Comments on Selected AERMOD Model Development and Implementation Issues

13th Conference on Air Quality Modeling

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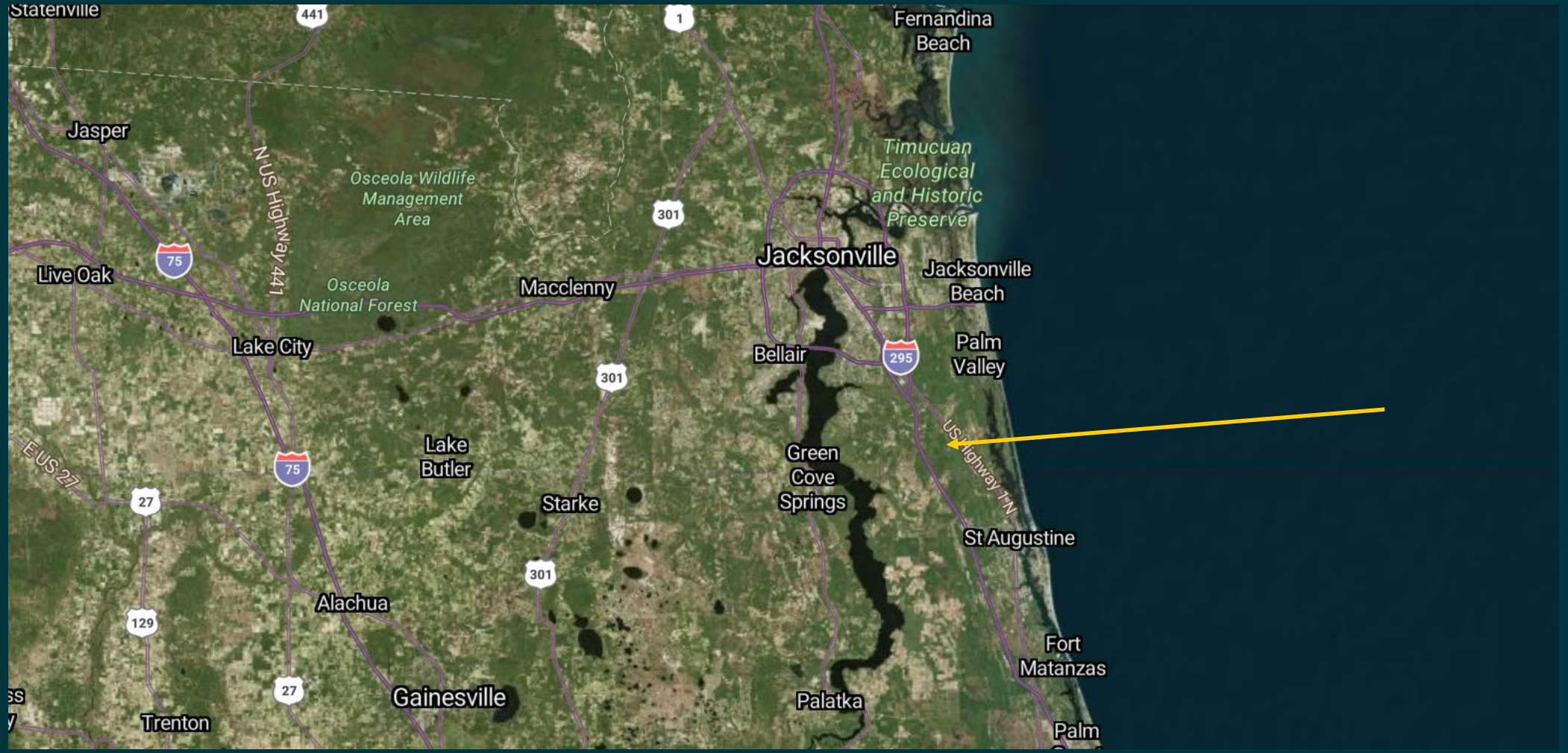
Overview

- Shoreline issues with installing OCD features in AERMOD
- Creating maps of estimated criteria pollutant concentrations from existing emission sources to assist in background concentration estimates
- Accounting for retirements of emission sources for monitored background assessments
- Accounting for reductions in precursor emissions in modeling of secondarily-formed PM2.5 or ozone

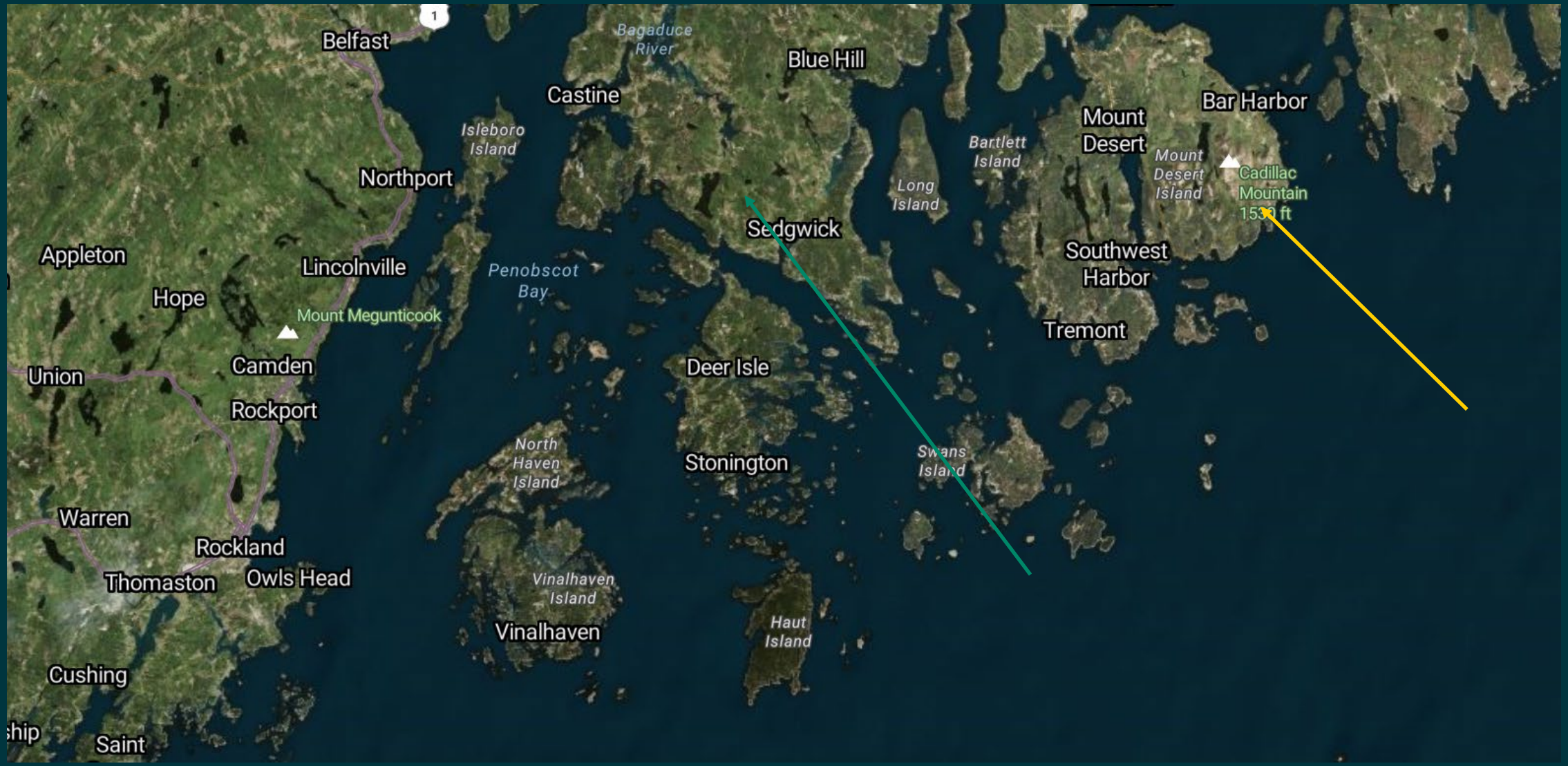
Note: these comments are my own and do not necessarily represent the views of AECOM or any client of AECOM.

Complications with shoreline definition in OCD

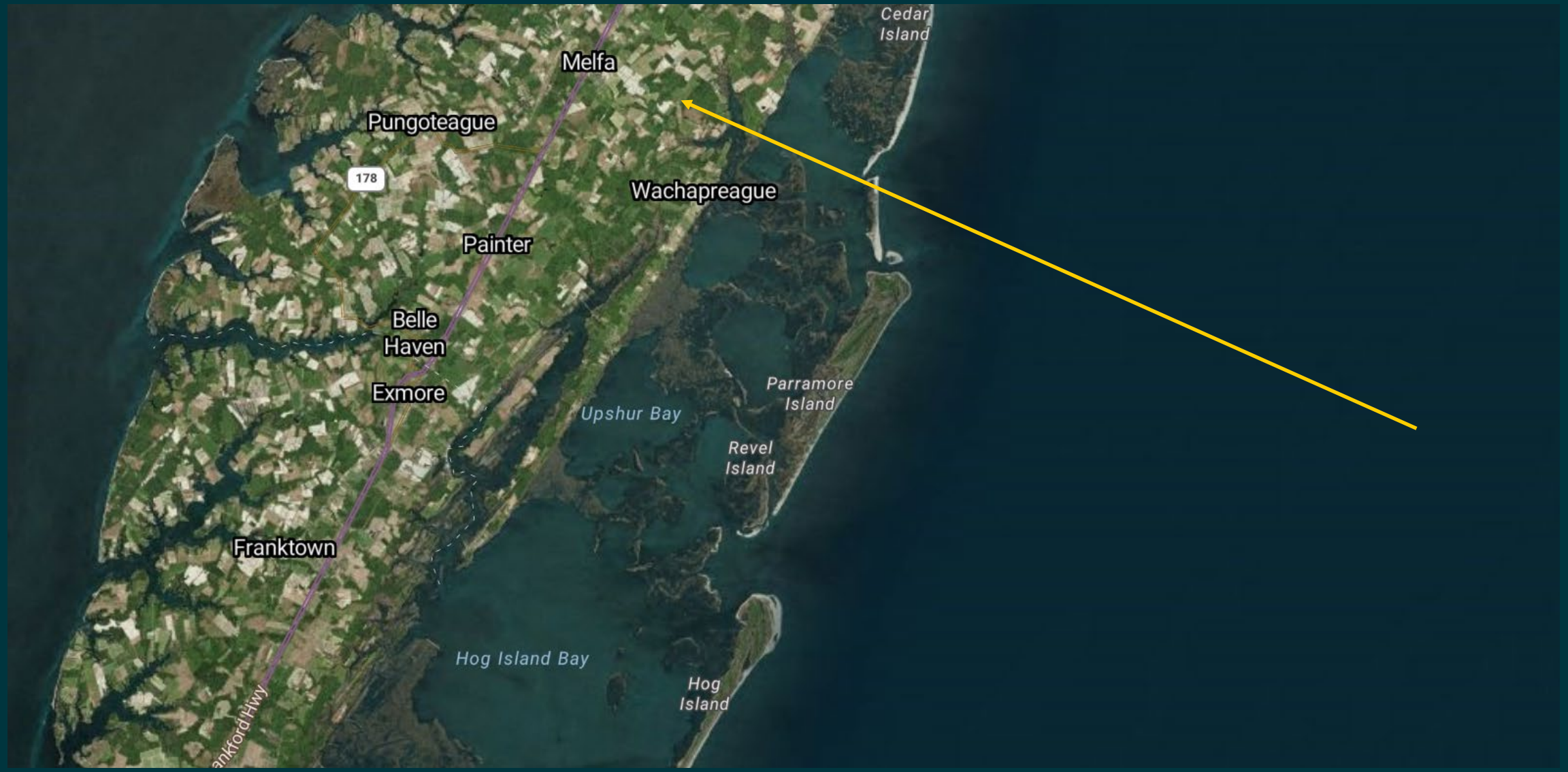
- Shoreline geometry can vary between being straight and simple vs. irregular



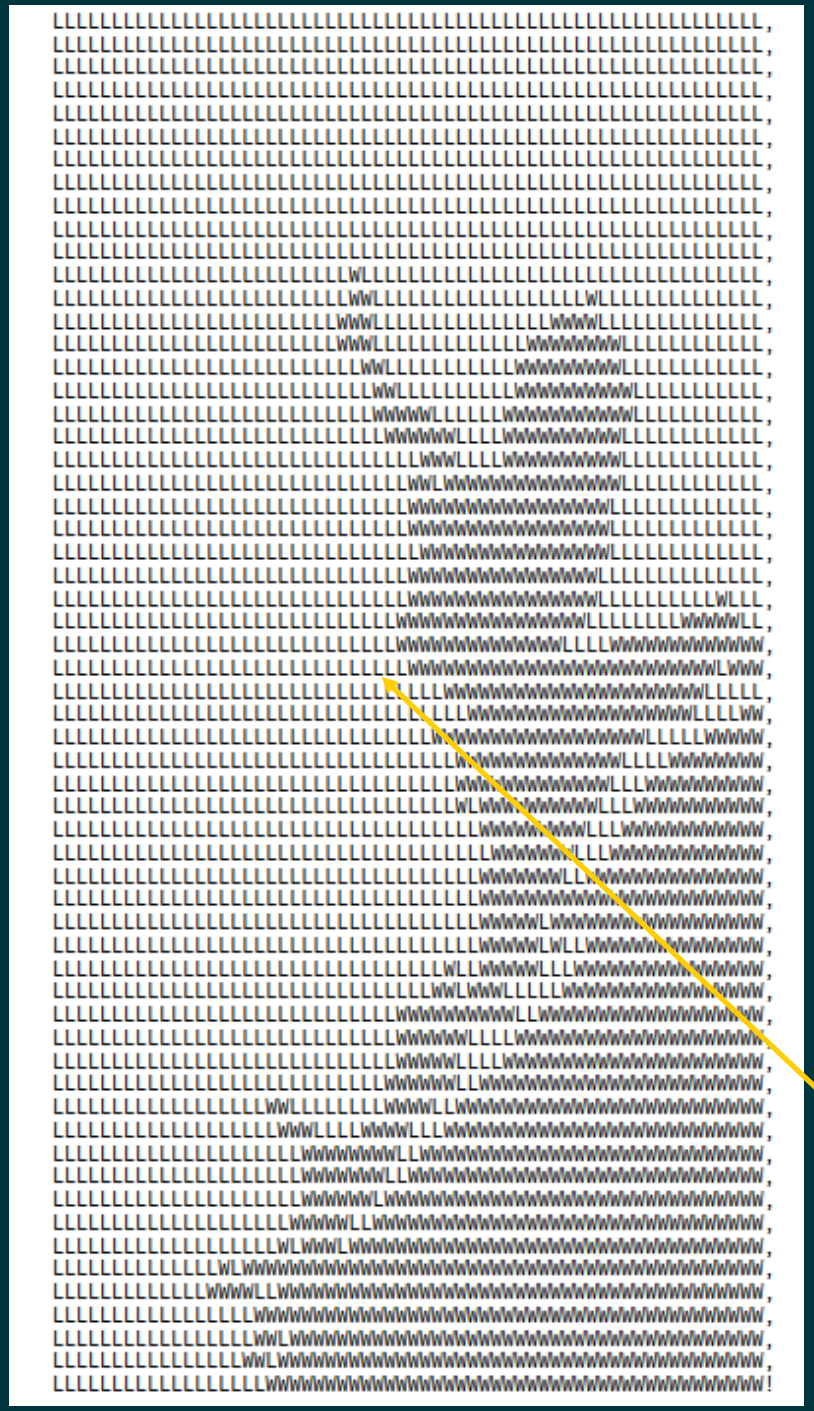
Complex Shorelines and Potential Plume Paths



Complex Shorelines, continued



OCD Representation of Land / Water Distribution



Growth of the Overland Thermal Internal Boundary Layer

OCS Study
BOEM 2023-044

Scoping Study for Shoreline Fumigation from Offshore Emissions

July 2023

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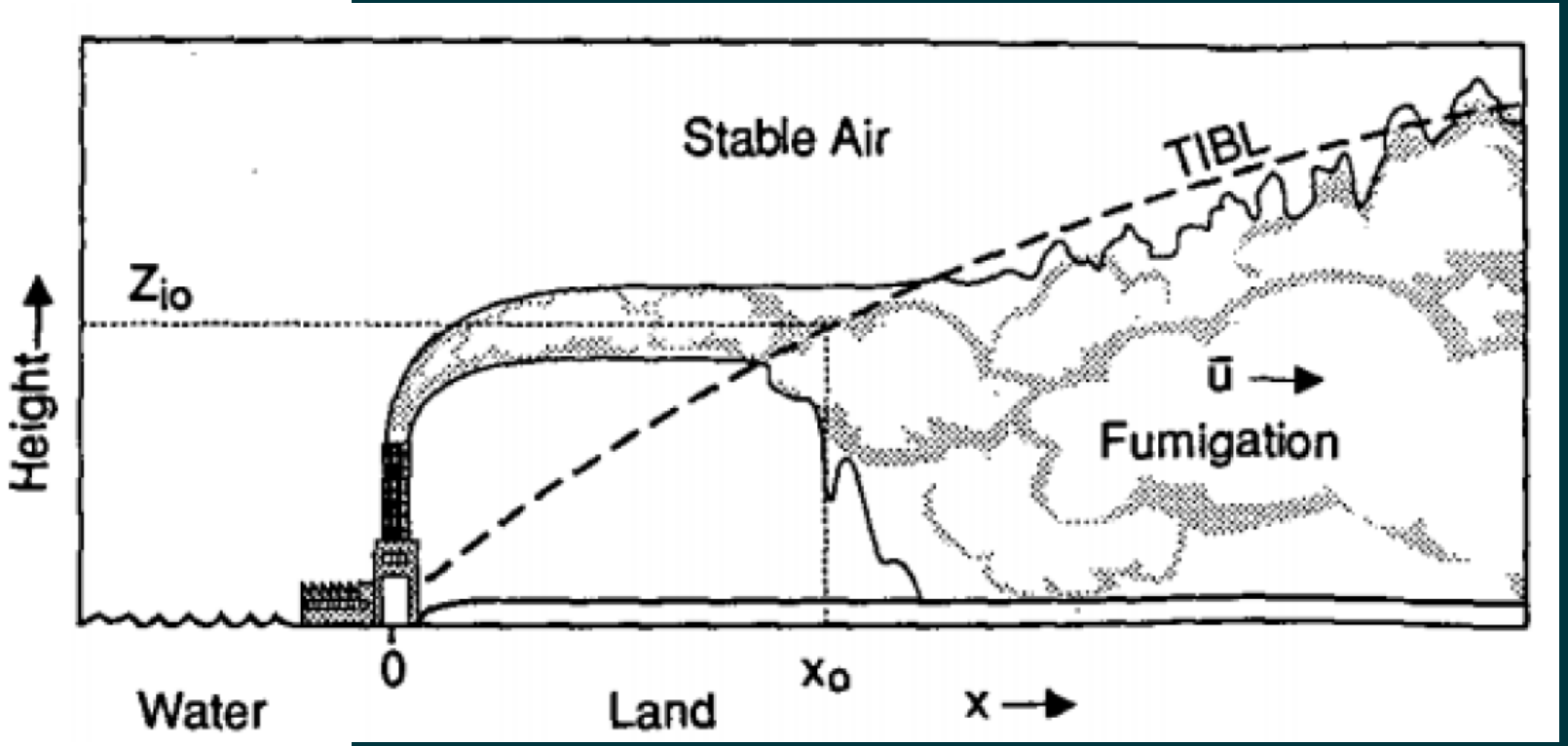


Suggestions for Additional Tools for Background Concentration Determination

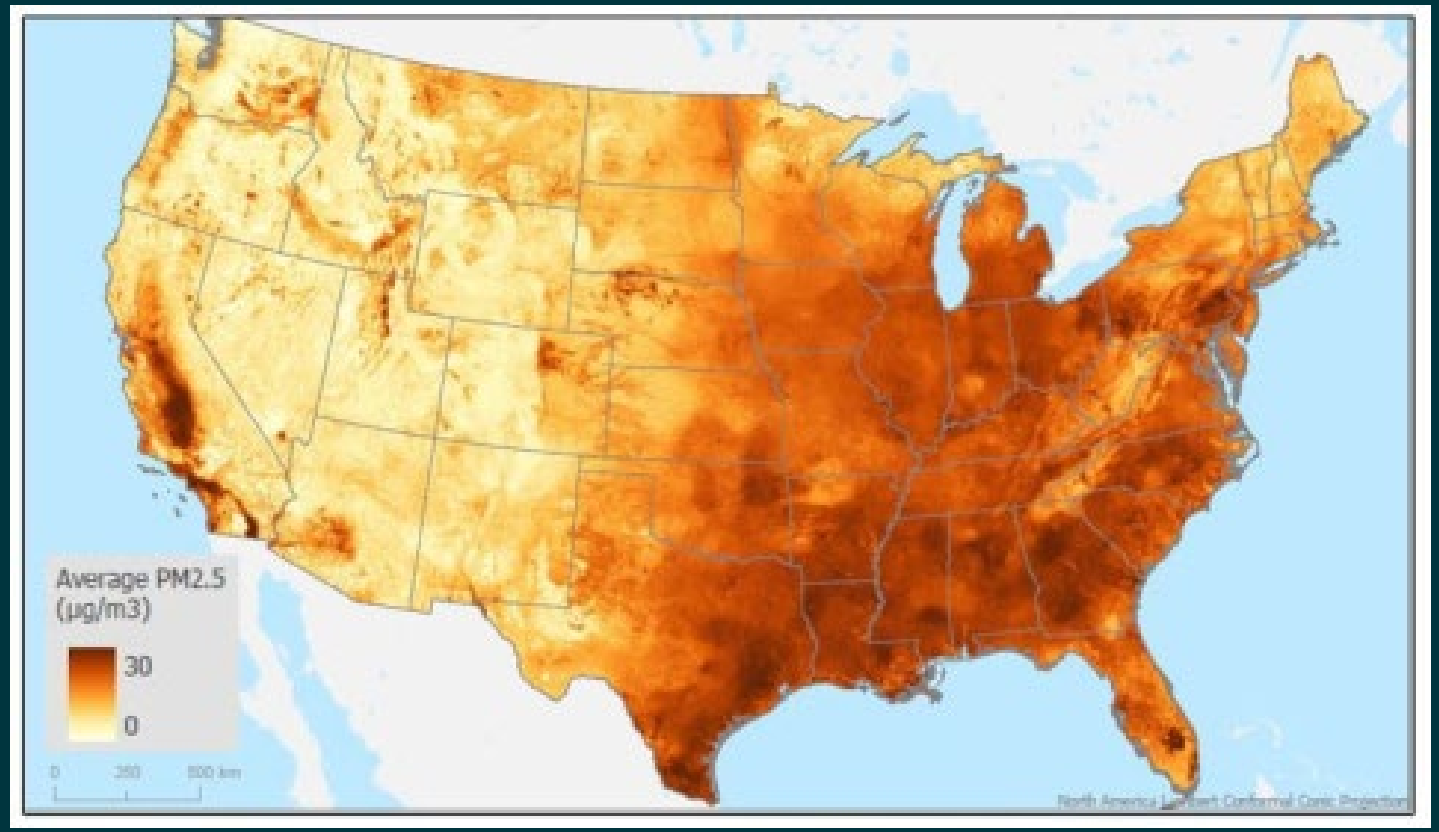
- A key issue is to determine whether available air monitors nearest to a proposed project location are representative of the existing air concentrations at the project site
- It would be helpful to have maps that show estimated concentration patterns for the pollutant of interest
- Then, the relative magnitude of the concentration estimate at the monitor site could be compared to that at the project site (this would be helpful even for annual averaged concentrations)
- There are two potential sources for these maps: extension of the AirToxScreen modeling effort to include criteria pollutants, and maps of satellite monitoring of criteria pollutant concentrations

Extension of the AirToxScreen Modeling

- EPA could extend the modeling used for air toxic compounds to criteria pollutants, as discussed by James Thurman yesterday
- Such maps could then be used as an additional tool to compare annual concentration estimates at the existing monitoring sites to those at proposed project sites
- The best matching monitoring site would be a candidate to represent existing concentration levels at the project site without the need to model additional sources in selected cases

Use of NOAA Satellite Data

- NOAA provides maps of satellite-derived concentration estimates for selected criteria pollutants: example with 1-km resolution at https://www.earthdata.nasa.gov/learn/articles/sedac-air-quality-health-data-collection



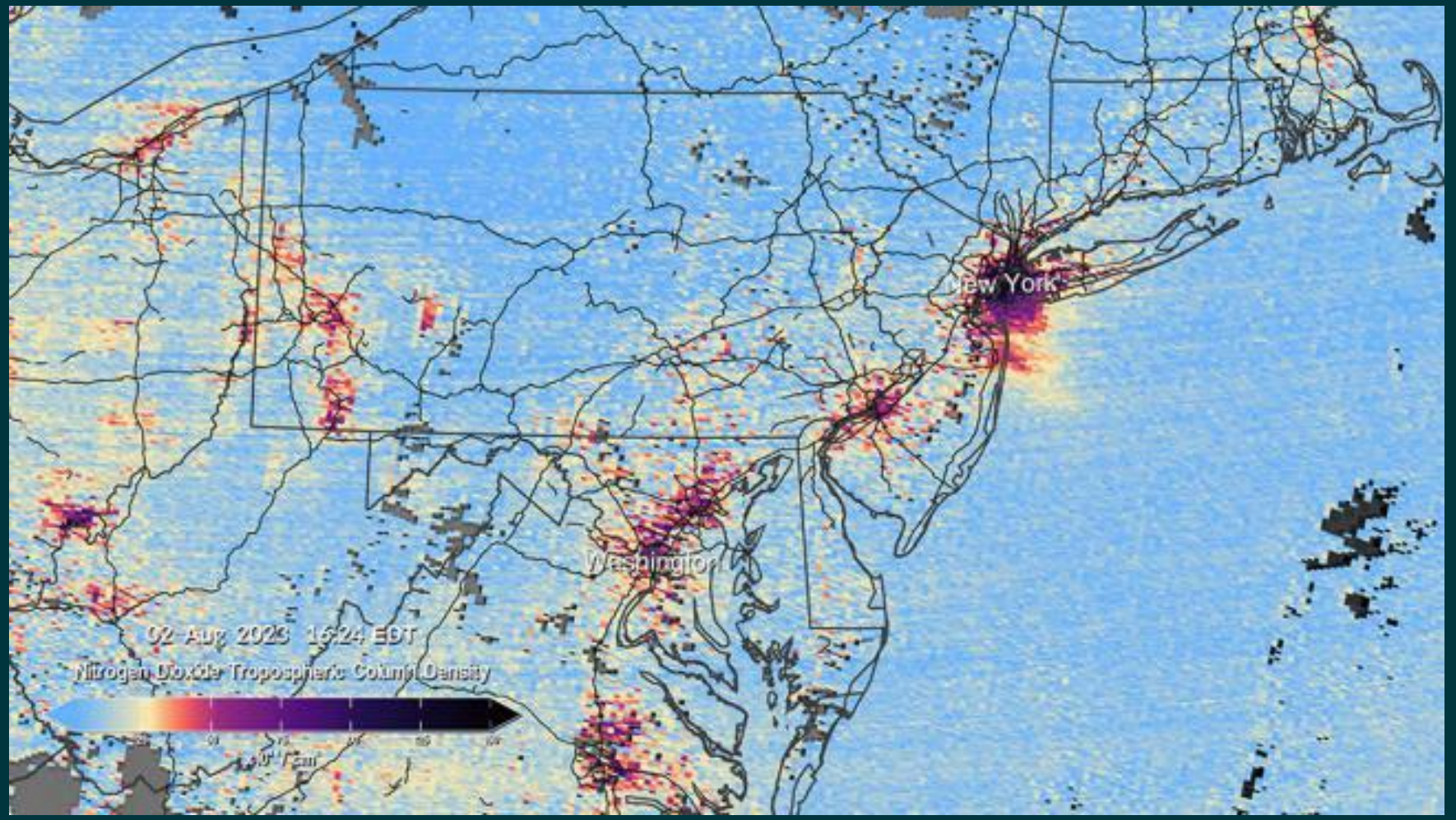
New Satellite with Promising Potential: TEMPO

- From its geostationary orbit 22,000 miles above the equator, NASA's TEMPO, or Tropospheric Emissions: Monitoring of Pollution, is the first space-based instrument designed to continuously measure air quality above North America with the resolution of a few square miles with 1-hour resolution.

- In addition to nitrogen dioxide, TEMPO will track most major air pollutants during daylight hours, including ozone, aerosols, sulfur dioxide and formaldehyde.

Sample of TEMPO Image for NO_2

- Available at https://www.cfa.harvard.edu/news/tempo-instrument-captures-its-first-images-air-pollution-over-greater-north-america



How to Adjust Monitored Background Estimates When a Large Nearby Source is Retired

- Many permit applications use a 3-year average of monitored design concentrations to estimate monitored background.

- This is conservatively high because it is assumed that near-peak design concentrations are always present to characterize existing background concentrations.

- What happens, though, if a major nearby source is suddenly retired?

- Instead of waiting another 3 years for monitoring data to reflect this, one could exclude impacts from the direction sector of the retired source on the determination of monitored background with existing data.

Accounting for Reductions in Precursor Emissions in Modeling

- While the MERPs guidance accounts for formation of secondarily-formed PM2.5 and ozone with increases in precursor emissions, it does not account for reductions in emissions from one precursor pollutant that could offset the effect of emissions increase in a second precursor pollutant.
- Suggestion: use the relative MERPs secondary pollutant formation from the decreasing and increasing precursor emissions to adjust the formation of the secondary pollutant.
- Example: for PM2.5, 100 tpy of increased SO_2 emissions results in an additional 2 $\mu g/m^3$ of PM2.5, while 100 tpy of increased NOx results in an additional 1 $\mu g/m^3$ of PM2.5.
- If a project proposes an increase of 100 tpy for SO_2, but a reduction of 100 tpy for NOx, then the resulting increase in PM2.5 from these precursors would be 2 - 1 = 1 $\mu g/m^3$ of PM2.5.