MARYLAND

Department of the Environment

Complying With the NAAQS - 2012 and Beyond -

The Dominant Role of Air Pollution Transport

- Science, Control Programs and Challenges -

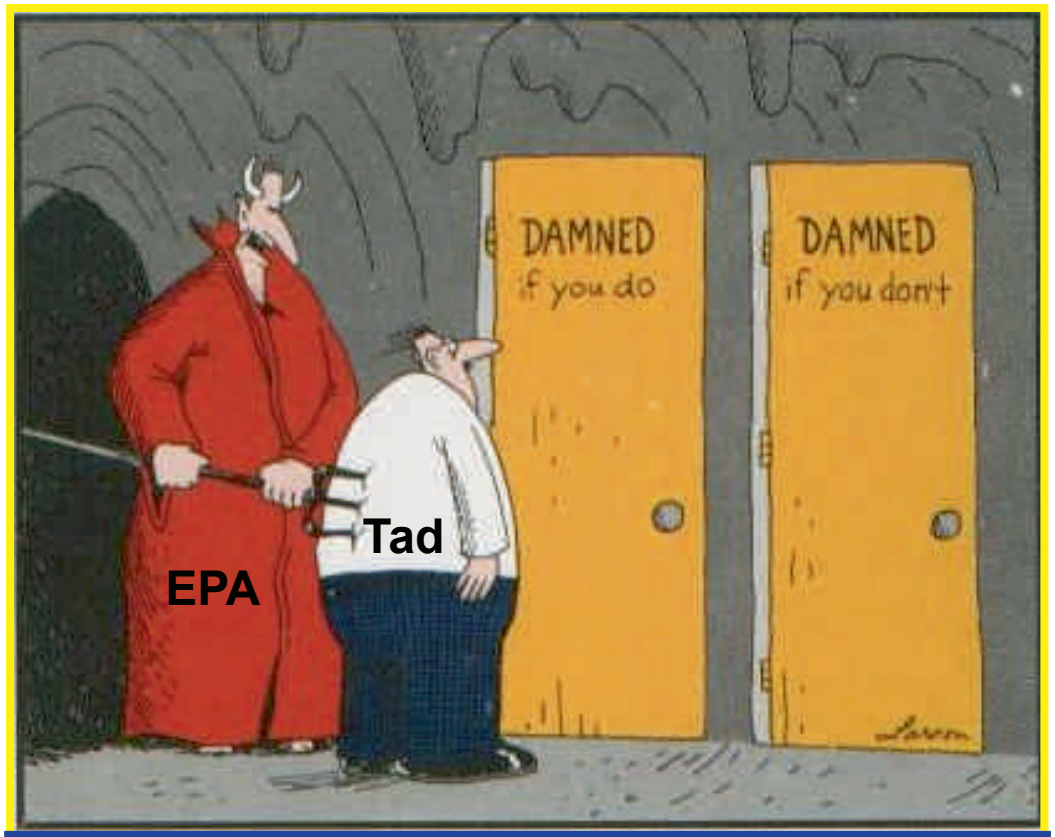
Tad Aburn - Air Director, MDE

June 21, 2012 - AWMA Meeting - San Antonio, TX

MDE

MARYLAND

Department of the Environment



But that's scientificall y impossible … man

Just submit the SIP!! …

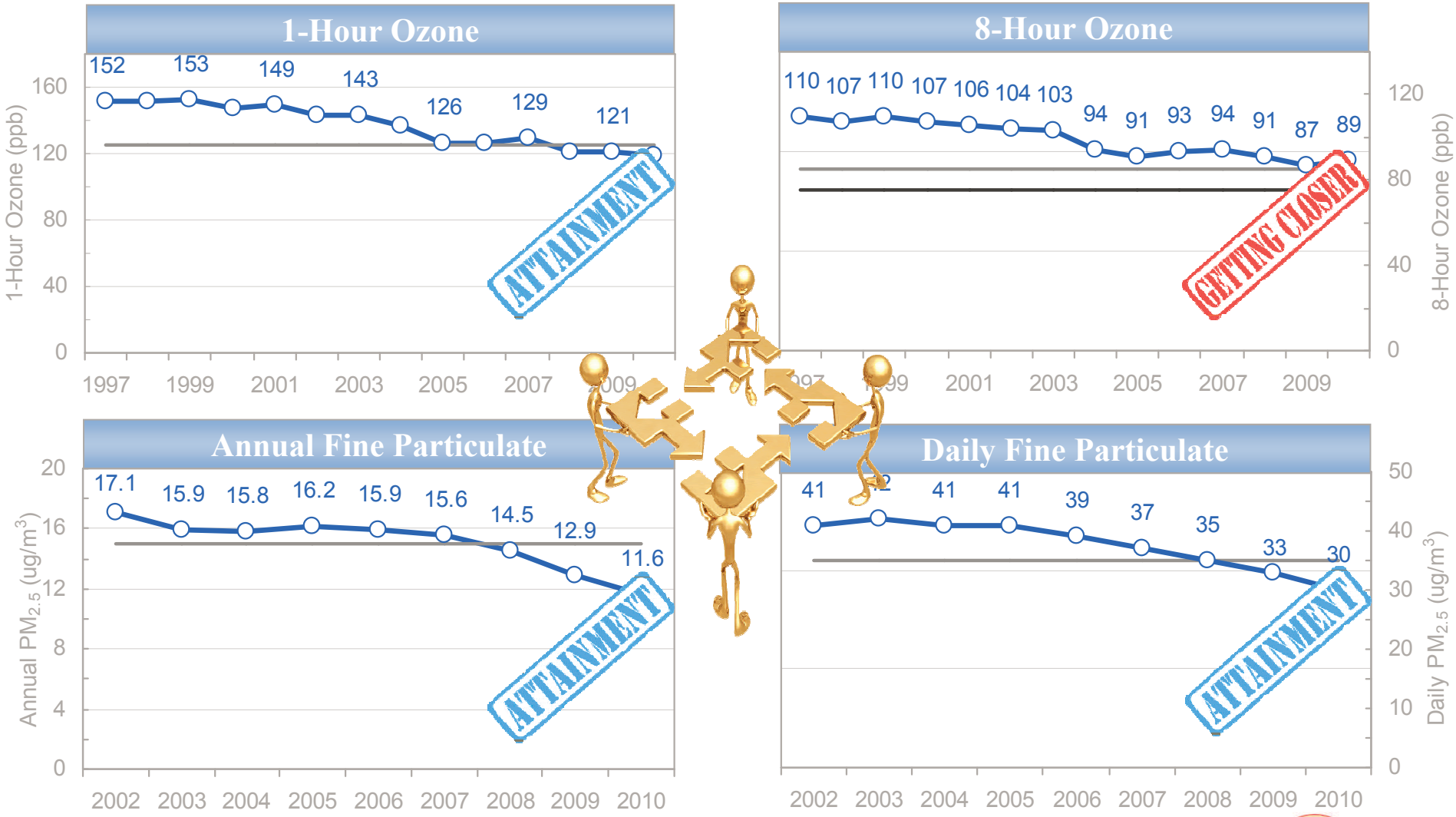
I don't care what you think - the law says you can clean the air by 2013

MDE

Topics

- A little background on Maryland and the Mid-Atlantic
- The sad story of Baltimore
  - The poster child of transport
    - A “meteorologically challenged” area
- Really understanding transport
  - The elevated pollution reservoir
  - The different types of transport
- Pushing for National Control Programs
  - The critical role of CSAPR, Tier 3/Low Sulfur Fuel and CSAPR #2
- Other CAA legal options
  - Now being considered by MD and other states

Progress in Cleaning Maryland's Air



What Have We Learned from All of This?

Air Quality Issues in Maryland

- Ground level Ozone and Transport
- Fine Particulate
- The new SO2, NO2 and lead standards
- Air quality contributions to the Chesapeake Bay
- A State required greenhouse gas SIP
- Multi-Pollutant Planning, Environmental Justice and more
- Today's presentation will focus on ozone and ozone transport

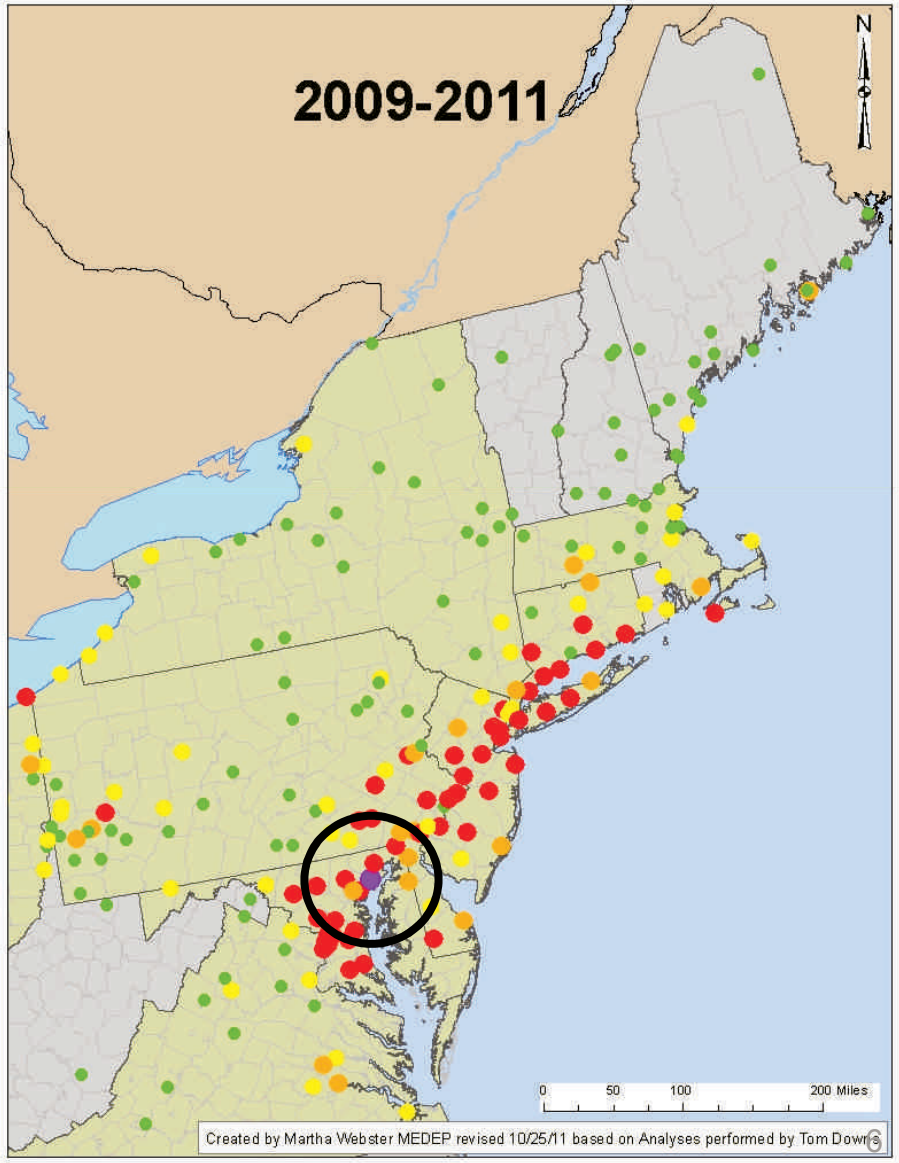
Baltimore – The Last Purple Dot

Preliminary 2011 Ozone Design Values in the OTR

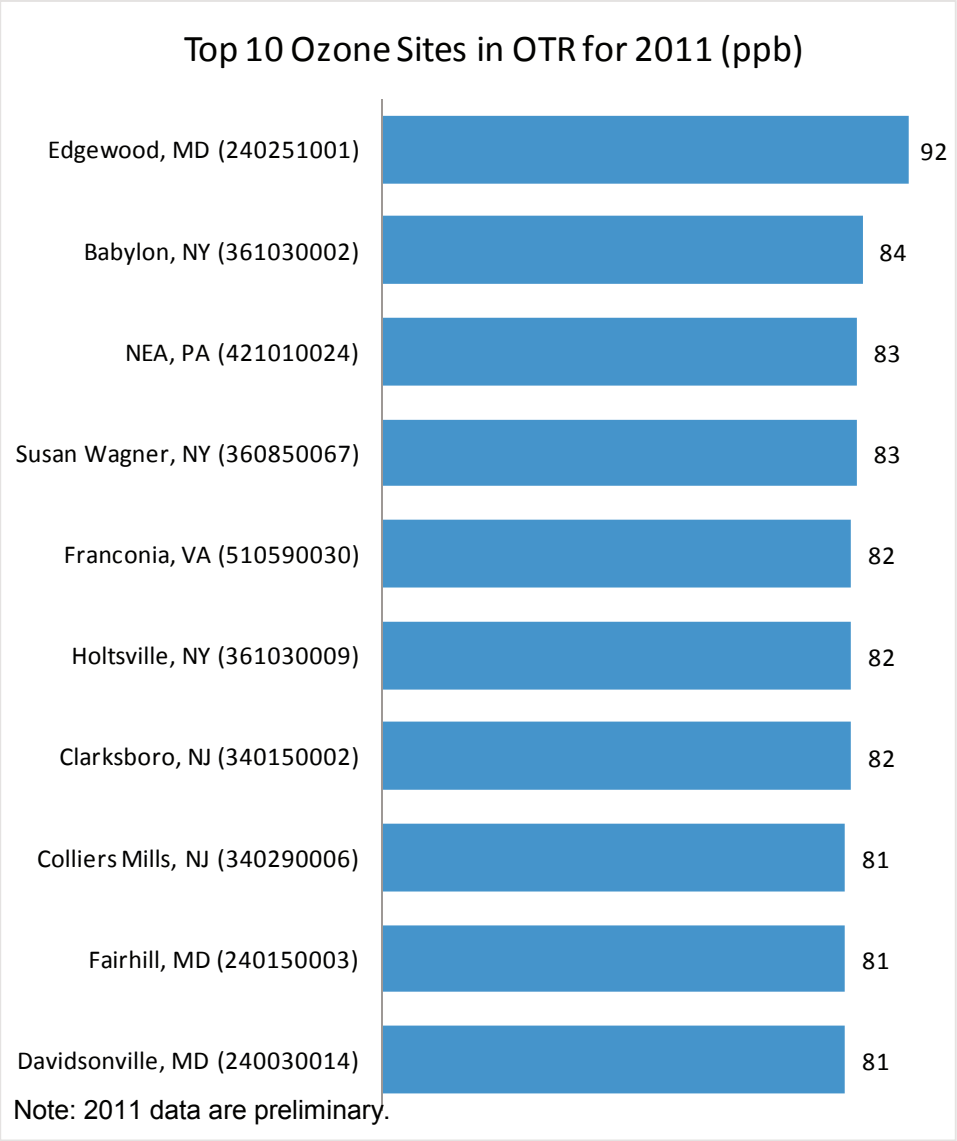
- <71
- 71-73
- 74-75
- 76-85 (mar)
- >85 (mod)

Parts per Billion (ppb)

States with Nonattainment Monitors



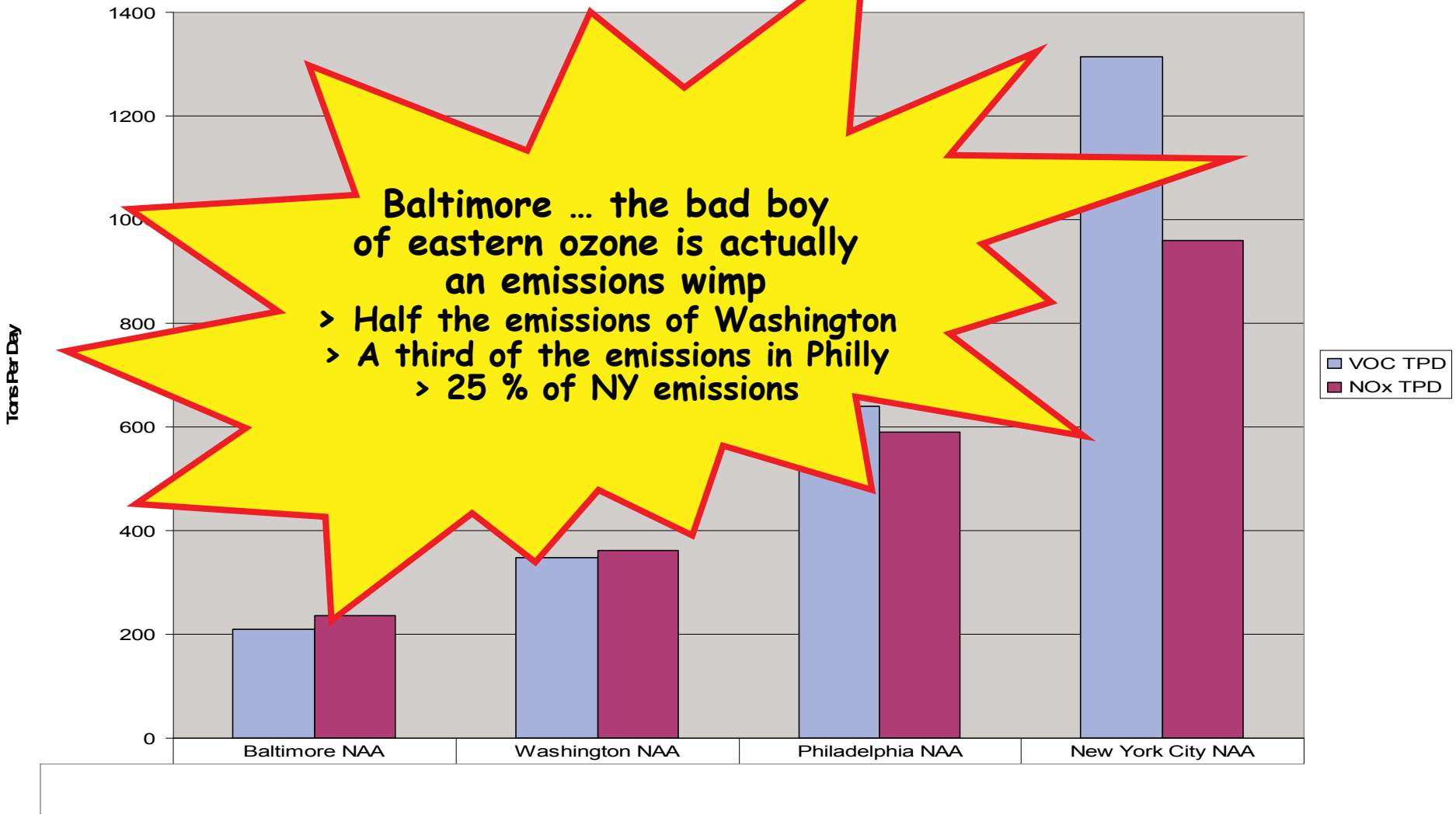
The Top 10 – or Maybe the Bottom 10 - List



What About Maryland's Healthy Air Act?

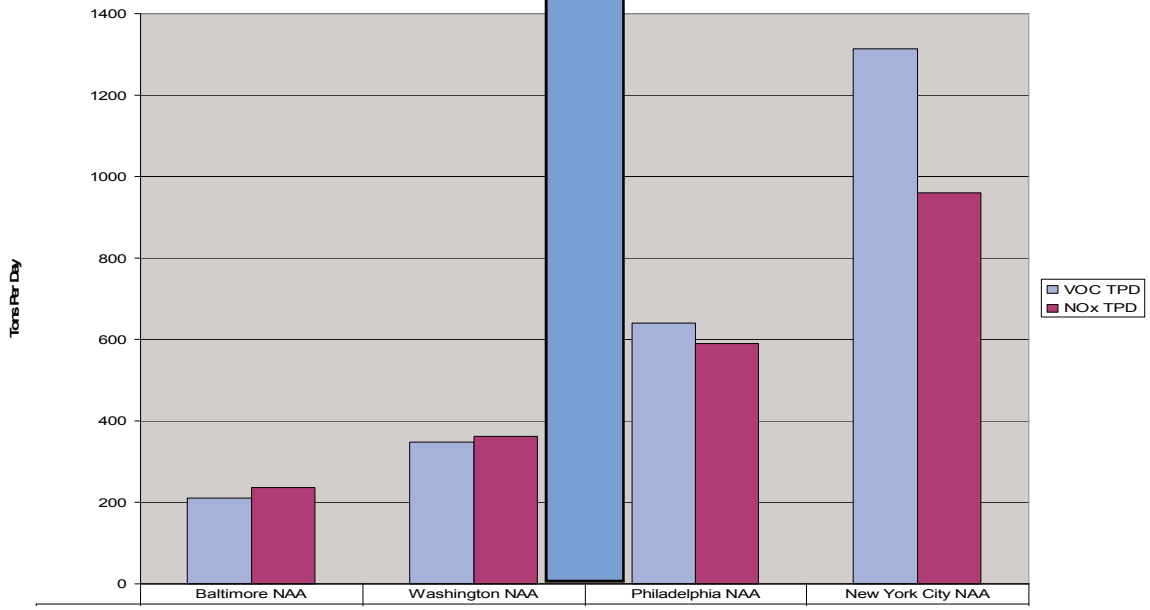
- Yes – It's a $3 Billion EGU control program
  - Single sources in upwind states now emit more NOx than all of MDs sources combined
  - NJ, PA, Philly – Say thank you!
- Also a California Car State
  - Toughest car standards allowed by law
- New local rules on everything we can find
  - Cement kilns to perfume
  - Even pushing crazy stuff
    - Using transportation conformity budgets to drive deeper mobile source NOx reductions
    - If you have a new idea – let me know
- Supporting EPA on Tier 3/LSF, CSAPR, MATs, and every other federal effort on regional rules

2009 Emissions – How Can This Be True?



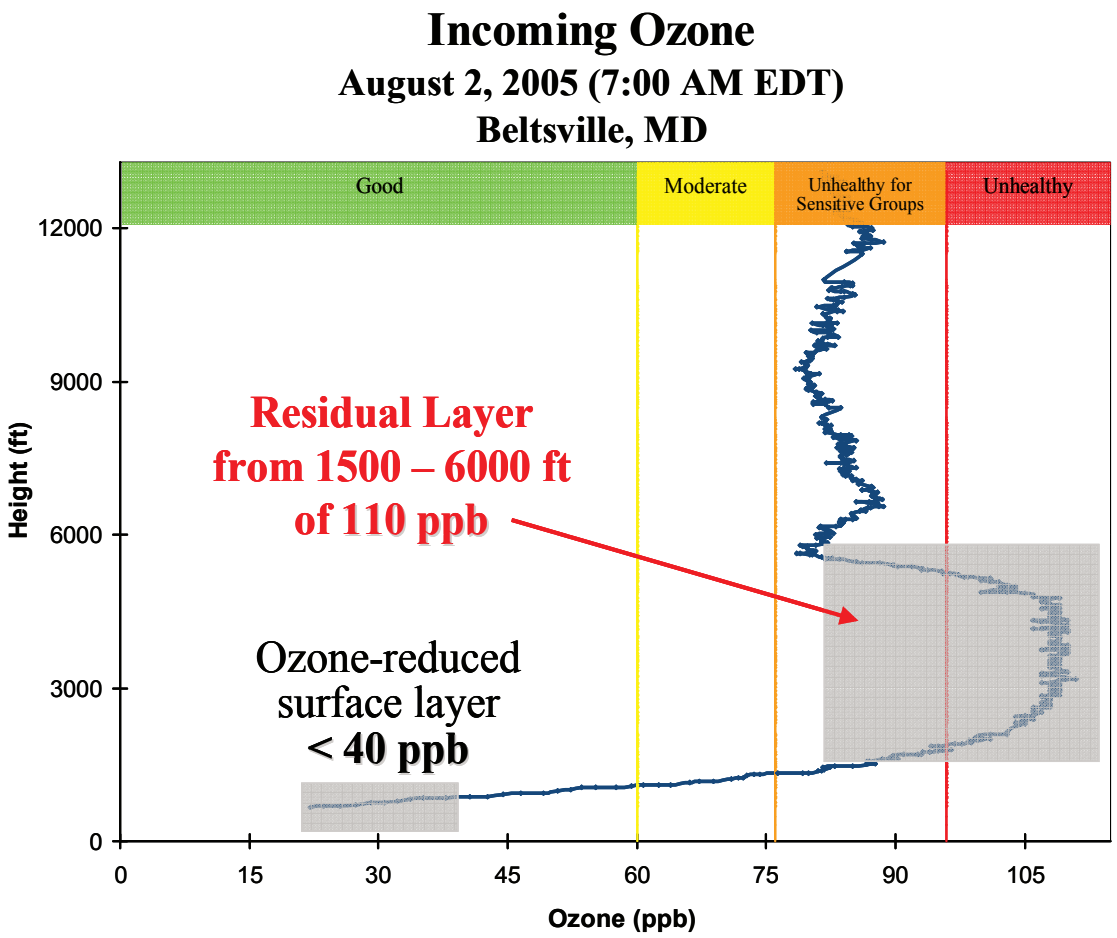
2009 Emissions – What About Nearby States?

Add the NOx emissions from the 4 most significant upwind, nearby states - that contribute to Maryland



So What the Heck is Going On?

… Why does Baltimore measure the worst ozone in the East?



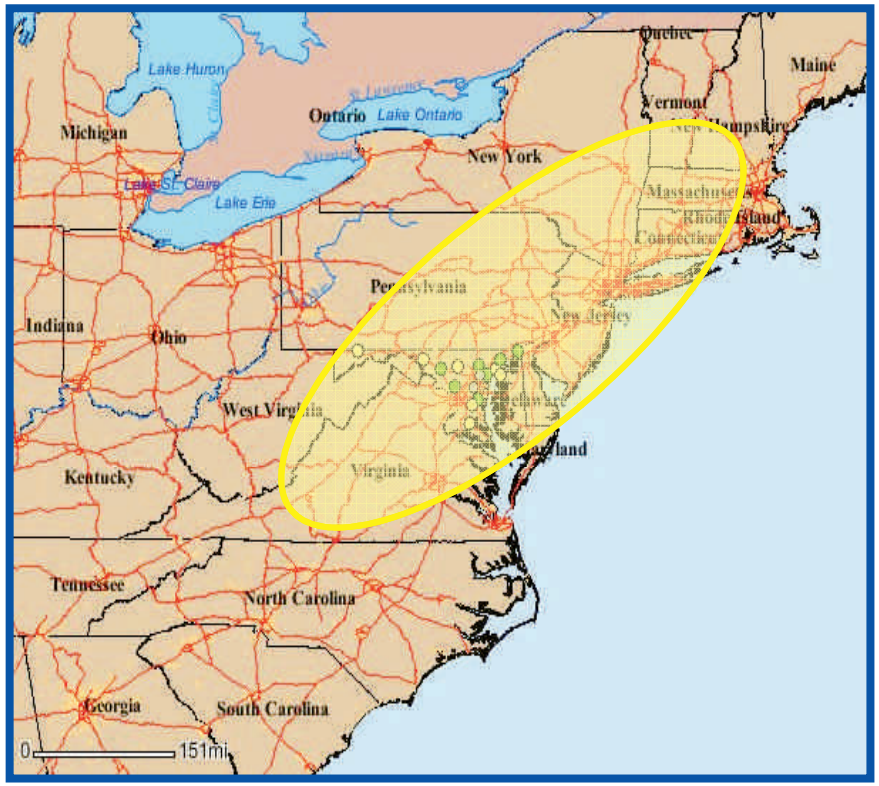
Source: Maryland Department of the Environment & Howard University

Understanding Ozone Transport

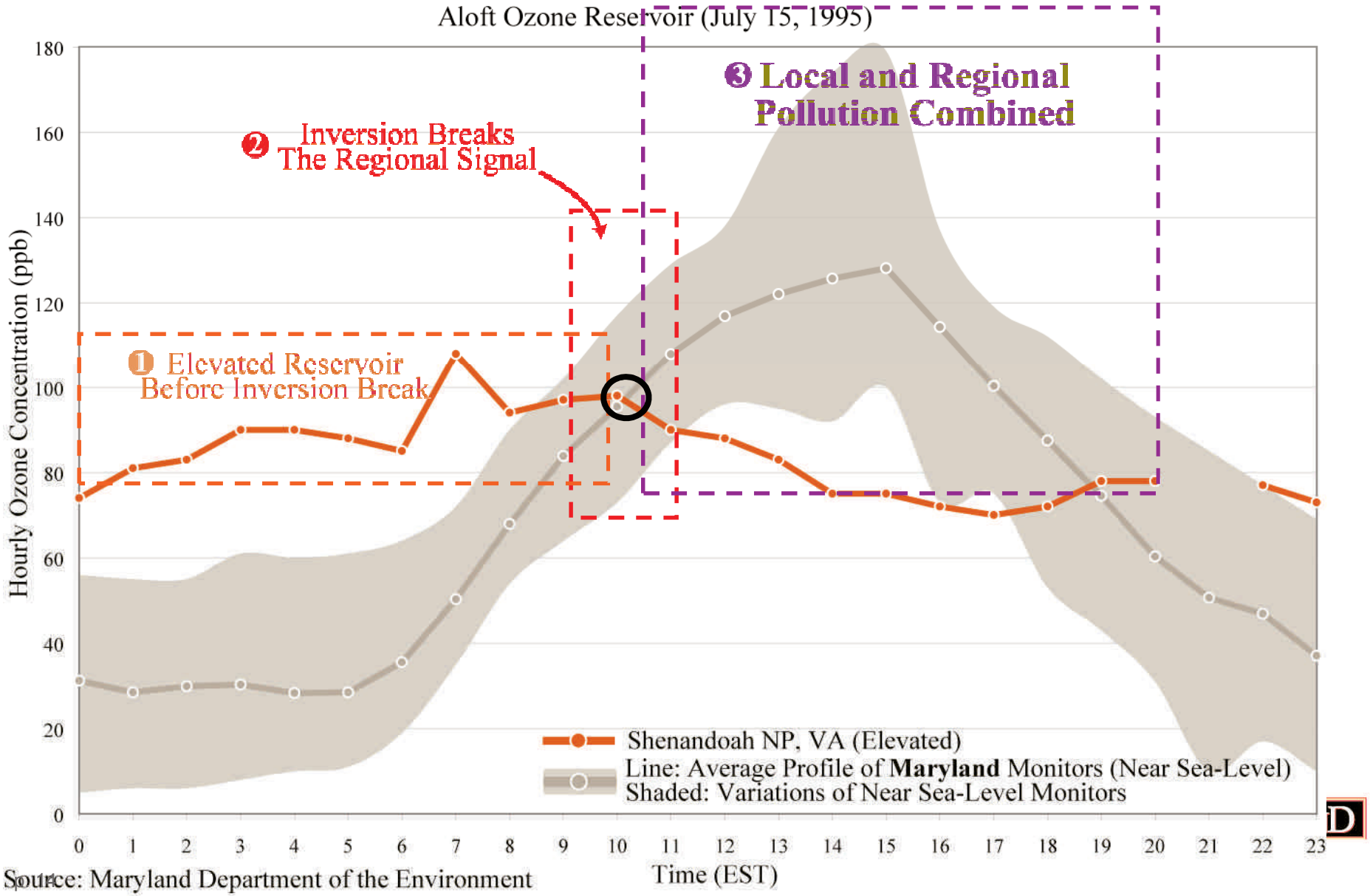
- The elevated reservoir
  - The transport cloud
  - The elevated ocean of ozone
  - The residual layer
  - Where transported pollutants congregate and have a beer
- A simplified conceptual model for ozone
  - The different types of transport
- Which type of transport is the worst?

The Elevated Ozone Reservoir

- Every bad ozone day, in the morning hours, a large reservoir of ozone sits above Maryland and the Mid-Atlantic area waiting to mix down.
  - Ozone levels in the reservoir can routinely reach 60 to 100 ppb.
  - In the morning, ozone levels at the surface are very low.
- Around 10:00 or 11:00, the ozone in the reservoir mixes down to the surface and degrades air quality.

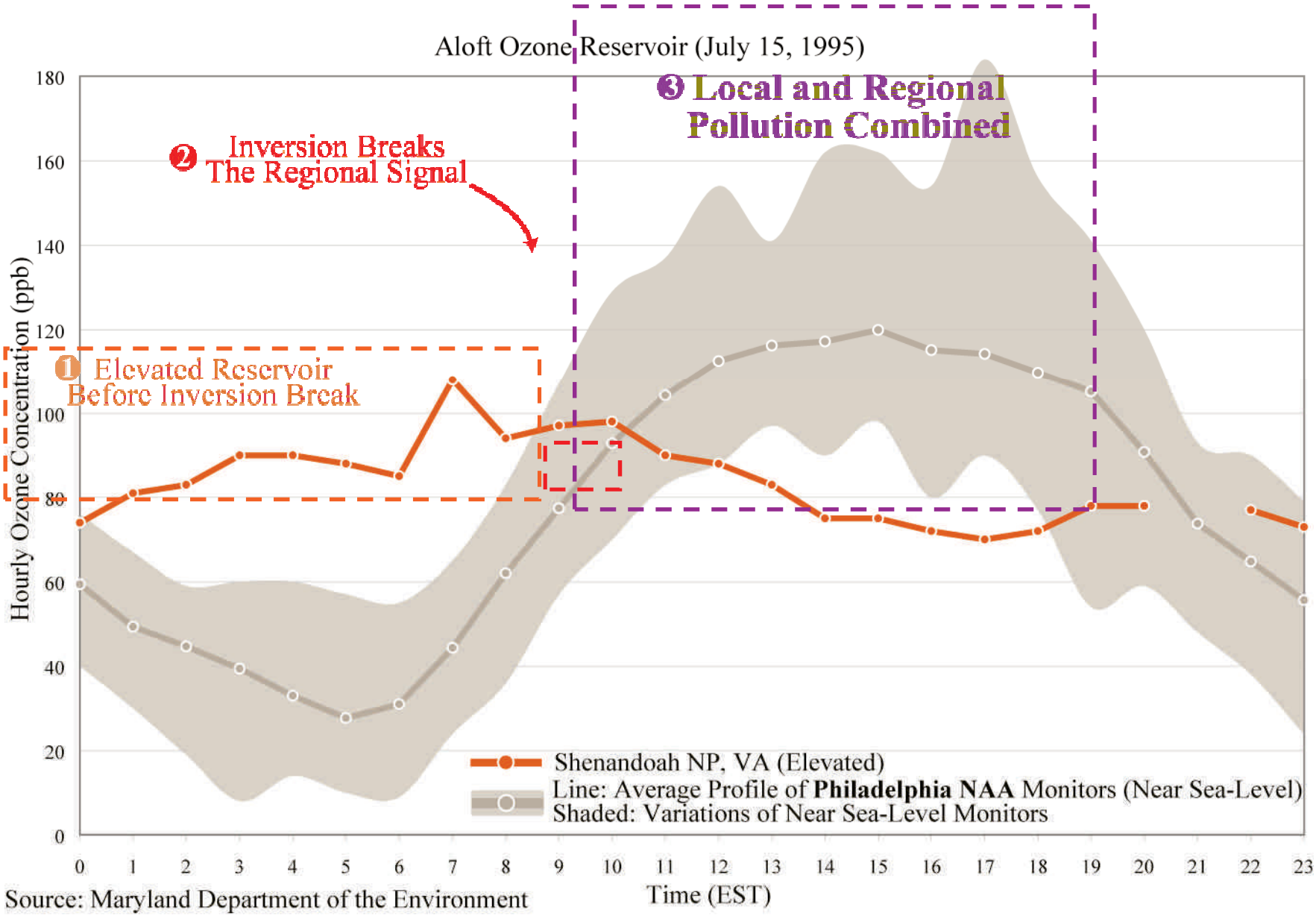


The Elevated Reservoir – The 90's



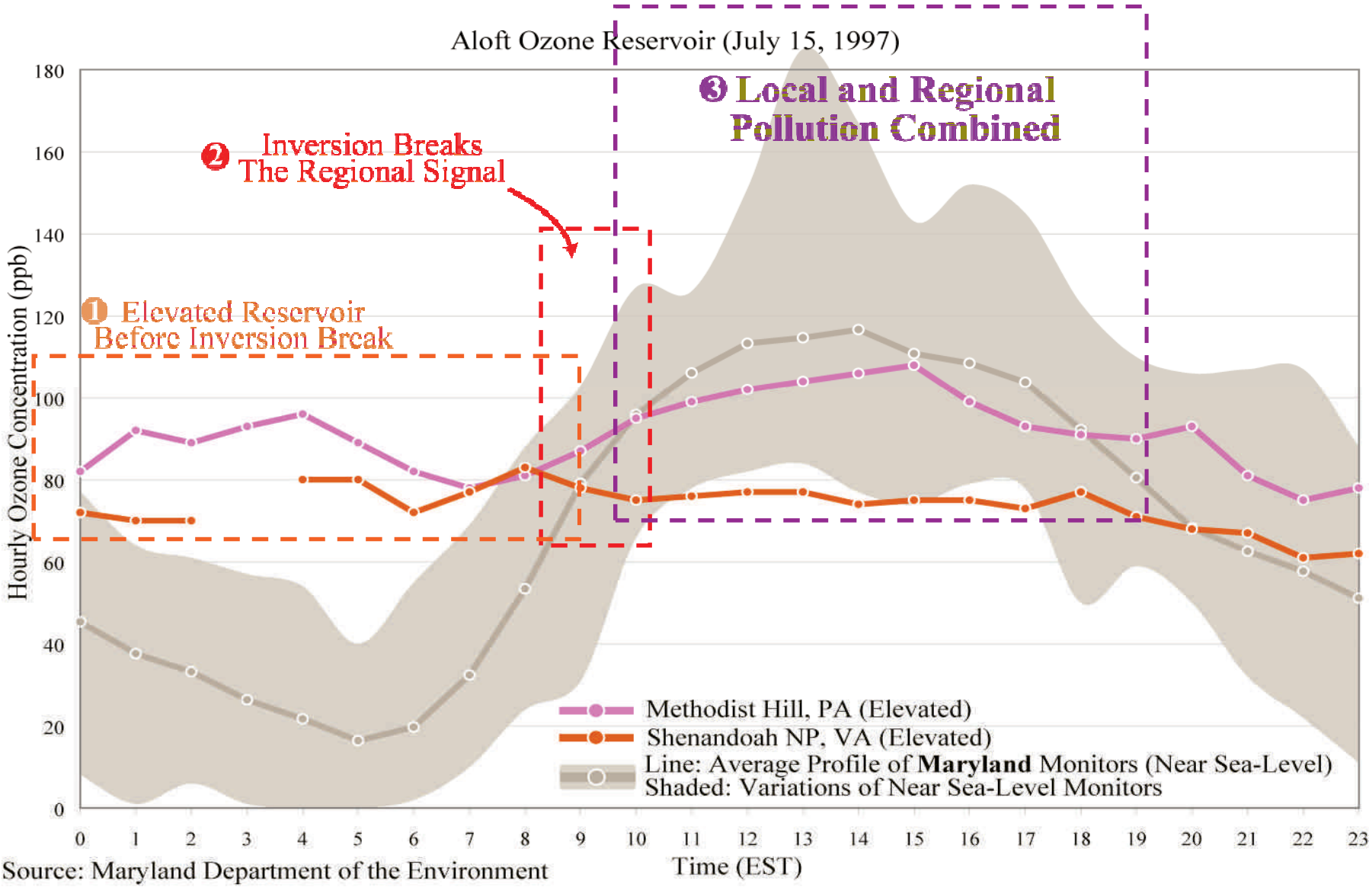
Source: Maryland Department of the Environment

Same Signal – Philly 1995



Source: Maryland Department of the Environment

Same Signal – Maryland 1997



Source: Maryland Department of the Environment

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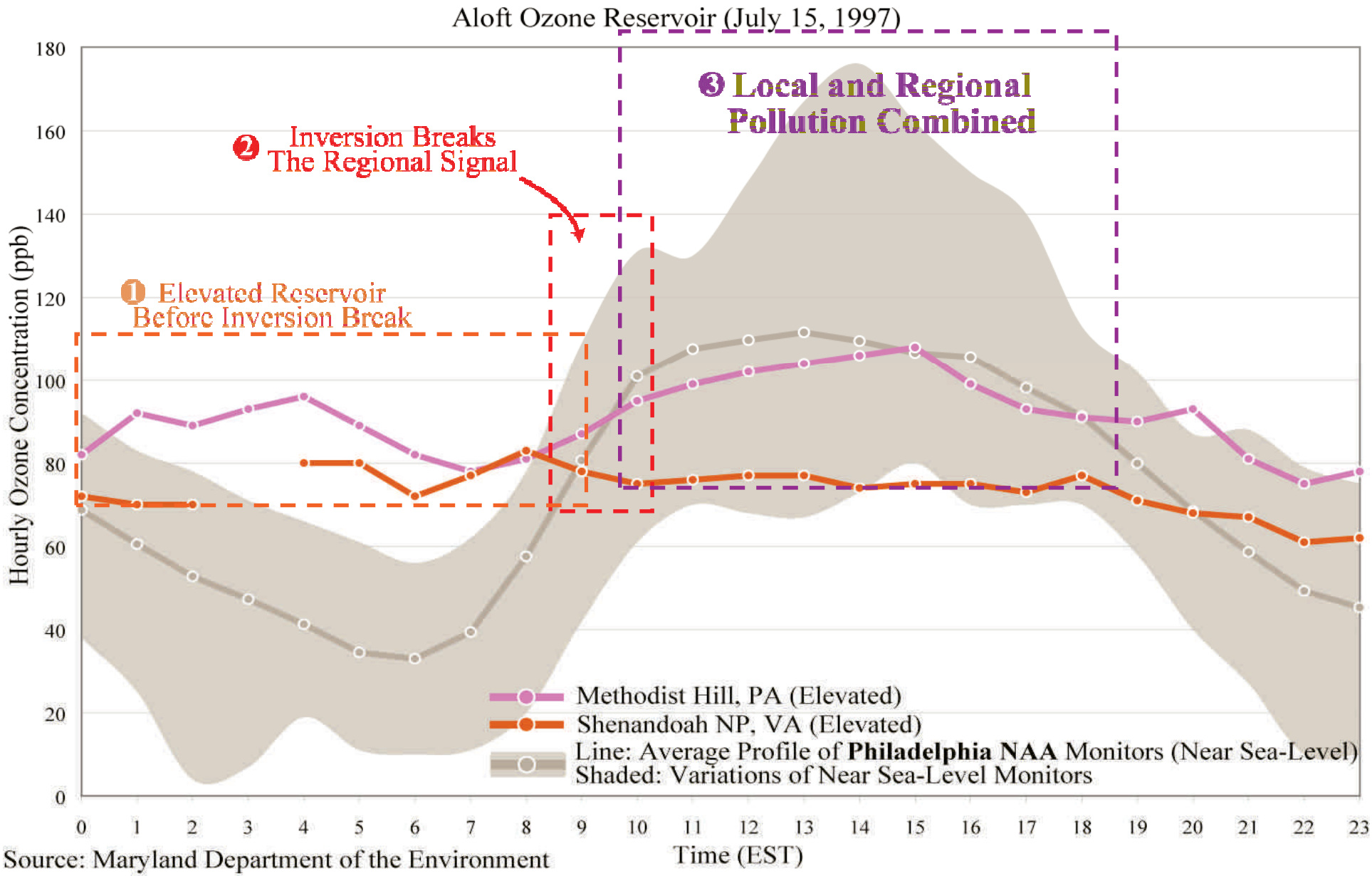
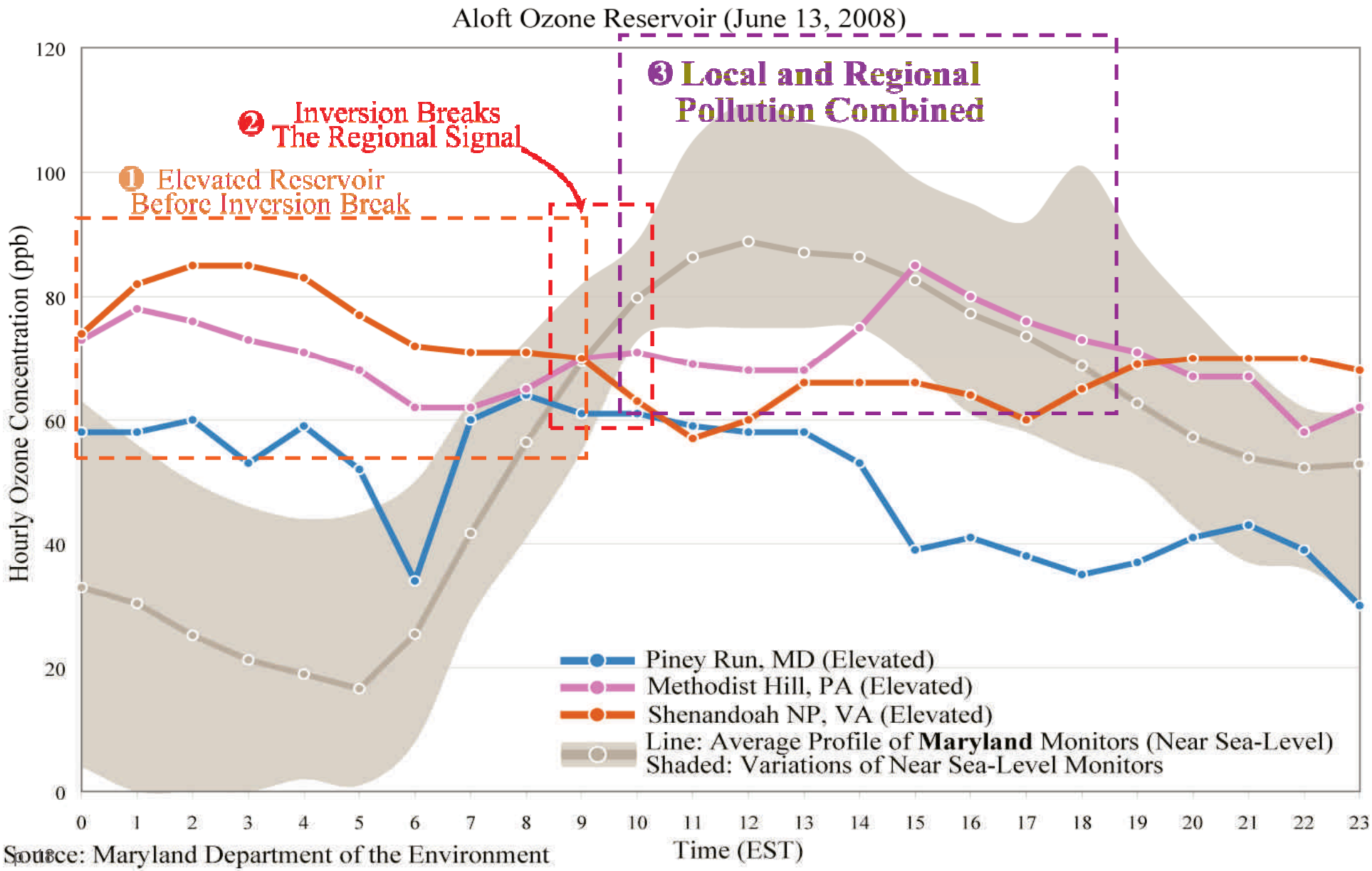


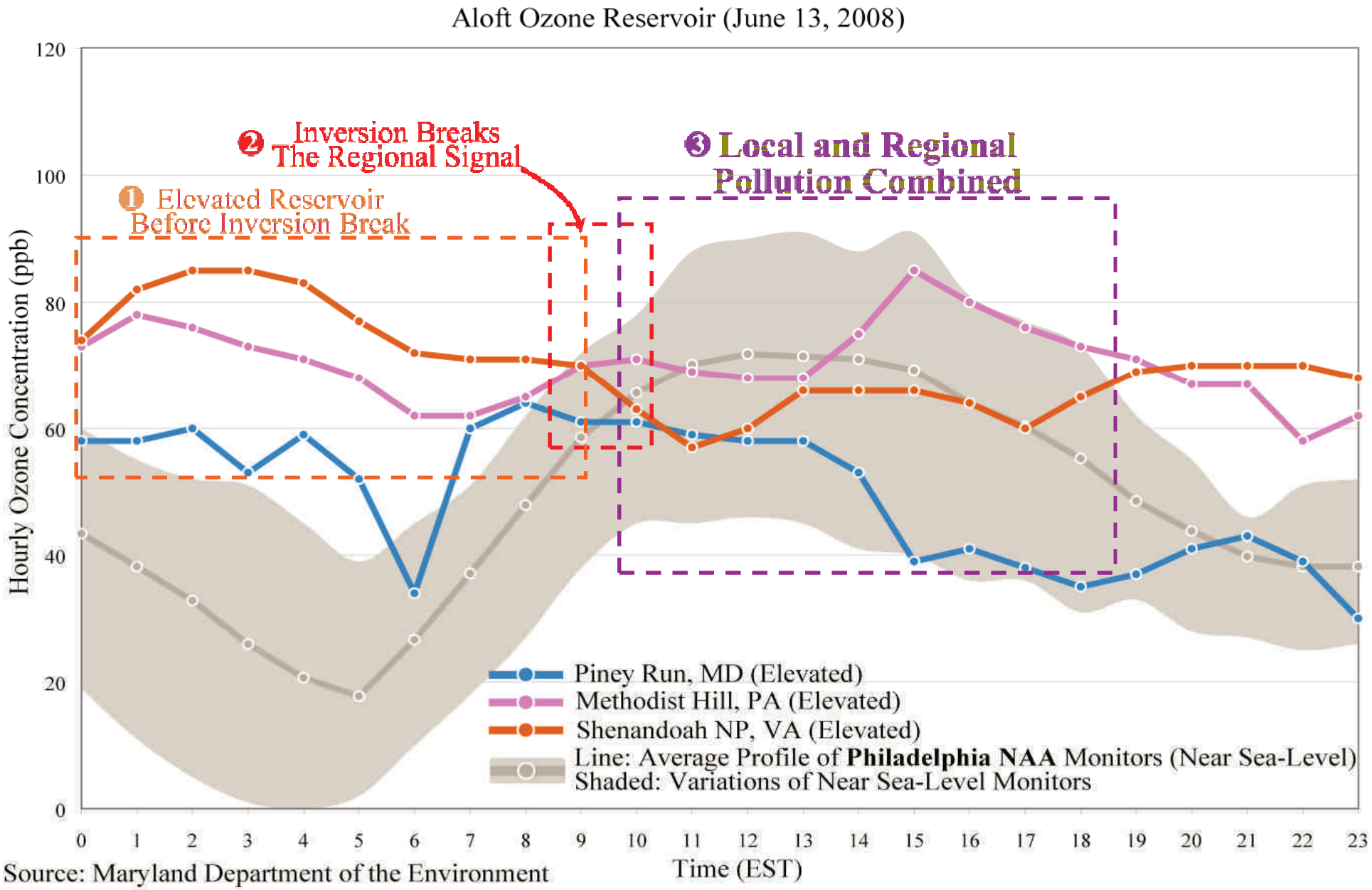
Source: Maryland Department of the Environment

Same Signal – Maryland 2008

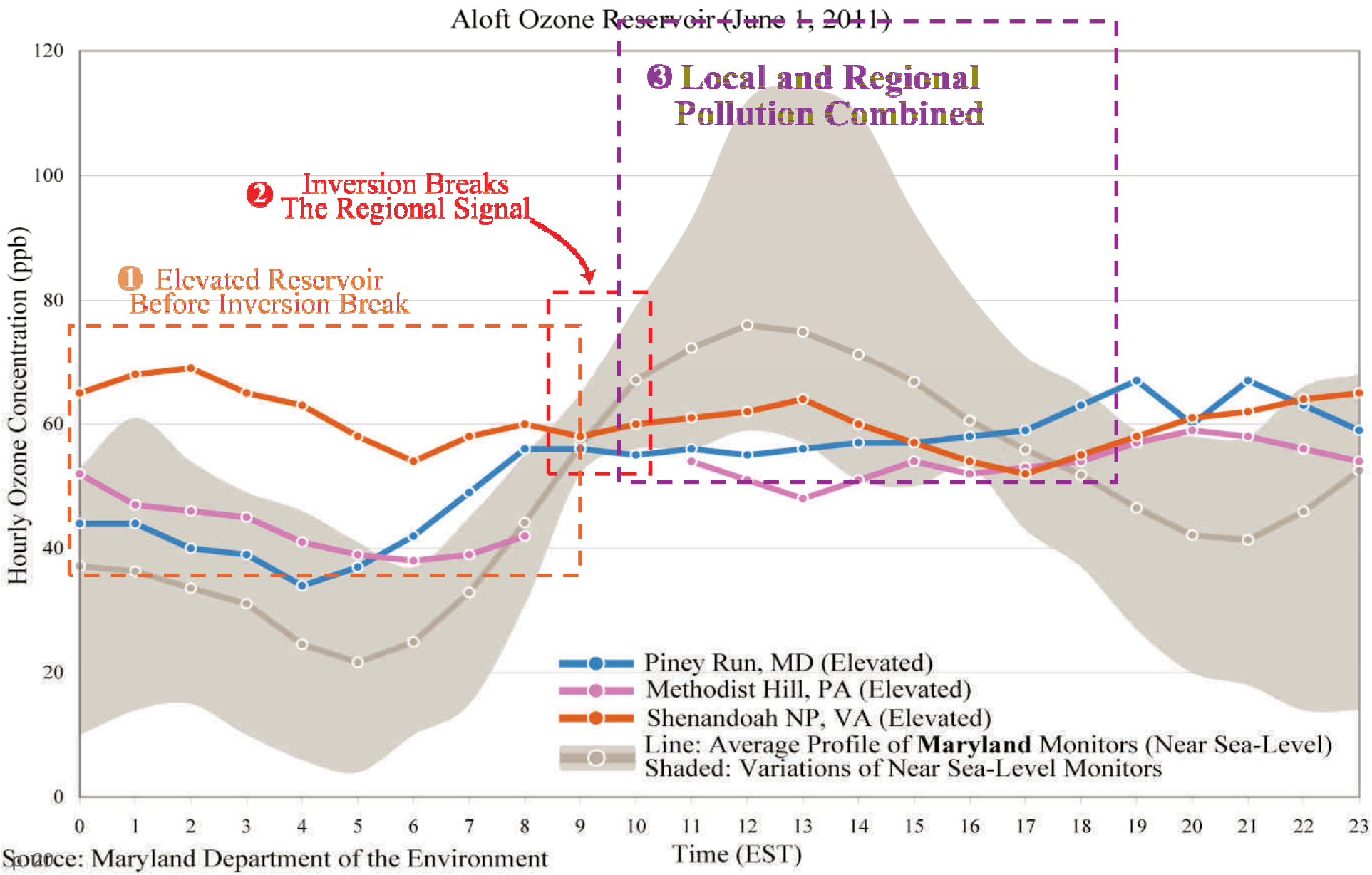


Source: Maryland Department of the Environment

Same Signal – Philly 2008

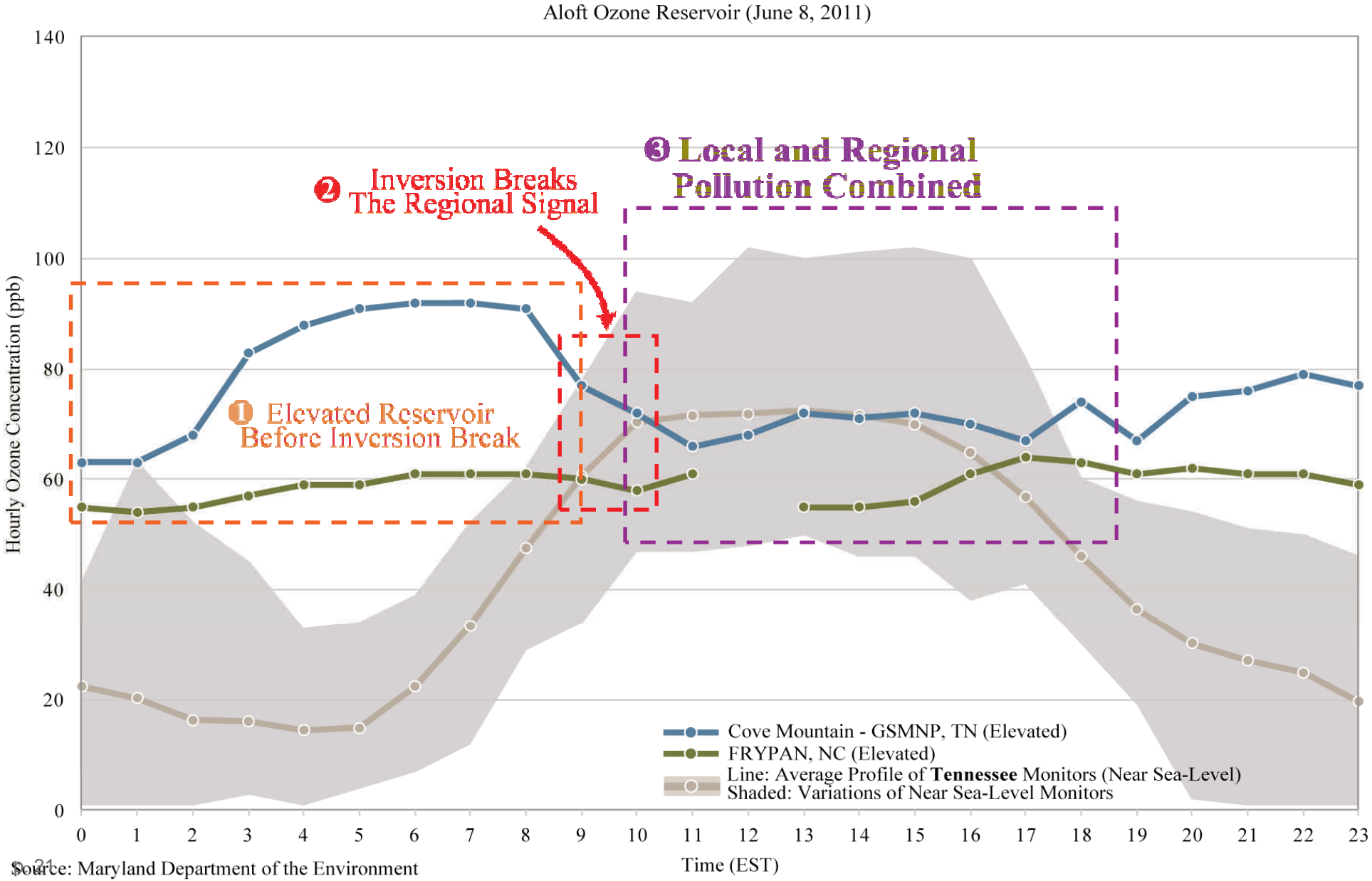


Same Signal – Maryland 2011



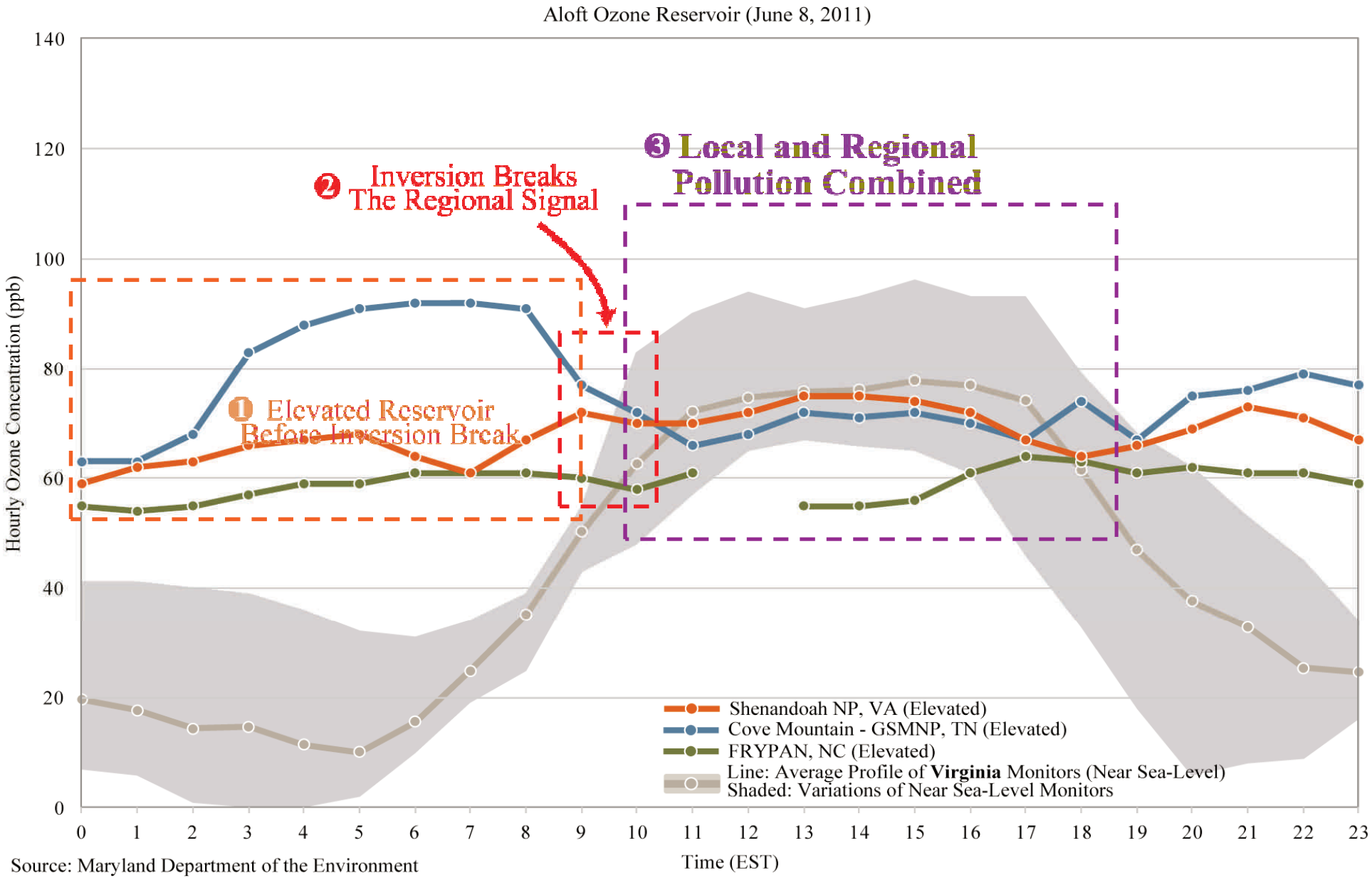
Source: Maryland Department of the Environment

Same Signal – Tennessee 2011



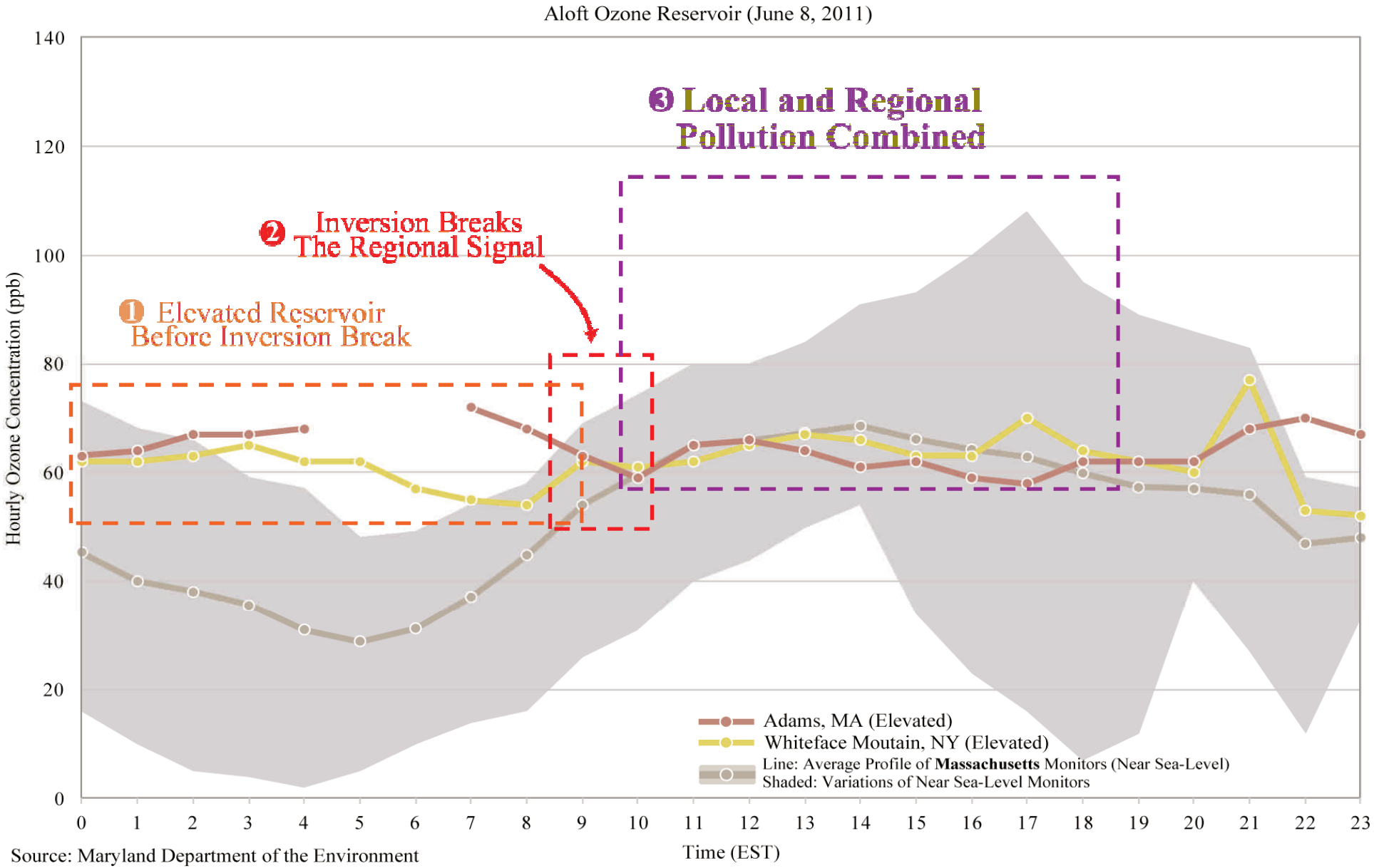
Source: Maryland Department of the Environment

Same Signal – Virginia 2011



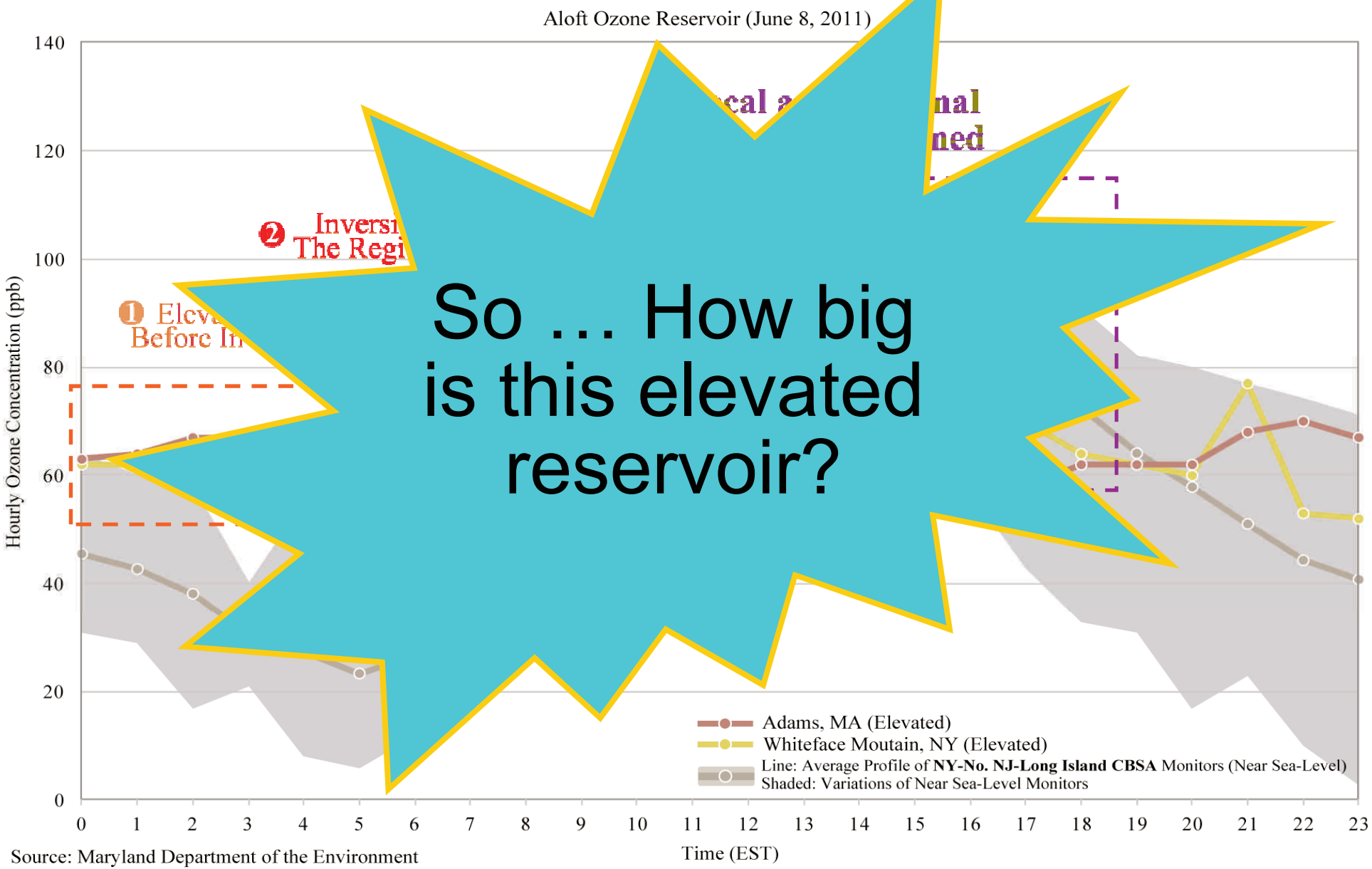
Source: Maryland Department of the Environment

Same Signal – Massachusetts 2011



Source: Maryland Department of the Environment

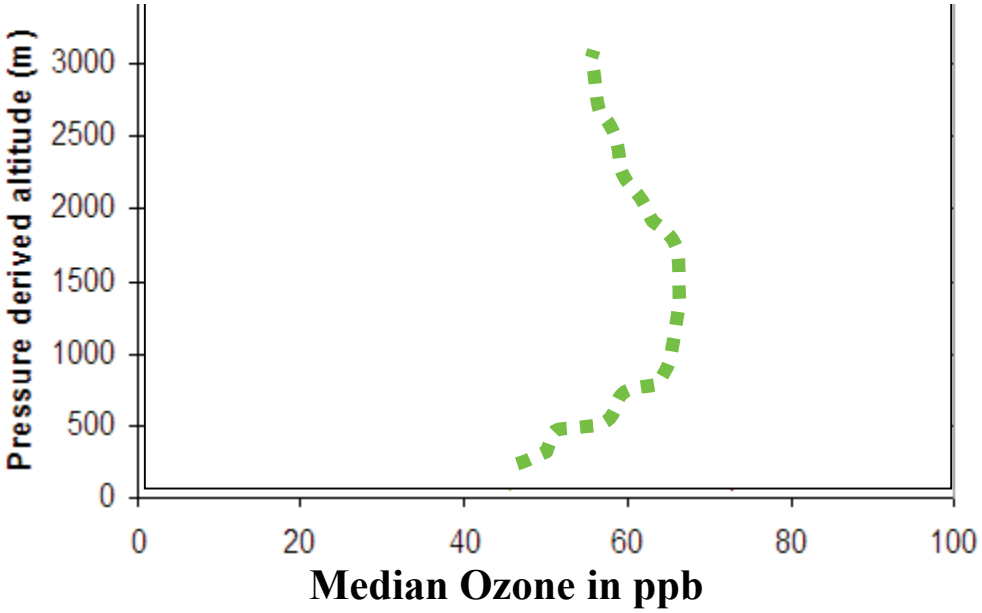
Same Signal – New York 2011



Who's Filling the Reservoir?

Aircraft Data – All Morning Ozone Profiles

(1996 – 2004)

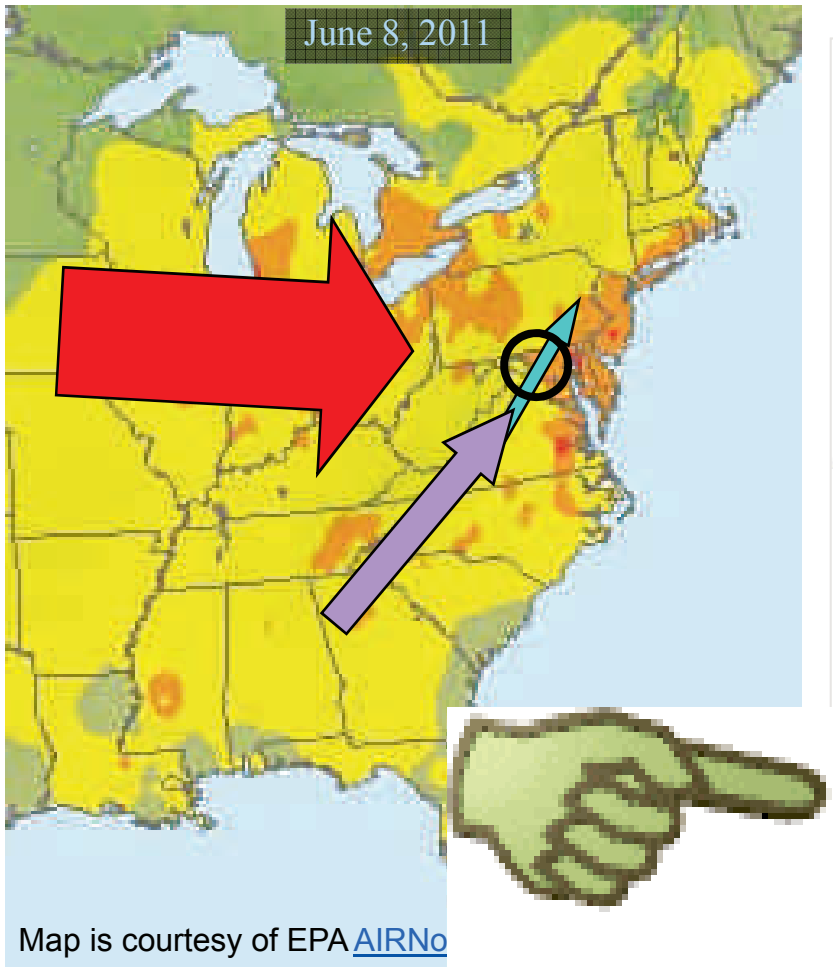


Courtesy of Jennifer Hains

University of Maryland

- What's over MD on Tuesday started off in Ohio or North Carolina on Monday.
  - MD's pollution soup floats to NJ and NY
  - New York's pollution floats to New England
- Power plants, cars, trucks and other sources are all contributors to the elevated pollutant reservoir.
- Filled with ozone and ozone precursors.

A Simplified Conceptual Model

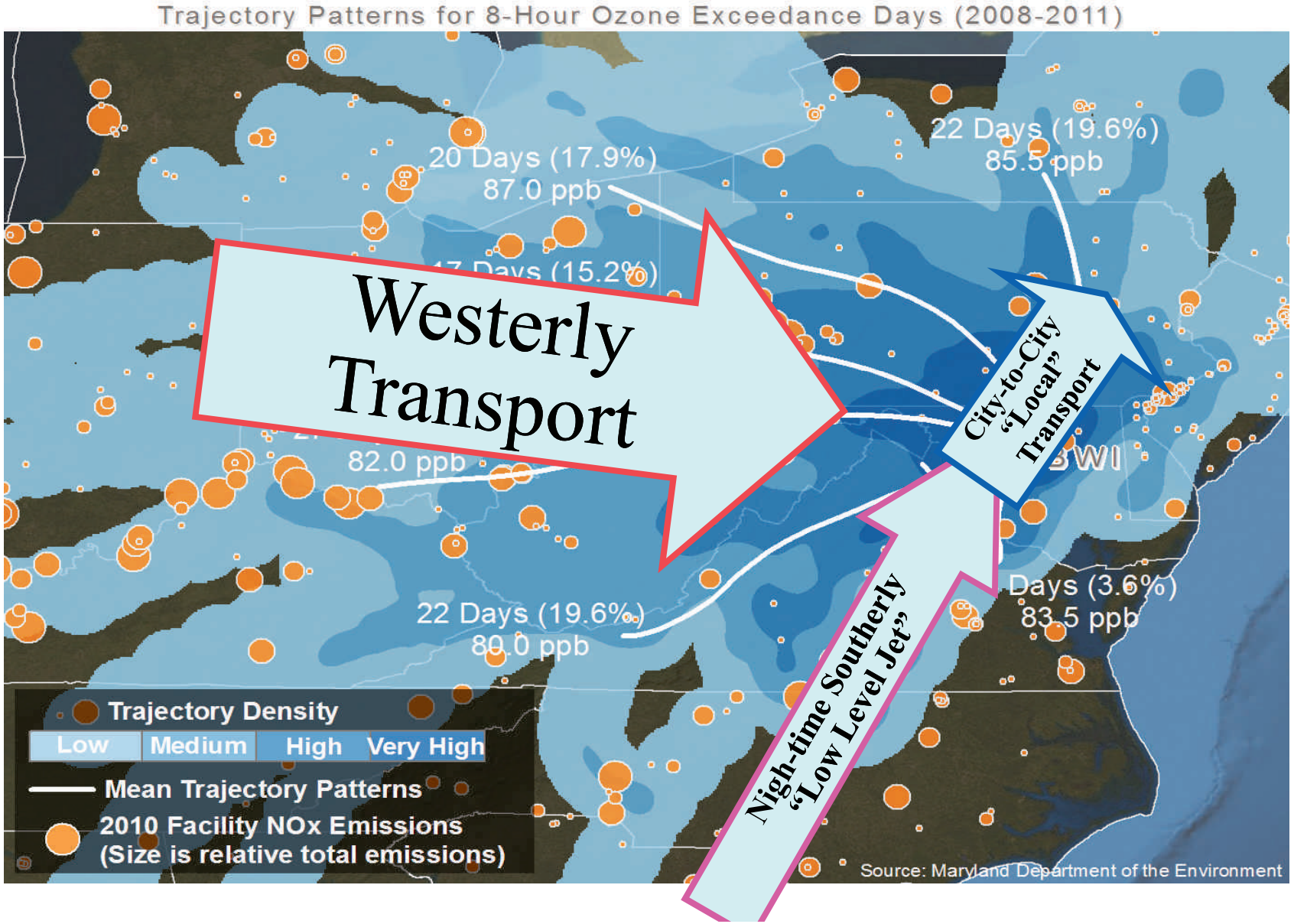


Map is courtesy of EPA AIRNo

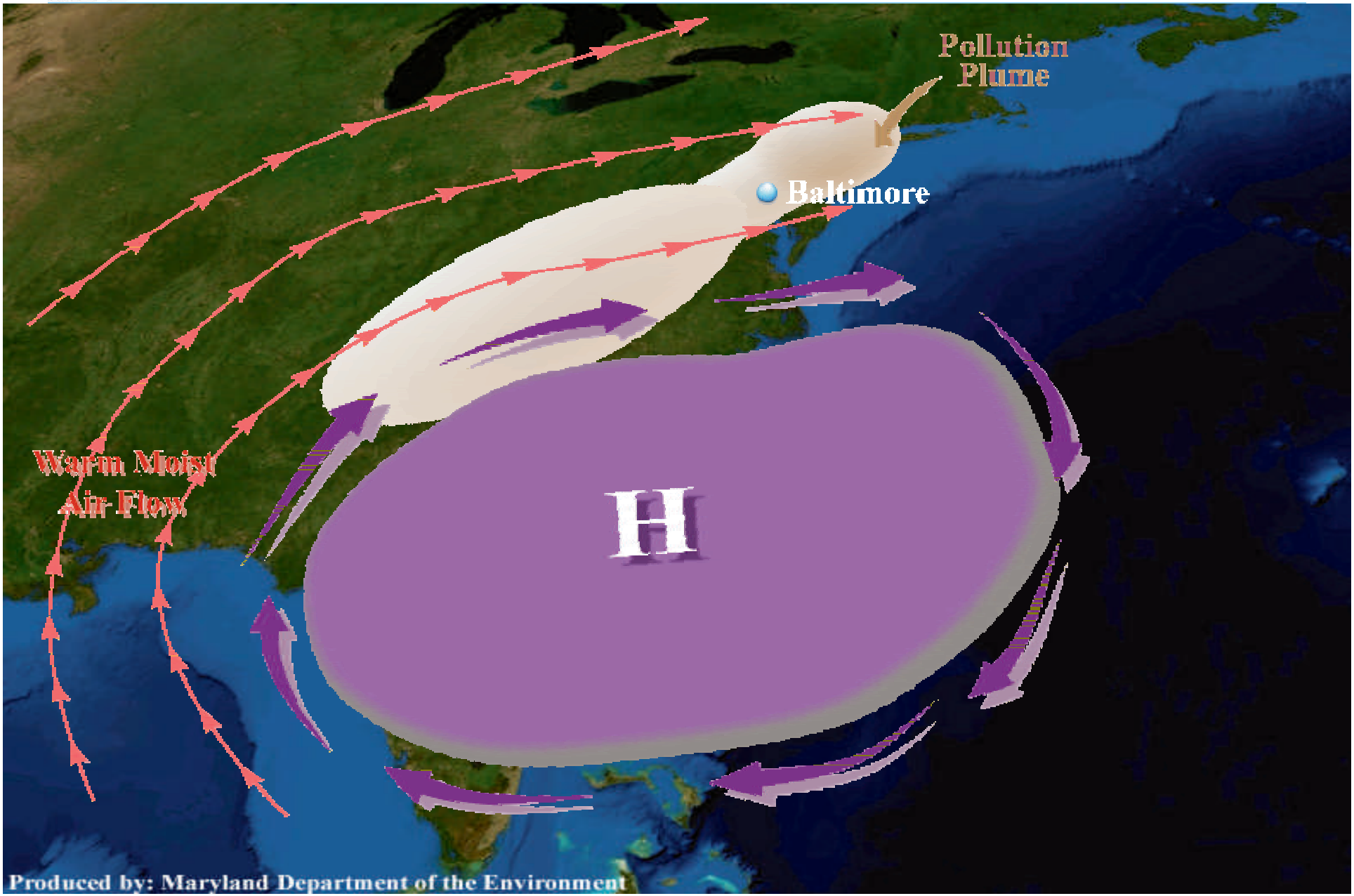
Four Distinct Parts

- **Local emissions in Cities (nonattainment areas)**
  - **Reducing local emissions can be important**
    - **If you're smart**
- **Three distinct types of transport**
  - **Short range - City to city**
    - **"Ground level" transport**
    - **Washington to Baltimore, Baltimore to Philadelphia, etc.**
  - **Westerly, Long range (up-over-and-down)**
    - **"Aloft" transport - 100s of miles**
    - **Generally from W or NW**
  - **Southerly, Nocturnal Low Level Jet (NLLJ)**
    - **"Aloft" transport at night !!!**
    - **100s of miles**
    - **SW to NE along the Atlantic**

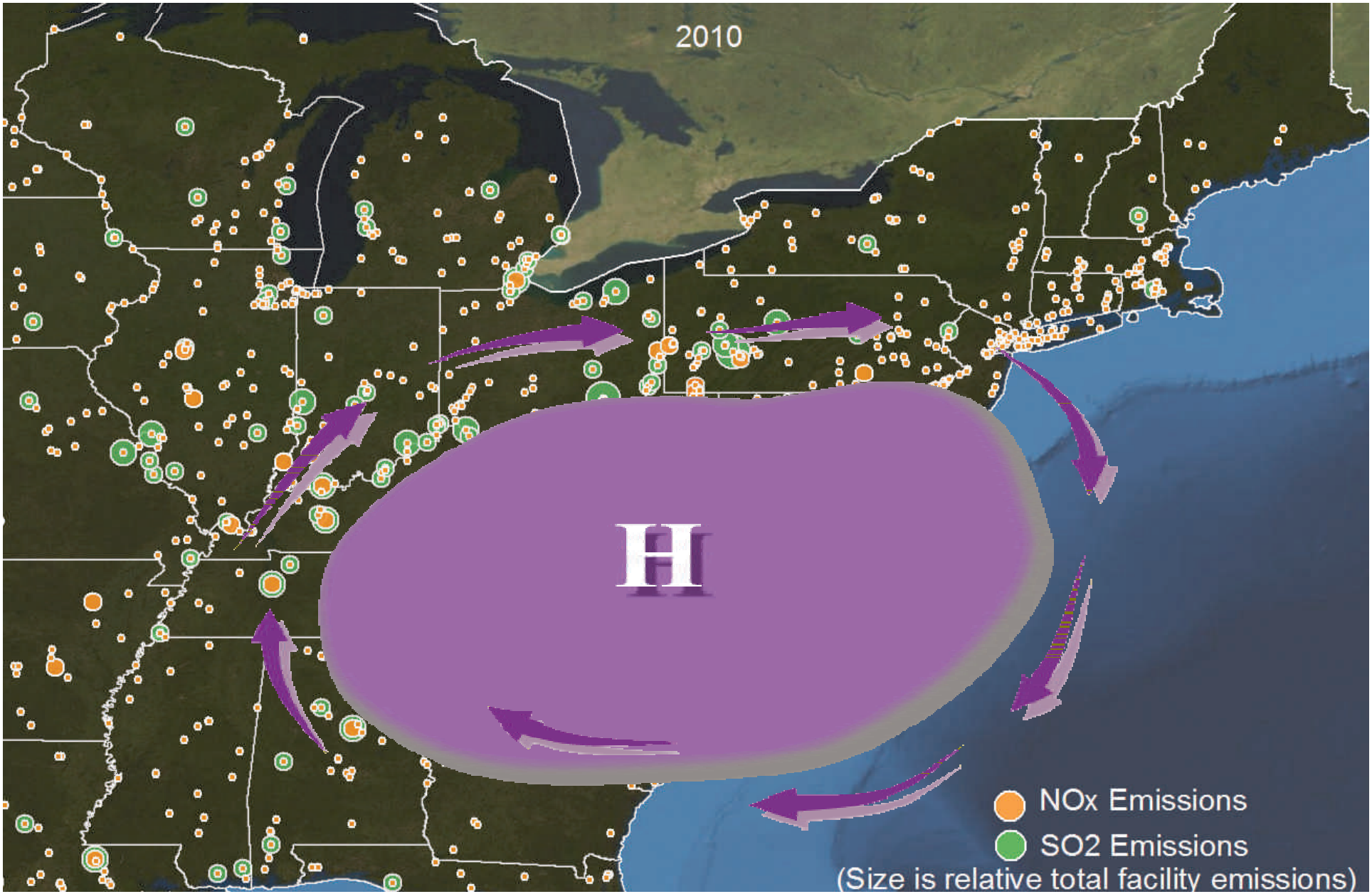
The Three Different Types of Transport



Classic Mid-Atlantic Ozone Weather

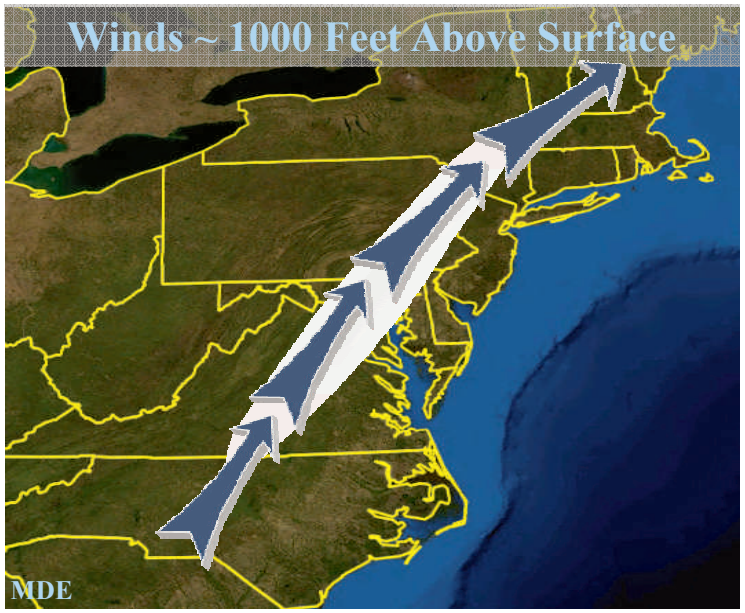


Westerly Transport



Southerly Transport at Night

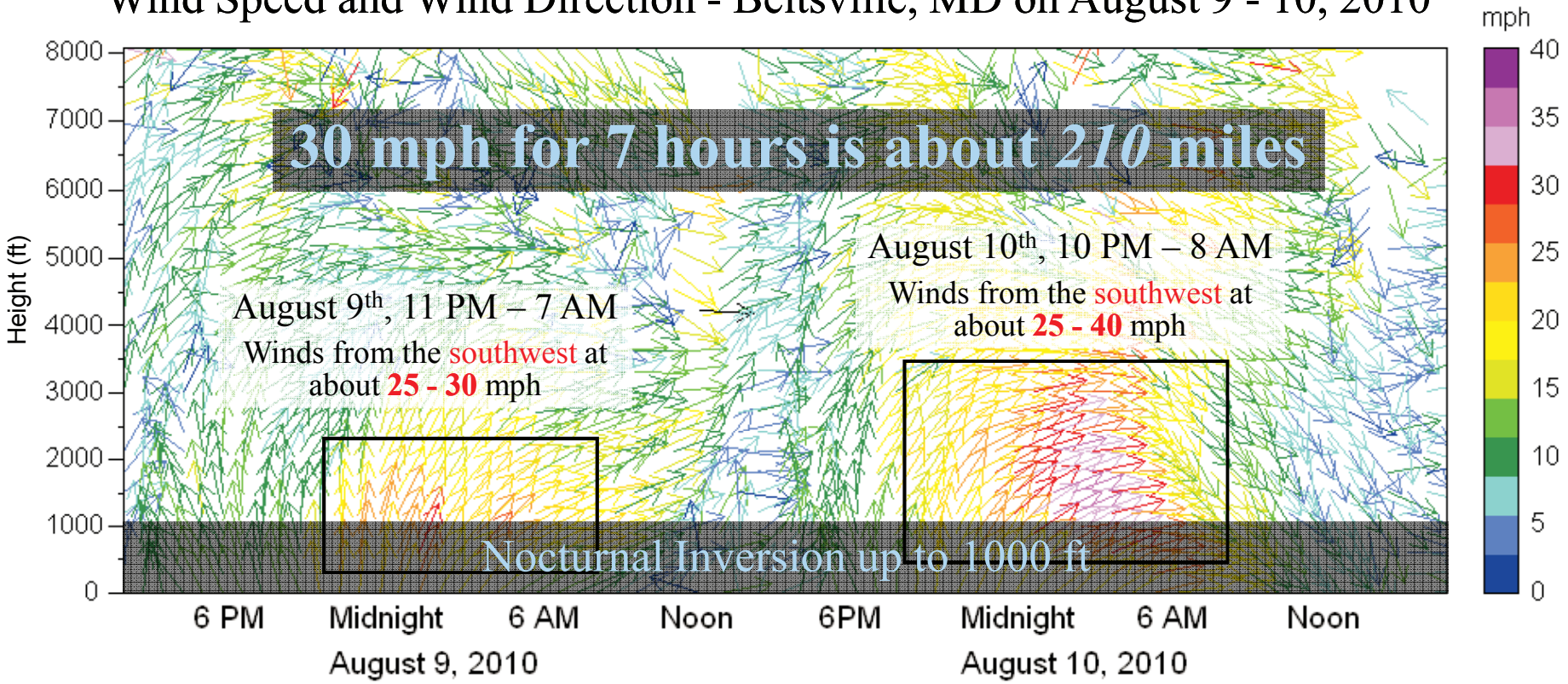
The Nocturnal Low Level Jet (NLLJ)



- Fast-moving, narrow "river" of air typically around 1000 feet above the surface
- In the Mid-Atlantic, typically observed during the night between Appalachians and the Atlantic Ocean.
  - Wind speeds can reach 40 mph or more.
  - Stretches from NC to MD to NJ and further up the east coast.
- Seen during most, Mid-Atlantic summer-time air pollution events.
  - Some form of NLLJ on virtually all code orange or red days
- Recent findings indicate:
  - Presence of a NLLJ increased Baltimore maximum ozone by 7 ppb.
  - Ozone concentrations of 90 – 100 ppb have been measured in the NLLJ.

Measuring the NLLJ

Wind Speed and Wind Direction - Beltsville, MD on August 9 - 10, 2010

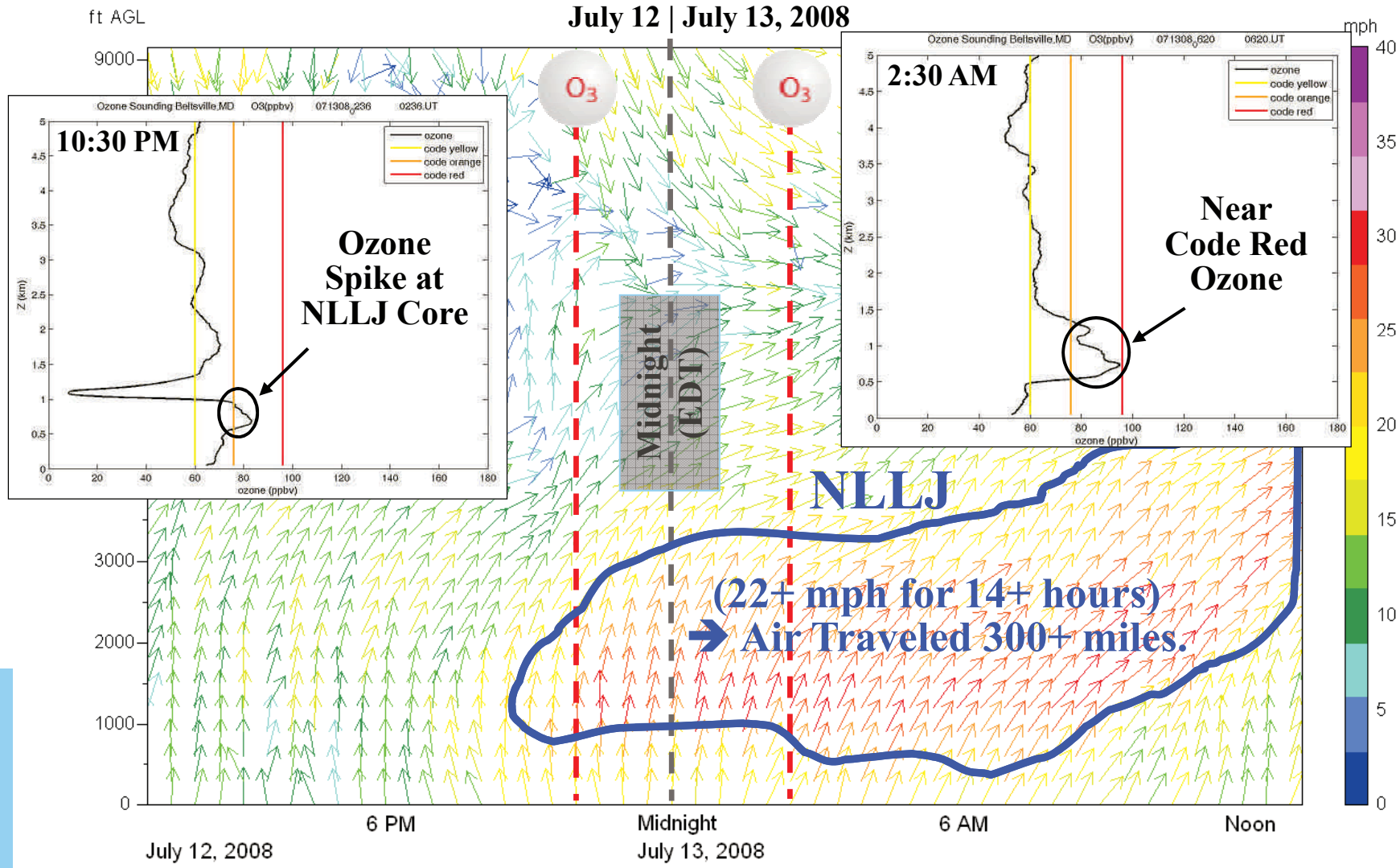


What does this graph tell us?

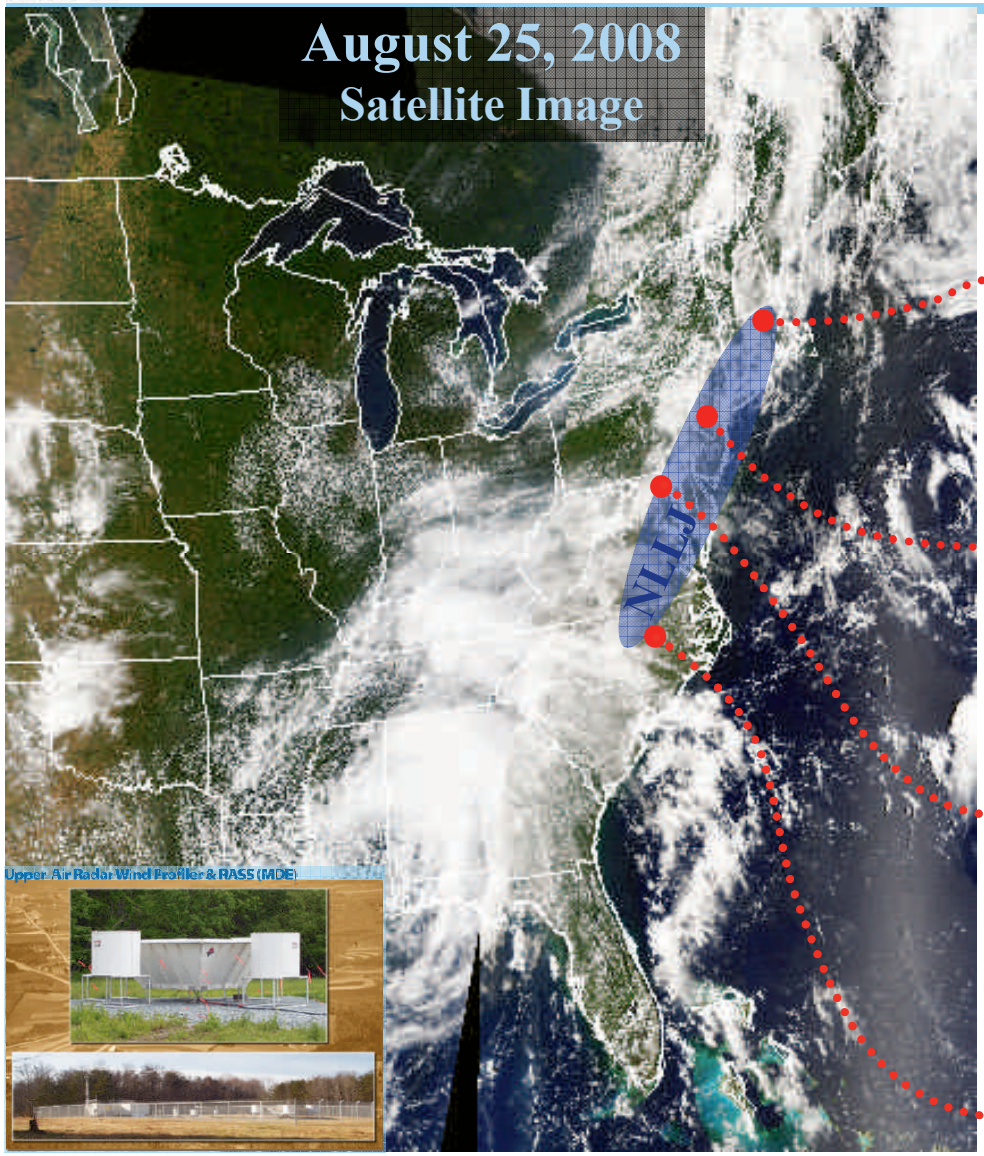
- Wind direction
- Wind speed
- From the ground up

Measuring Ozone Transport in the NLLJ

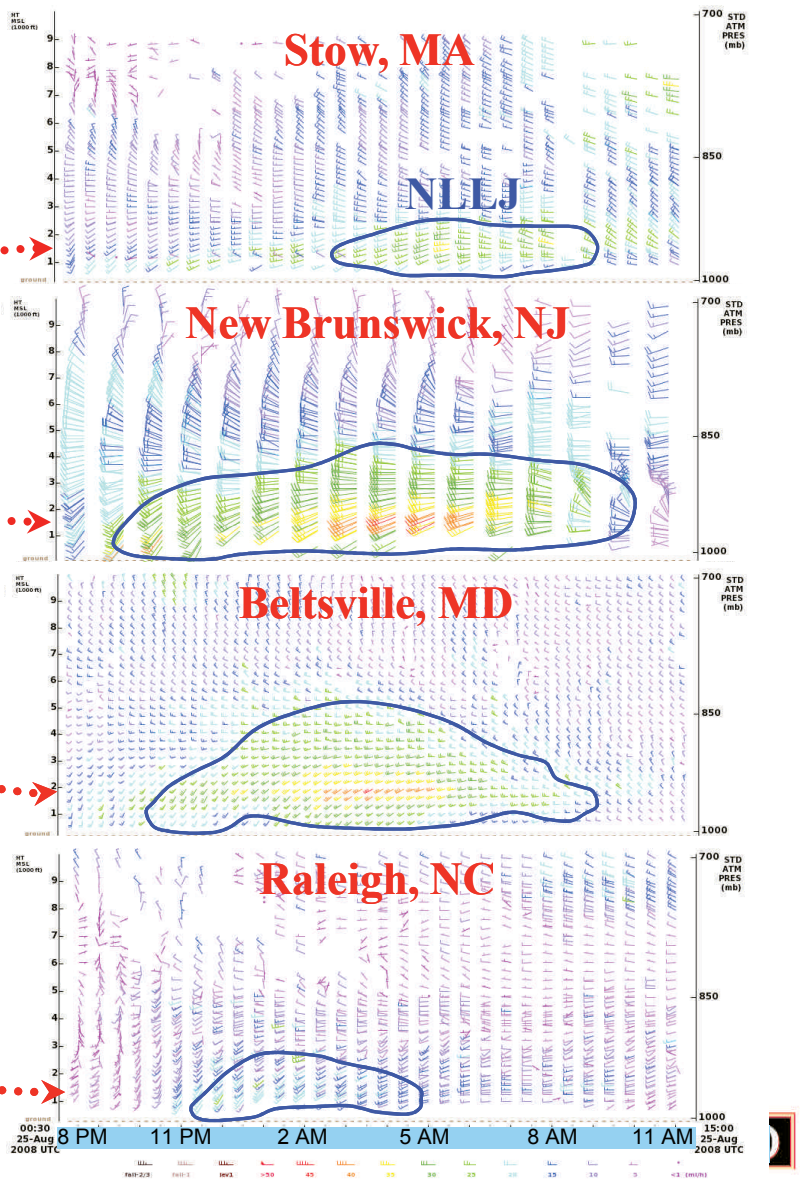
Howard University launched 4 ozonesondes on July 12-13, 2008. The 10:30 PM (Saturday, July 12th) and 2:30 AM (Sunday, July 13th) occurred during a NLLJ event, as captured by MDE's Wind Profiler.



How Big is the NLLJ?

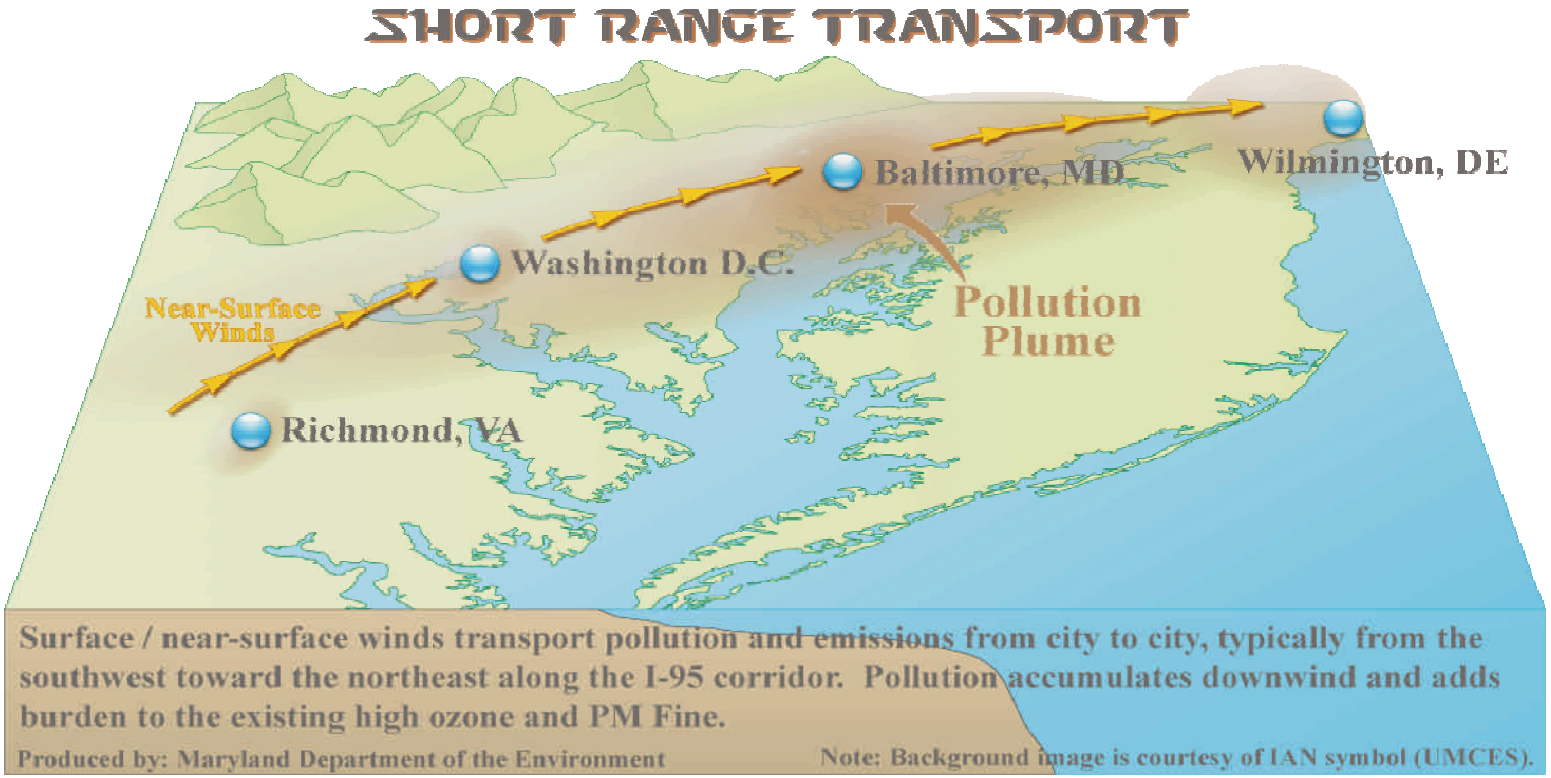


Sources: NASA, NOAA MADIS



WIND SPEED AND DIRECTION

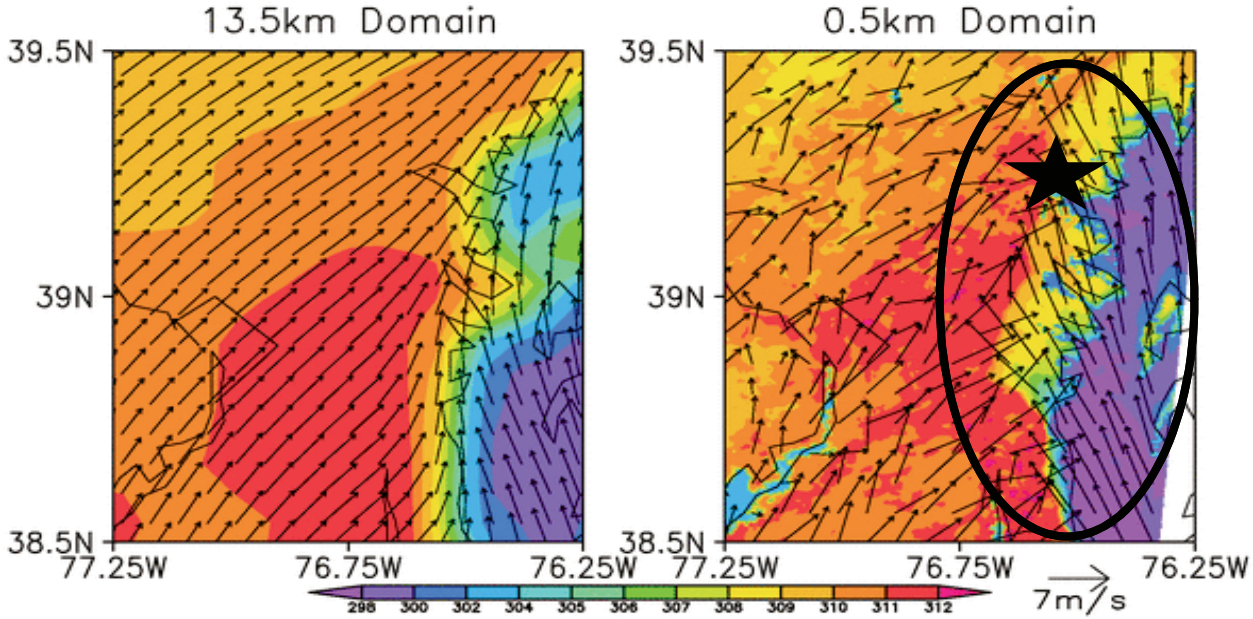
City-to-City "Local" Transport



- Surface winds are typically from the southwest to the northeast.
- The morning pollution in Washington stays at ground level and floats downwind to become part of the afternoon pollution in Baltimore.
  - Pollution from Central/Northern VA ⇨ DC ⇨ Baltimore ⇨ Philly ⇨ NJ ⇨ NY …
- Emissions from cars, area sources and stationary sources all contribute.

New Local Controls for Baltimore

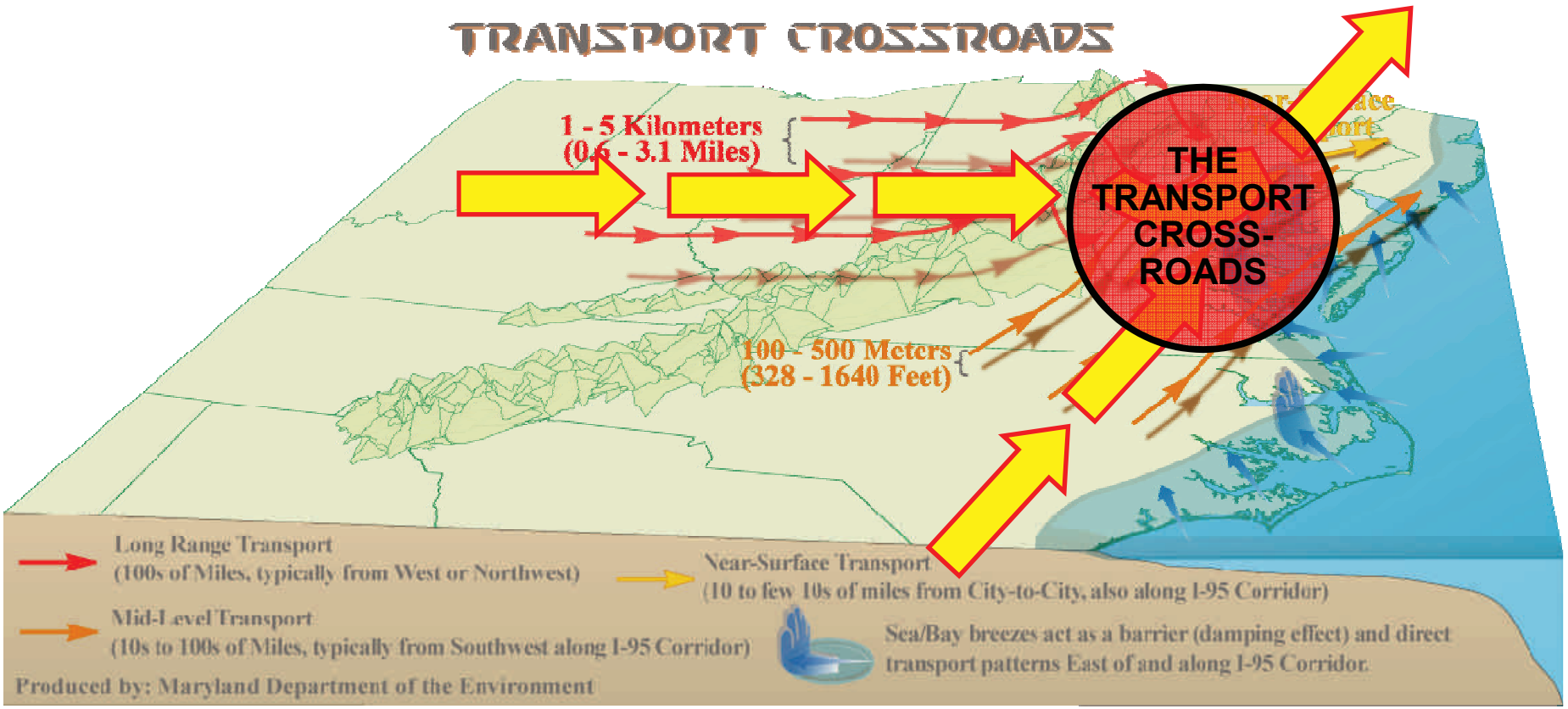
- Very Clear “City-to-City” transport
- Maryland regulation to use the conformity process to cut mobile source NOx emissions in Baltimore and Washington by an additional 10%
  - Washington area mobile NOx emissions more than double Baltimore’s
- Based on comprehensive research on the Chesapeake Bay breeze & how it “redirects” NOx emissions and ozone up the western edge of the Bay
  - Right at our Edgewood monitor
- Science based – not just control for the sake of control



July 9, 2007

2 pm

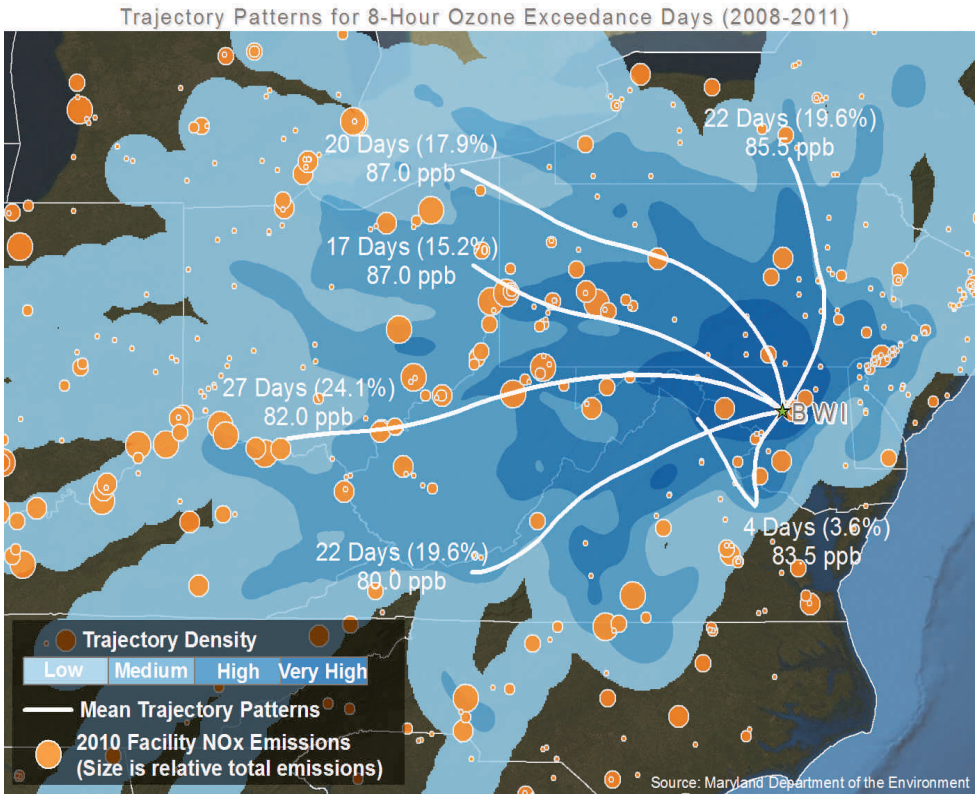
When Transport Patterns Collide



- Ozone air pollutions perfect storm. Westerly, local and southerly/NLLJ transport converge on the Mid-Atlantic states.
- Sea and bay breezes act as a barrier - or wall - and funnel ozone and other air pollutants up the Northeast Corridor.

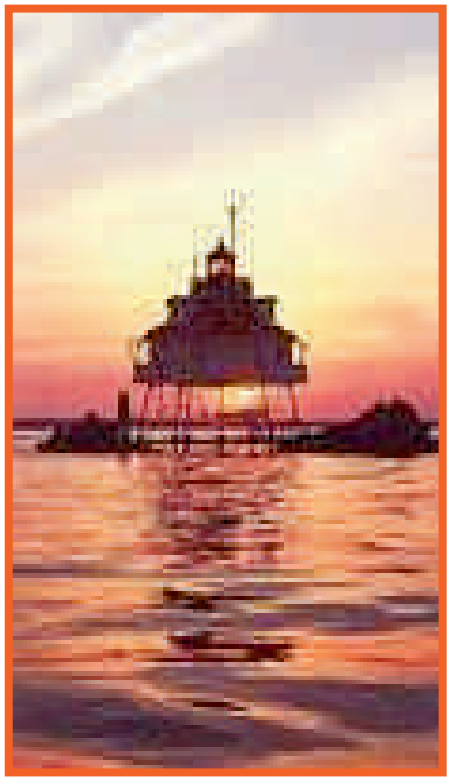
Baltimore: How Much is Transport?

- Varies with changes in meteorology but best guess is something like
  - 30 to 40% Westerly transport
  - 10 to 20% City-to-City “local” transport
  - 10 to 20% Night-time, southerly NLLJ transport
  - 10 to 20% local
- Local controls on local emission sources can only address this last 10% to 20%.



So What is the Solution?

- Super-Regional NOx controls
  - With science-based (not formula based) local controls in the toughest areas
    - NOx and – in some cases VOC
- So what is this "only in the toughest areas" thing coming from MD
  - We (MD) will need to have very aggressive local controls to complement the super-regional controls
    - The question is – do the new local controls make any sense alone?
- And yes – for all of those new areas that are just joining the nonattainment club
  - Or some of the old "on the edge" areas
    - Local controls alone do not make sense



Pushing Federal Measures

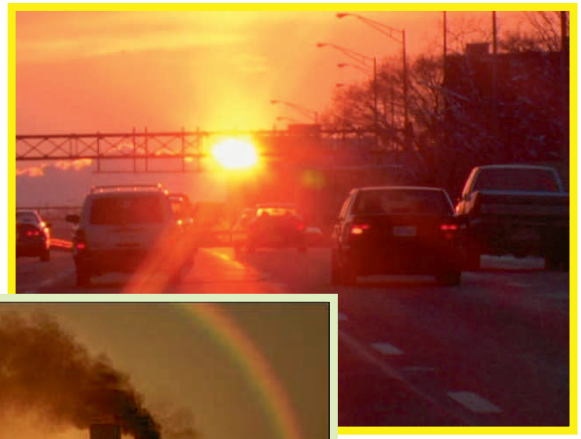
… as the best tool to address transport

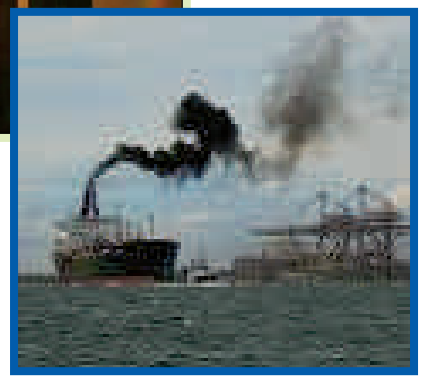
- Multiple OTC actions on federal measures over the past 2 years
  - Support for federal measures to reduce transport from almost all 50 states
- The OTC has built a very strong scientific basis for the need to reduce regional emissions with federal measures
  - Analyses of past efforts show that these regional emission reduction programs will work

The Priority Source Categories

The OTC and NACAA National Asks:

- Power Plants (EGUs)
- On-Road Vehicles – Cars and trucks
- ICI Boilers
- Cement Kilns
- Marine Engines
- Locomotives
- Aircraft



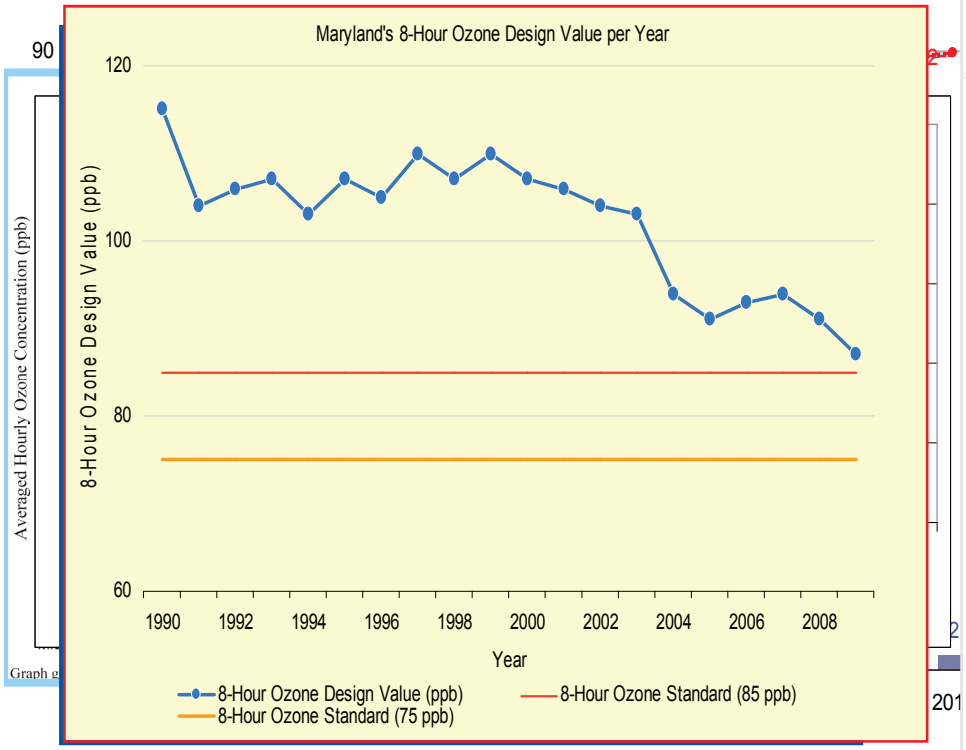


These represent …

- 75 % of the NOx left to regulate
- 85 % of the SO2 left to regulate
- 75 % of the 2005 Hg emissions

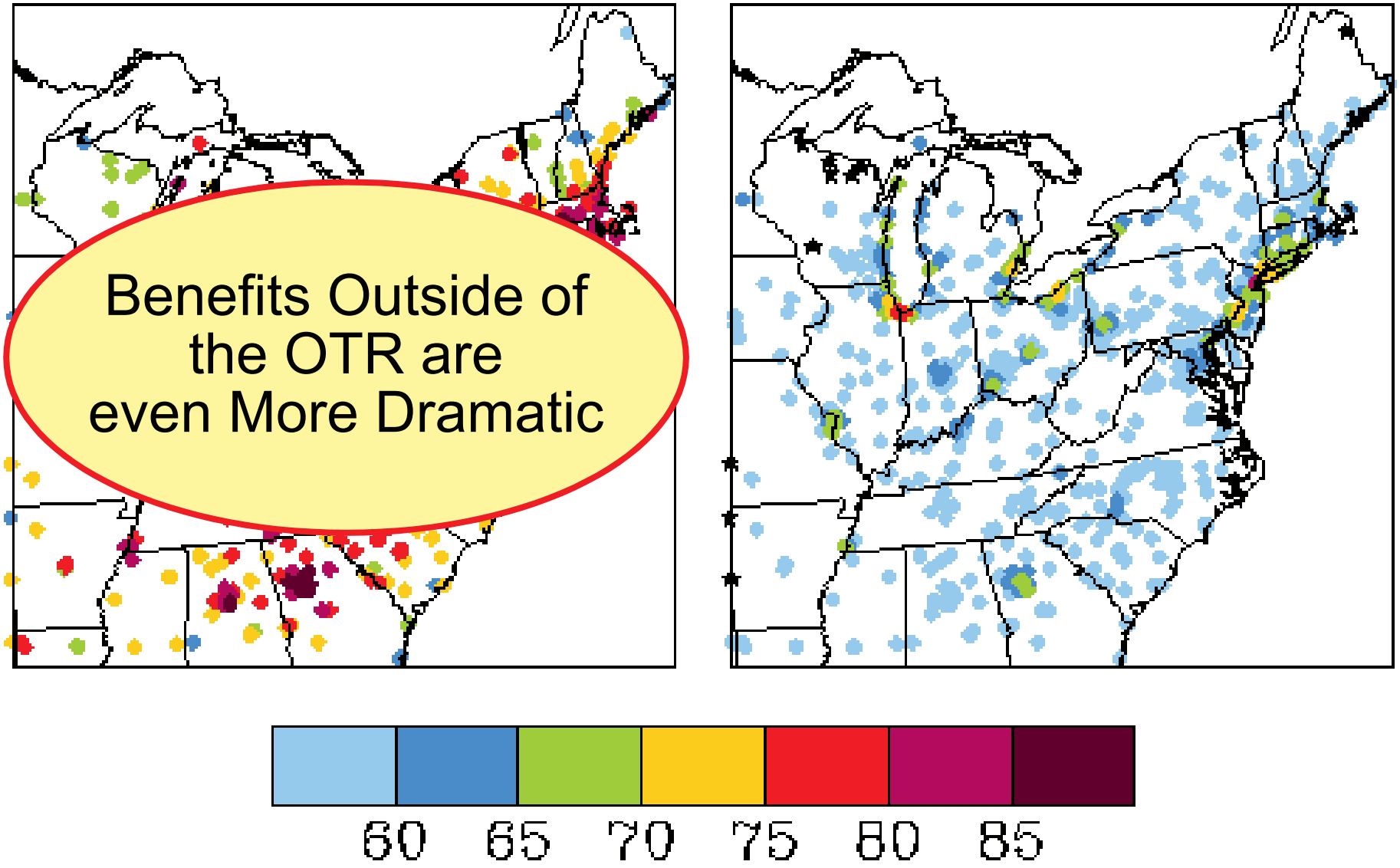
Why Are Federal Measures Important?

Ground Level Ozone Drops Dramatically in the Same Time Frame



- Because they work!
- The classic ozone transport story
  - Incoming ozone levels (as high as 80 ppb) collect in an elevated reservoir over night
  - Real world programs like the NOx SIP call have shown that
    - Adding regional controls
    - Results in regional NOx emission reductions …
    - Which lead to reduced ozone in the elevated reservoir …
    - Which lead to lower ozone at ground level and public health protection!

Will Federal Measures Get Us to 75 ppb?



Status of EPA's Federal Measures?

- Federal rules for all key categories in some stage of adoption or proposal
  - Kudos to EPA
    - Tier 3/low sulfur fuel and CSAPR are two good examples of EPA's efforts on federal rules to reduce transport
    - That said … many of EPA's current efforts fall short in reducing NOx – the key to reducing ozone transport
      - For example, EPA has promised to do more with NOx – in CSAPR "#2"
    - Some final rules and rules that are being proposed are likely to be litigated and delayed

Other L gal O ons f r "Transport"

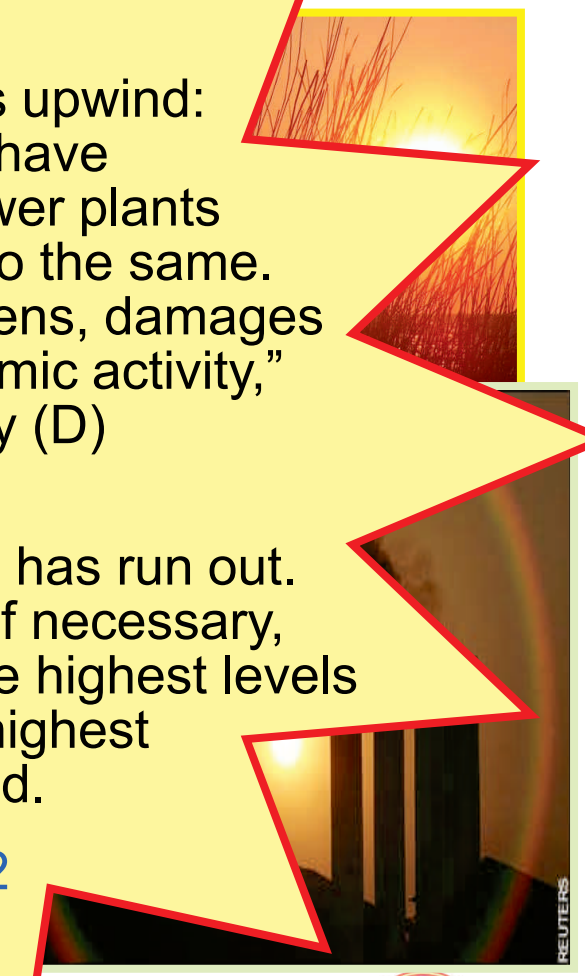
- At it's
  meetir
  te
  bo
- A Tra
  place
  - Looking at bo es
    and legal too

More Recently …

"Those of us in the Northeast have a simple message for our friends upwind: it is time for you to act. While we have invested heavily in cleaning up our power plants for too long, many states have failed to do the same. This failure threatens the health of our citizens, damages sensitive ecosystems, and distorts economic activity," said Connecticut Gov. Dan Malloy (D) in an address at the meeting.

"Let me be clear about this -- our patience has run out. The time to curb these emissions is now. If necessary, the Northeast states will press this case at the highest levels of our federal government and the highest courts in our nation," Malloy said.

ECOS Meeting - June 7, 2012

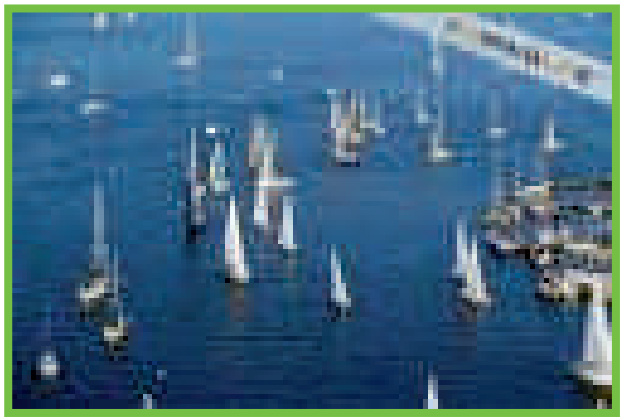


CAA Transport Tools

- Section 107
  - Giant non-attainment areas
- Section 126 Petitions against stationary sources
- Section 110A2D “Good Neighbor” requirements
- Section 176A (or 184) Petition to create a new, much larger “Eastern Transport Region”
- Another “state partnership” effort
  - Daughter of OTAG
- One, none or some combination of above?

So What Can States Do?

- Four pretty basic choices
  1. Push and Support EPA on their efforts to adopt federal measures to reduce transport
  2. Each state could – as required in the CAAs "Good Neighbor" provisions in Section 110(A)(2)(d) - adopt it's own set of NOx reduction programs
     - to reduce it's significant contribution to downwind neighbors
  3. Do both 1 and 2 – MDs plan
  4. Do nothing & cross your fingers



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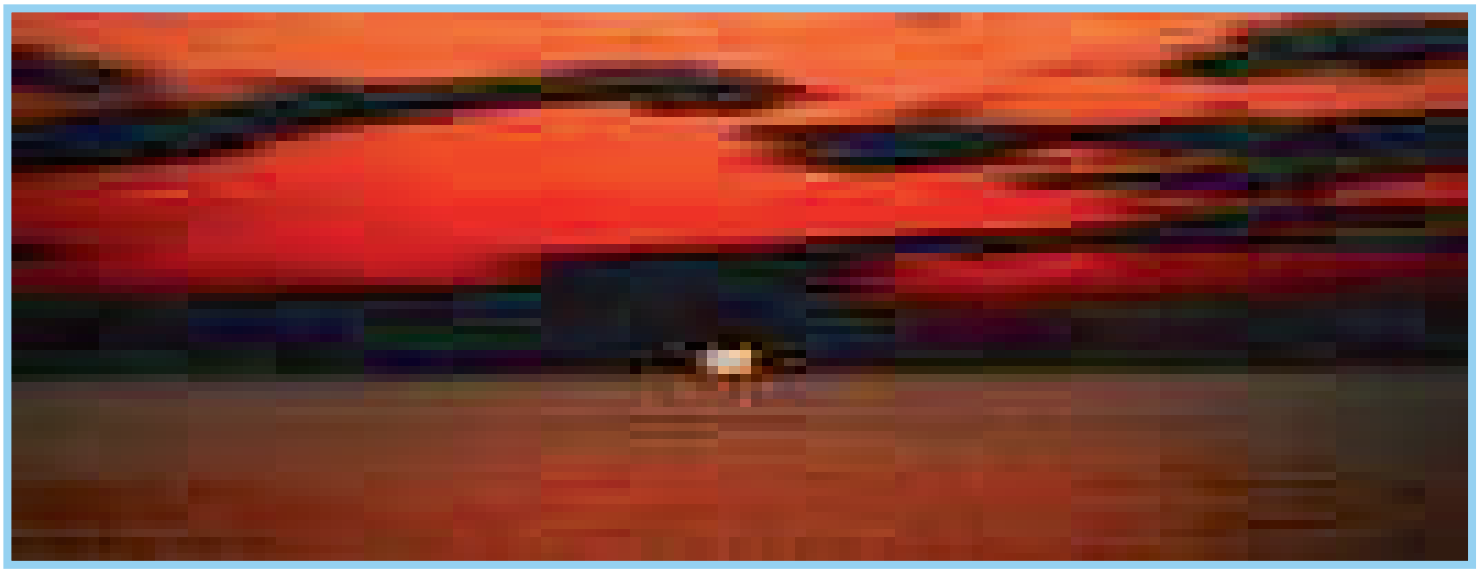
Questions?



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