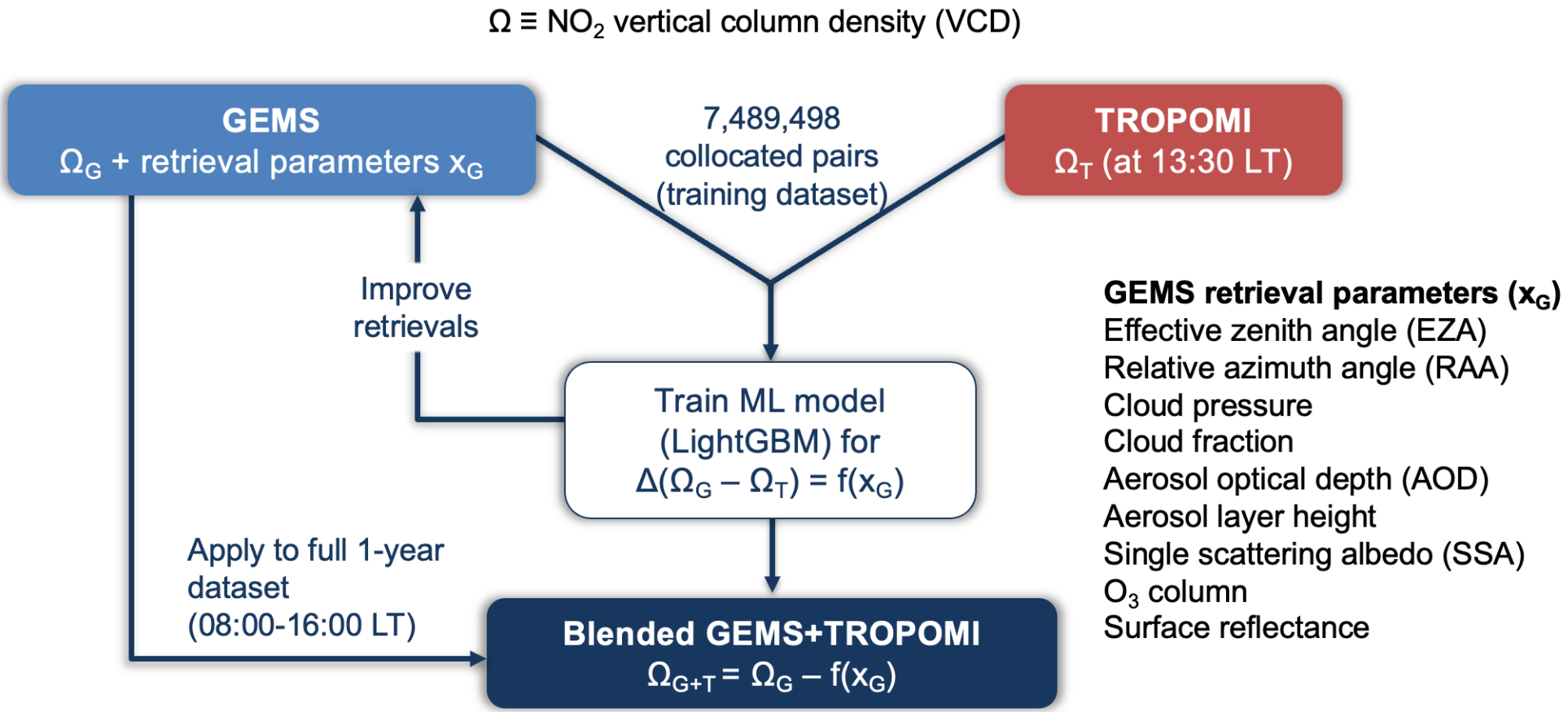
Vertical profiles simulated by **CTMs**

(GEMS: GEOS-Chem, TROPOMI: TM5-MP)

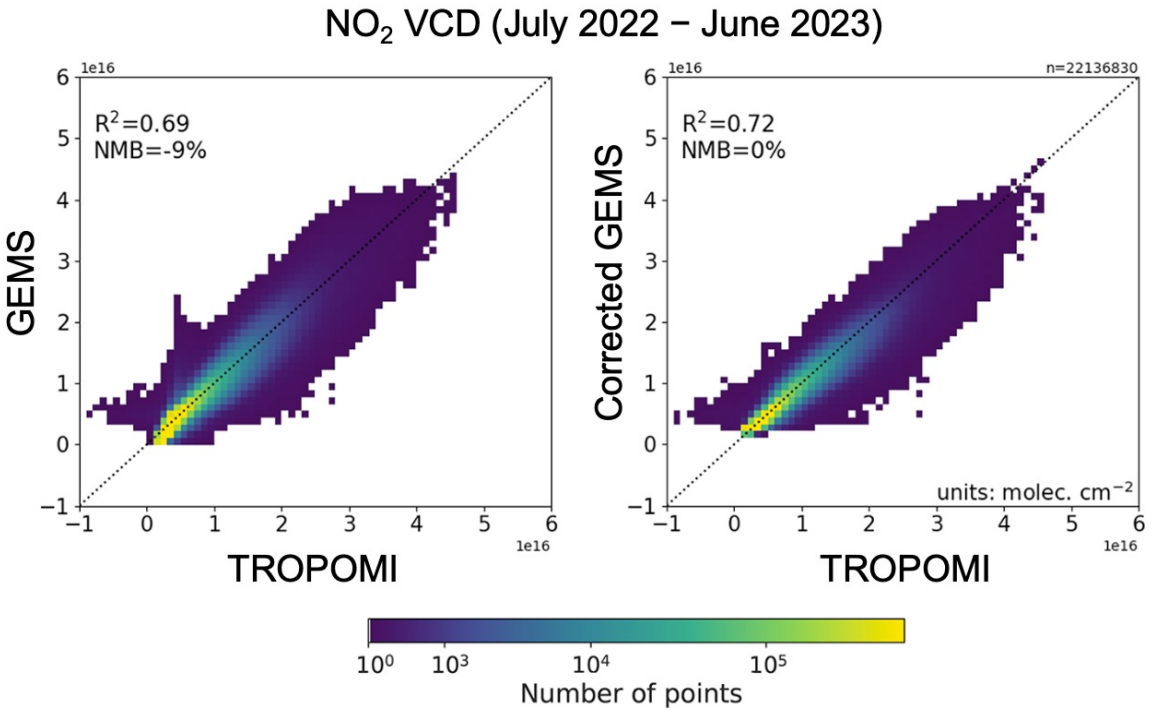


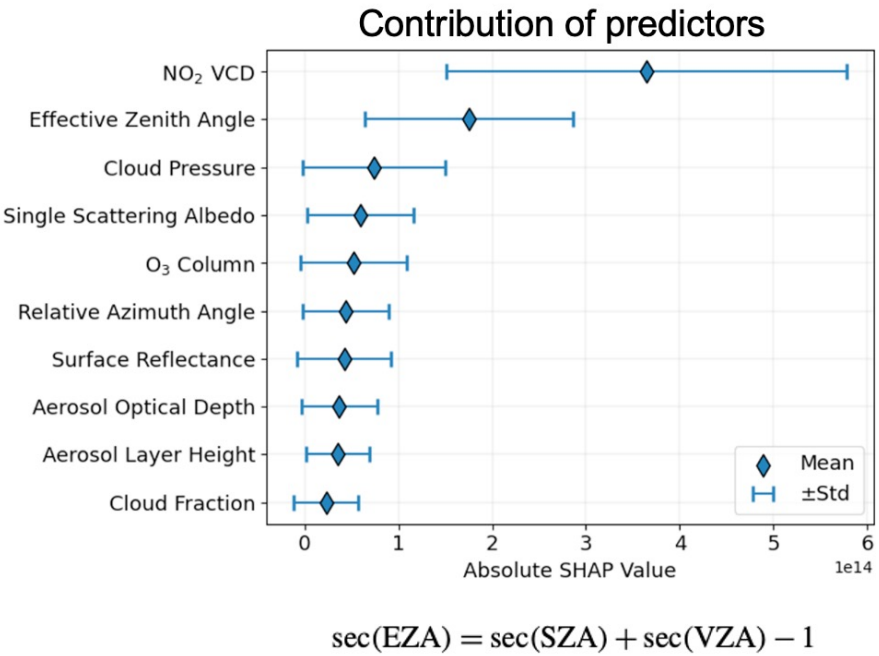


ML fits remaining biases enabling inter-mission consistency while preserving data density



GEMS NO_2 bias correction using machine learning

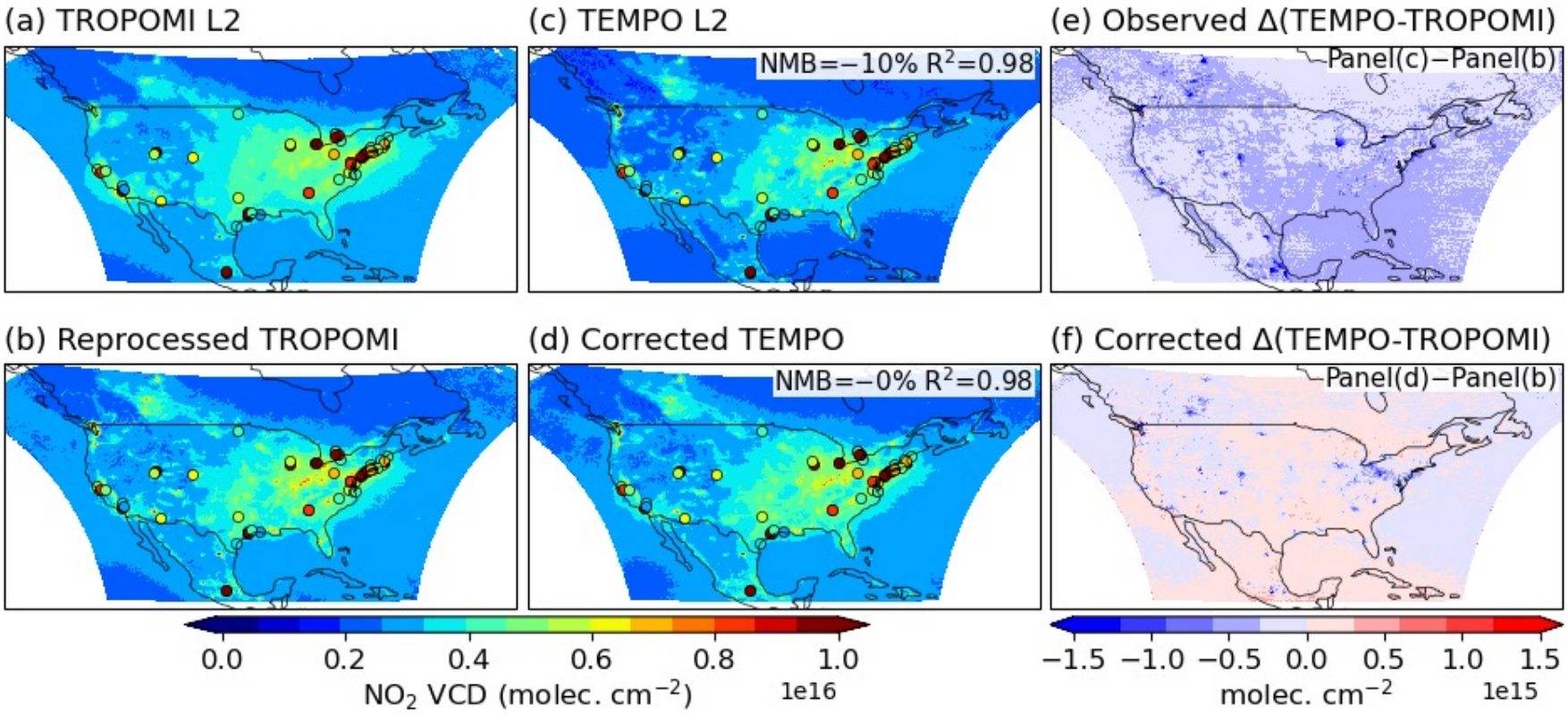




$$\sec(\mathrm{EZA}) = \sec(\mathrm{SZA}) + \sec(\mathrm{VZA}) - 1$$

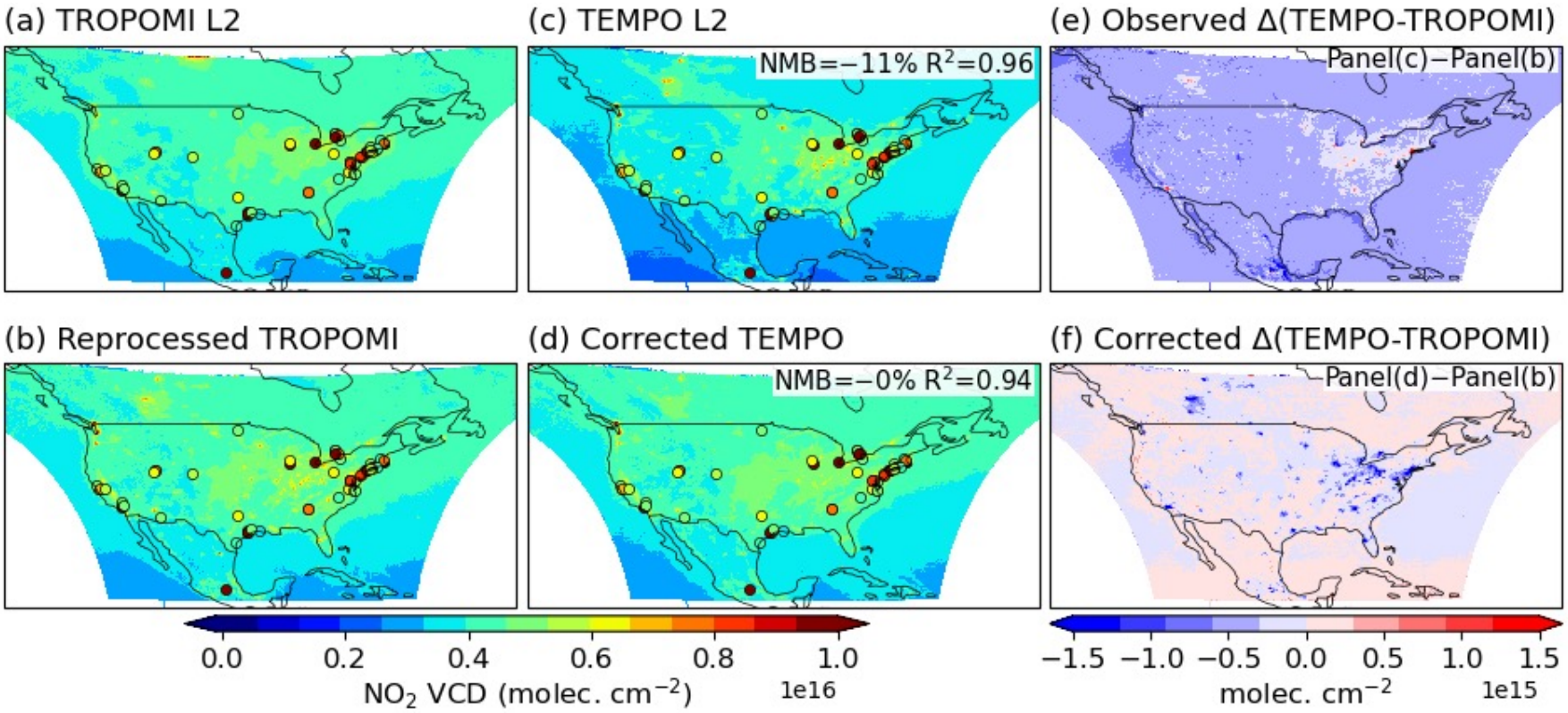
*GEMS version2.0 L2 product

Same application to TEMPO NO_2 (Jan-Mar, Oct-Dec 2024)



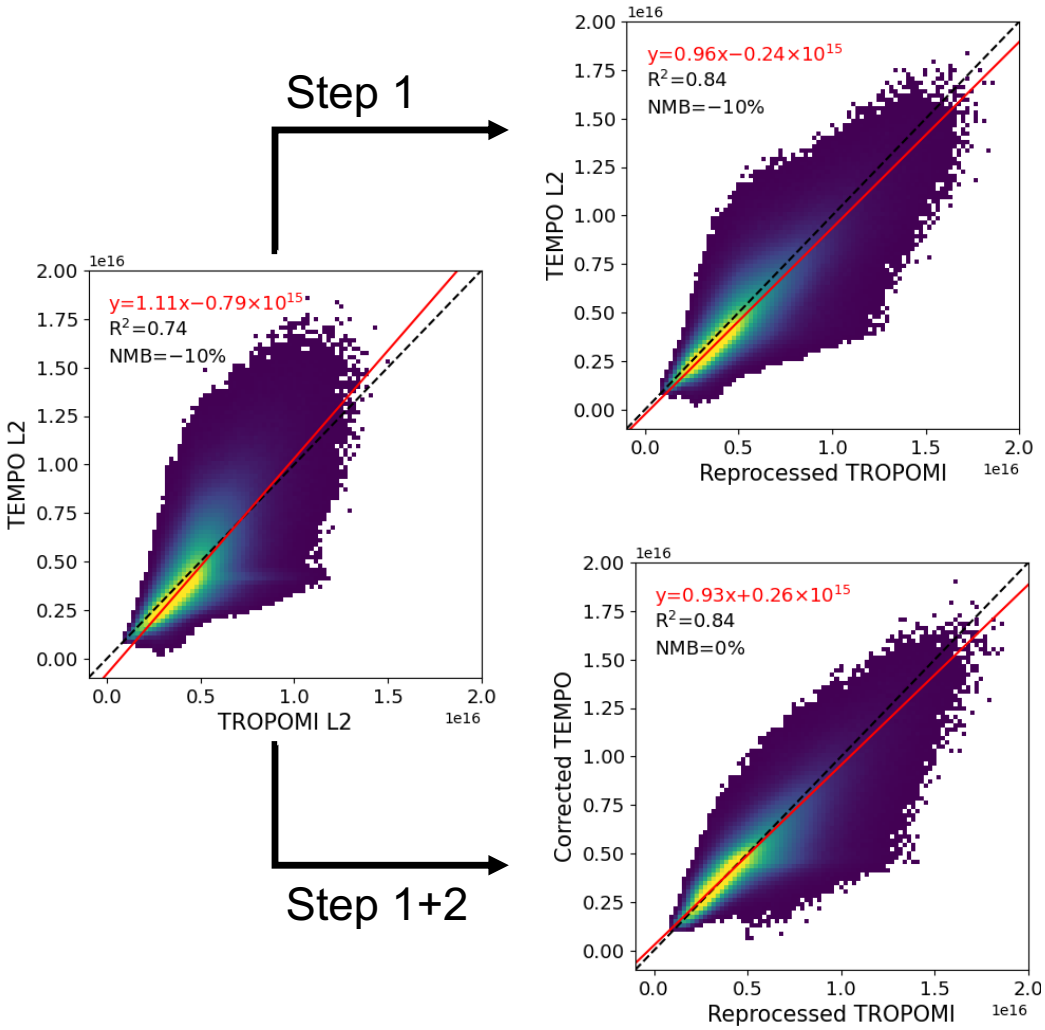
*TEMPO version3.0 L2 product

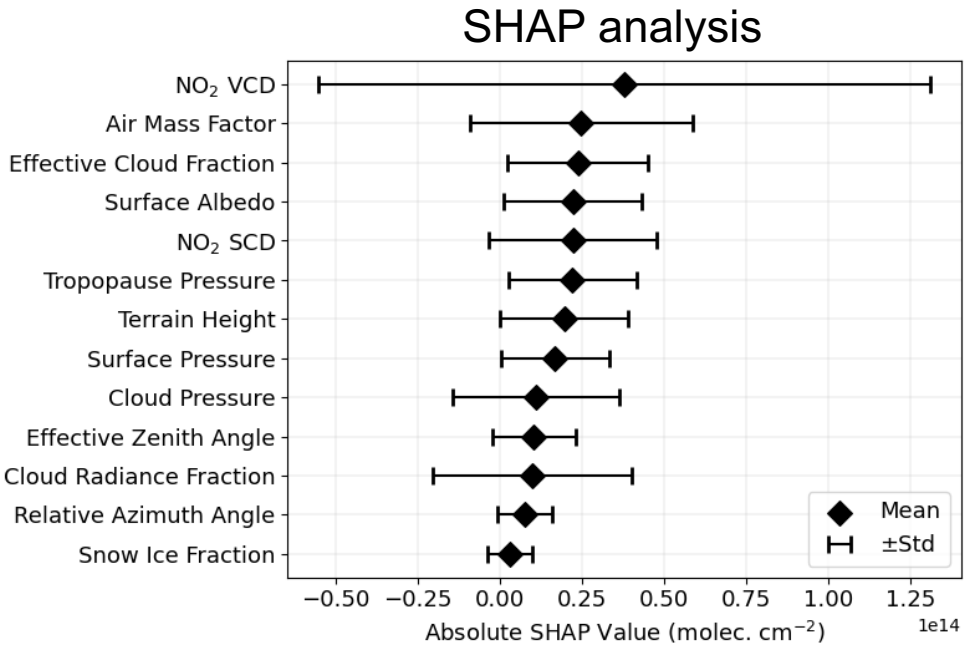
Same application to TEMPO NO_2 (Apr-Sep 2024)



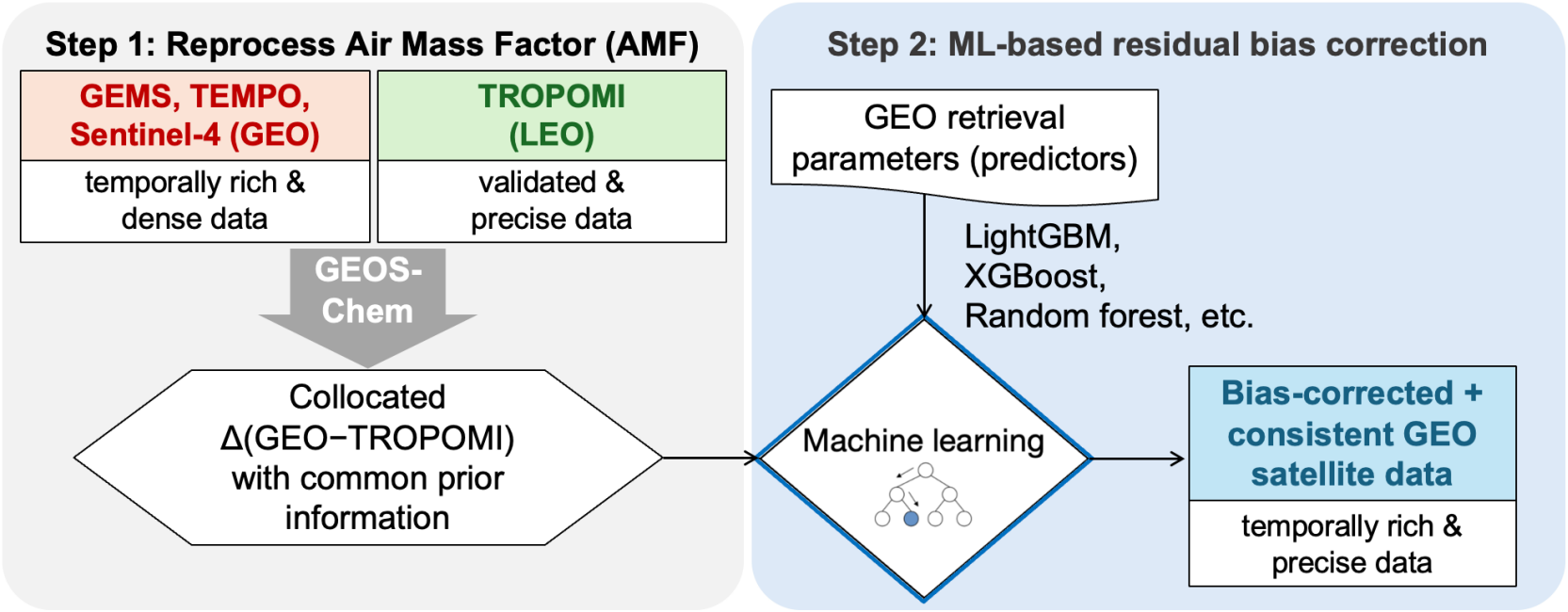
*TEMPO version3.0 L2 product

Contribution of predictors (TEMPO retrieval parameters)





Summary and takeaways



- **Used ML to calibrate GEO data using TROPOMI as a transfer standard**
- **TEMPO's low bias (~10%) is successfully reduced**
- **Application on GEO ring (GEMS, TEMPO, Sentinel-4) enables reliable joint analyses with LEO satellites**

For more details see **Oak et al. (2024)**, *AMT*

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