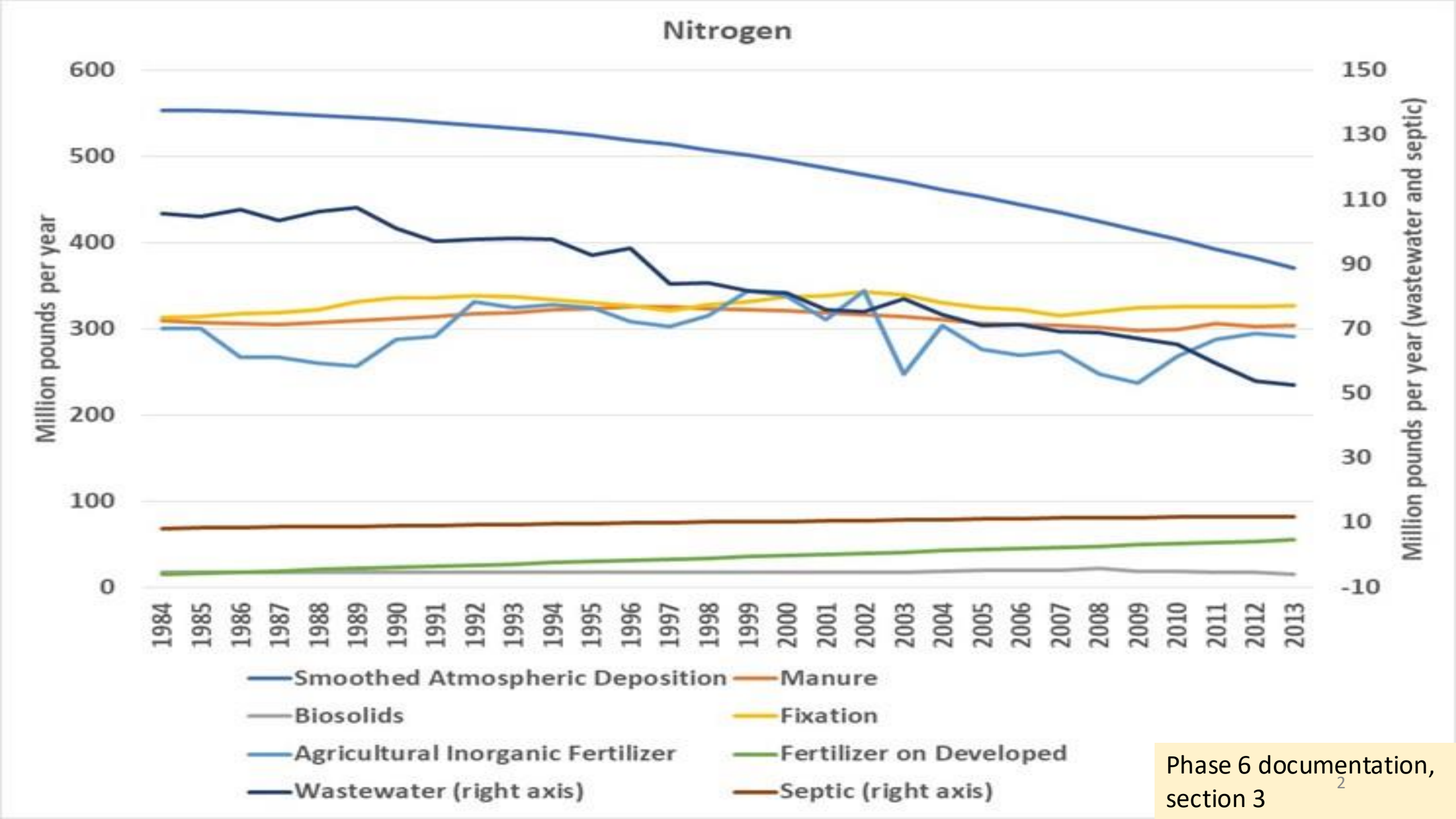
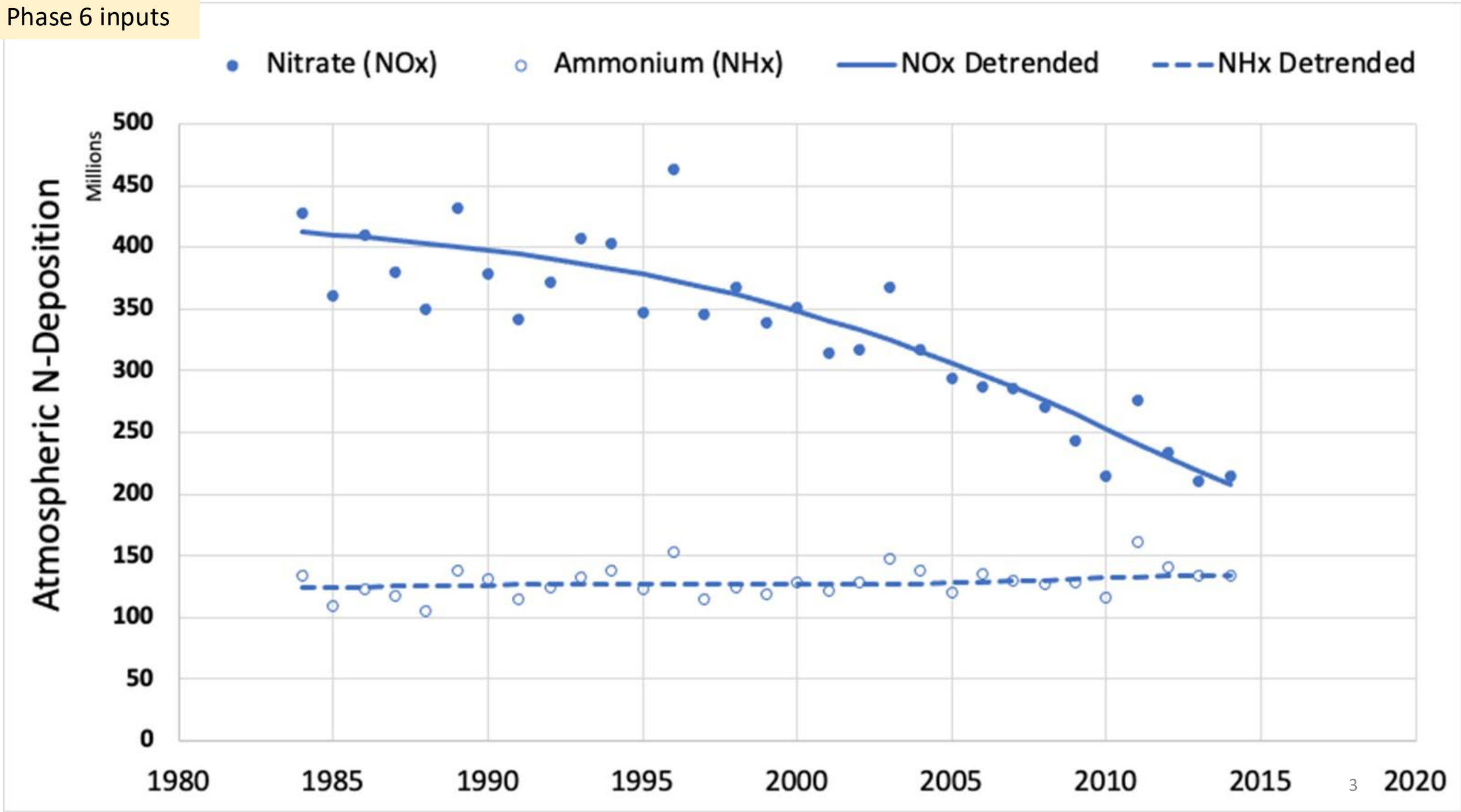
Atmospheric Deposition Source-Delivery Relationships

1/7/2025

MWG


Nitrogen
Million pounds per year
Million pounds per year (wastewater and septic)
600
500
400
300
200
100
0
150
130
110
90
70
50
30
10
-10
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Smoothed Atmospheric Deposition
Manure
Biosolids
Fixation
Agricultural Inorganic Fertilizer
Fertilizer on Developed
Wastewater (right axis)
Septic (right axis)

Phase 6 inputs



What is the effect of emission reductions?

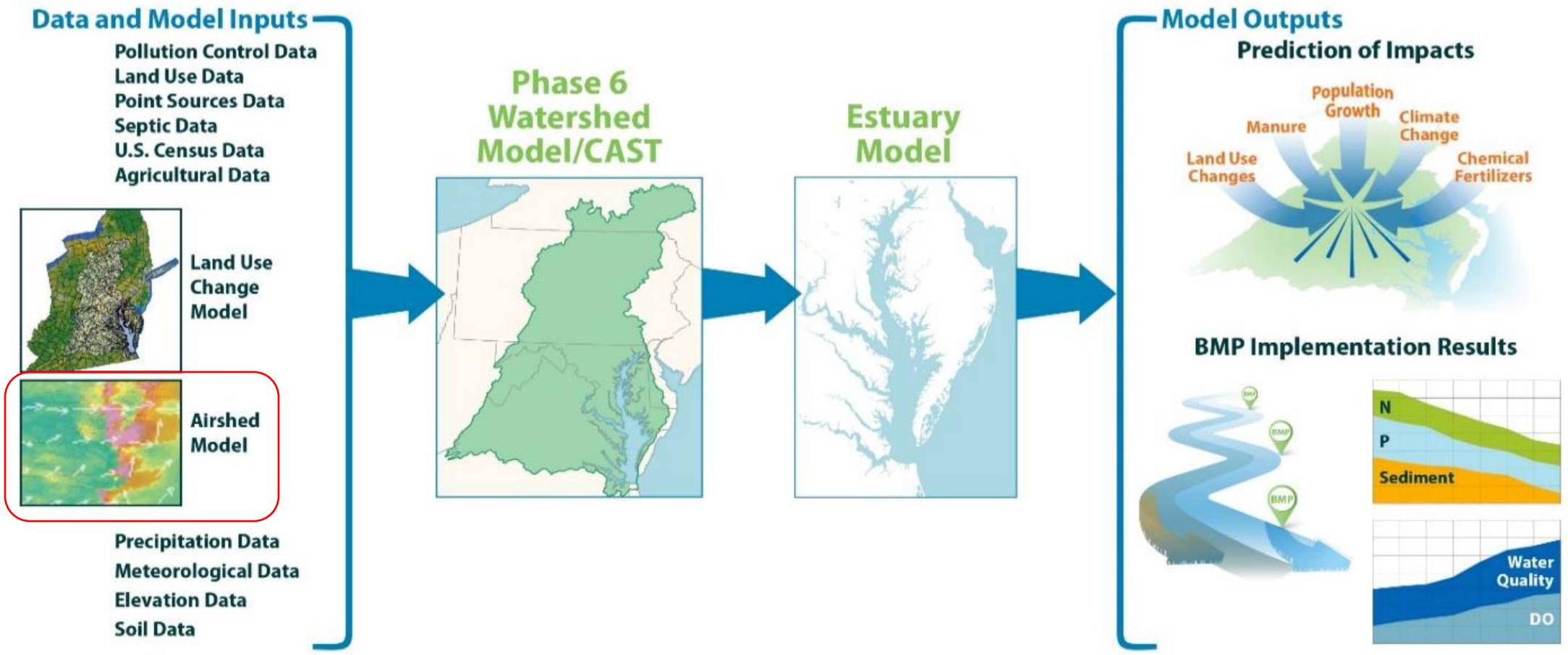
	Emitter					
	DE	MD	NY	PA	VA	WV
Reduced	5.27%	11.17%	2.43%	6.70%	8.93%	4.96%
Oxidized	1.83%	4.13%	0.83%	2.43%	3.36%	1.74%

These are currently in use but can change with the new ISAM model runs. Based on 2013 version of CMAQ source attribution by State for NOx only.

https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/rdennis3_ches_bay_nox_sce_attribution_cbayjan13.pdf

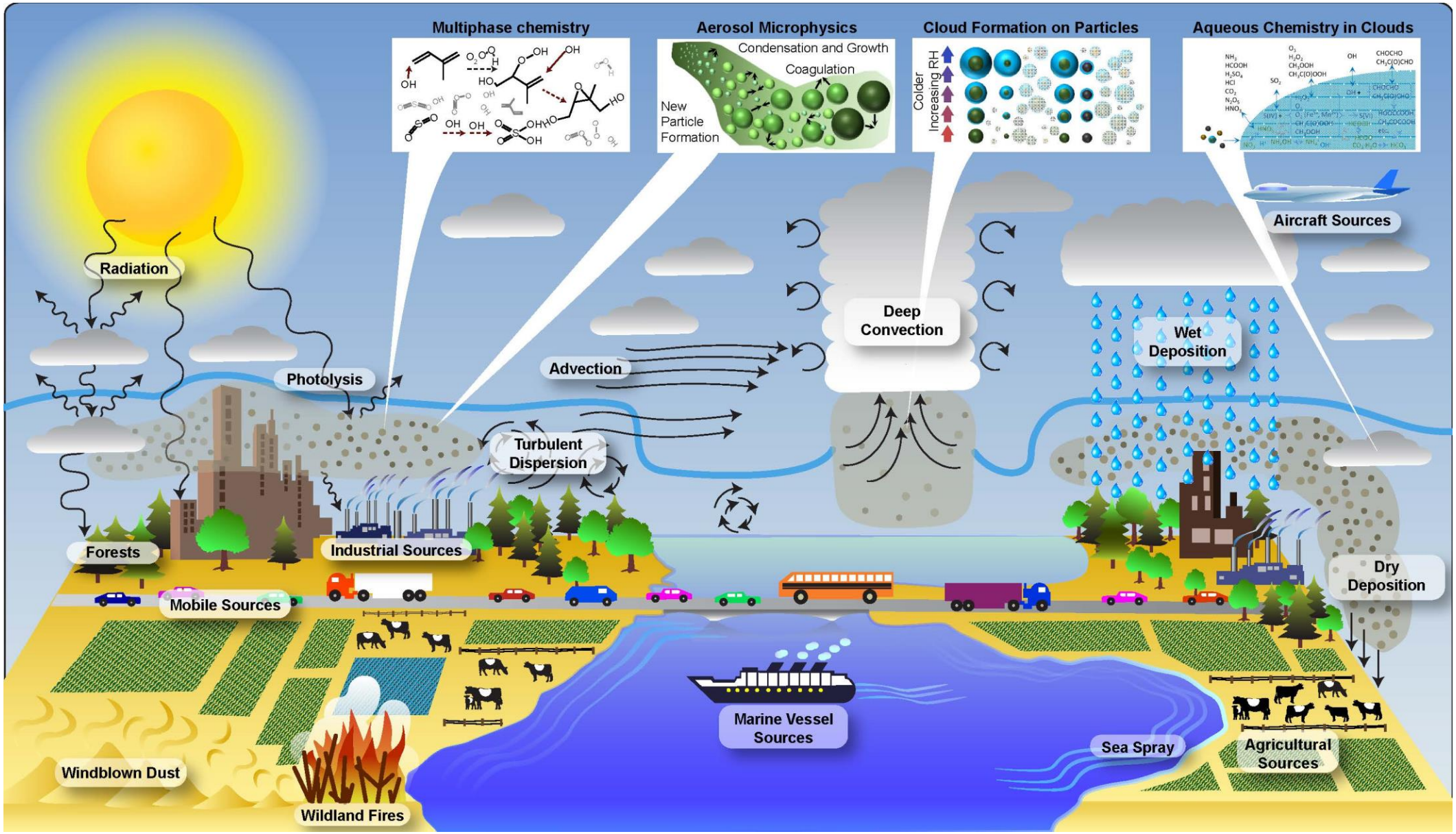
Source: Phase 6 documentation

Chesapeake Bay Program Modeling System



Hood et al. 2021 https://doi.org/10.1016/j.ecolmodel.2021.109635

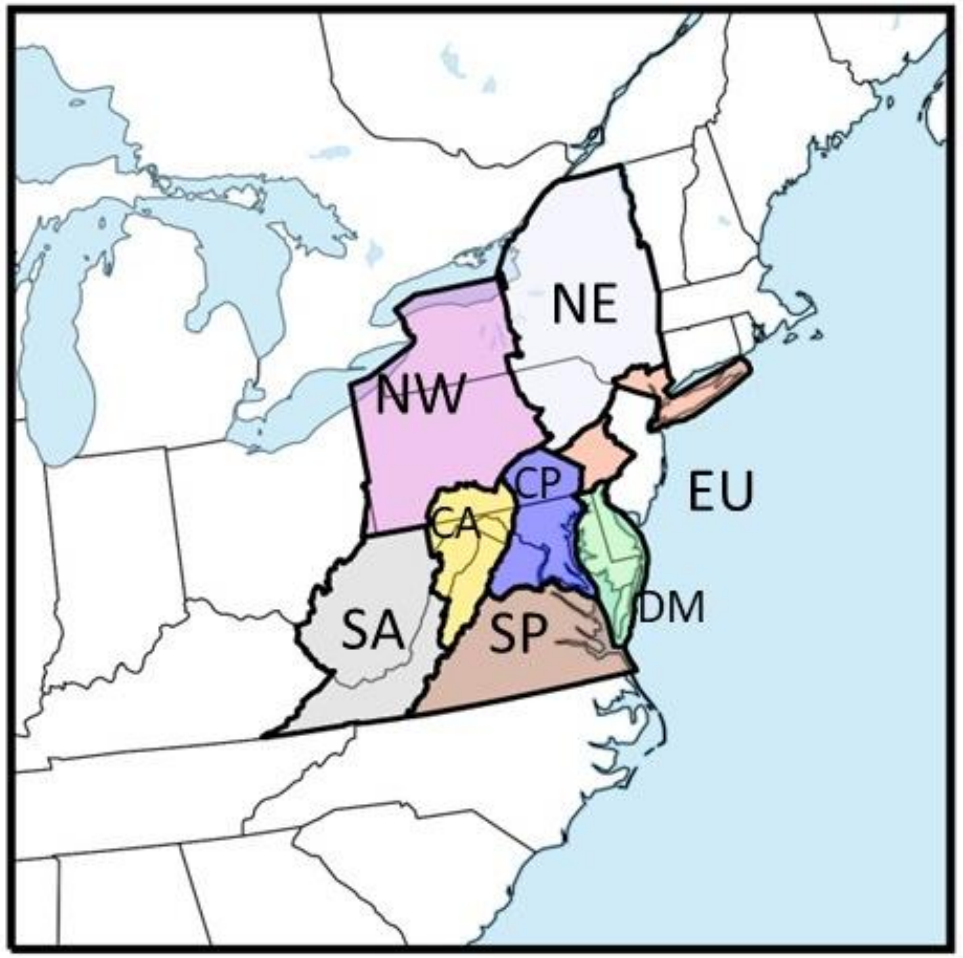
CMAQ



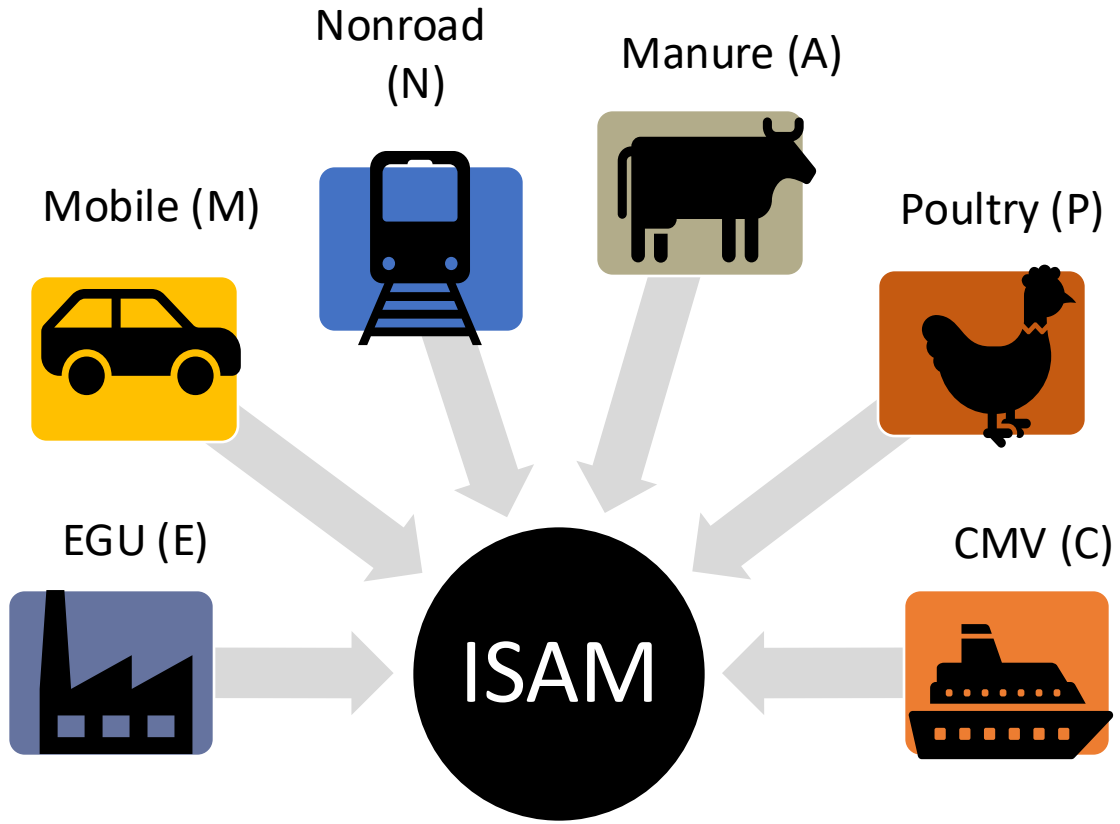
https://www.epa.gov/cmaq/overview-science-processes-cmaq

CMAQ Integrated Source Apportionment Method (ISAM)

Geographic emission source regions

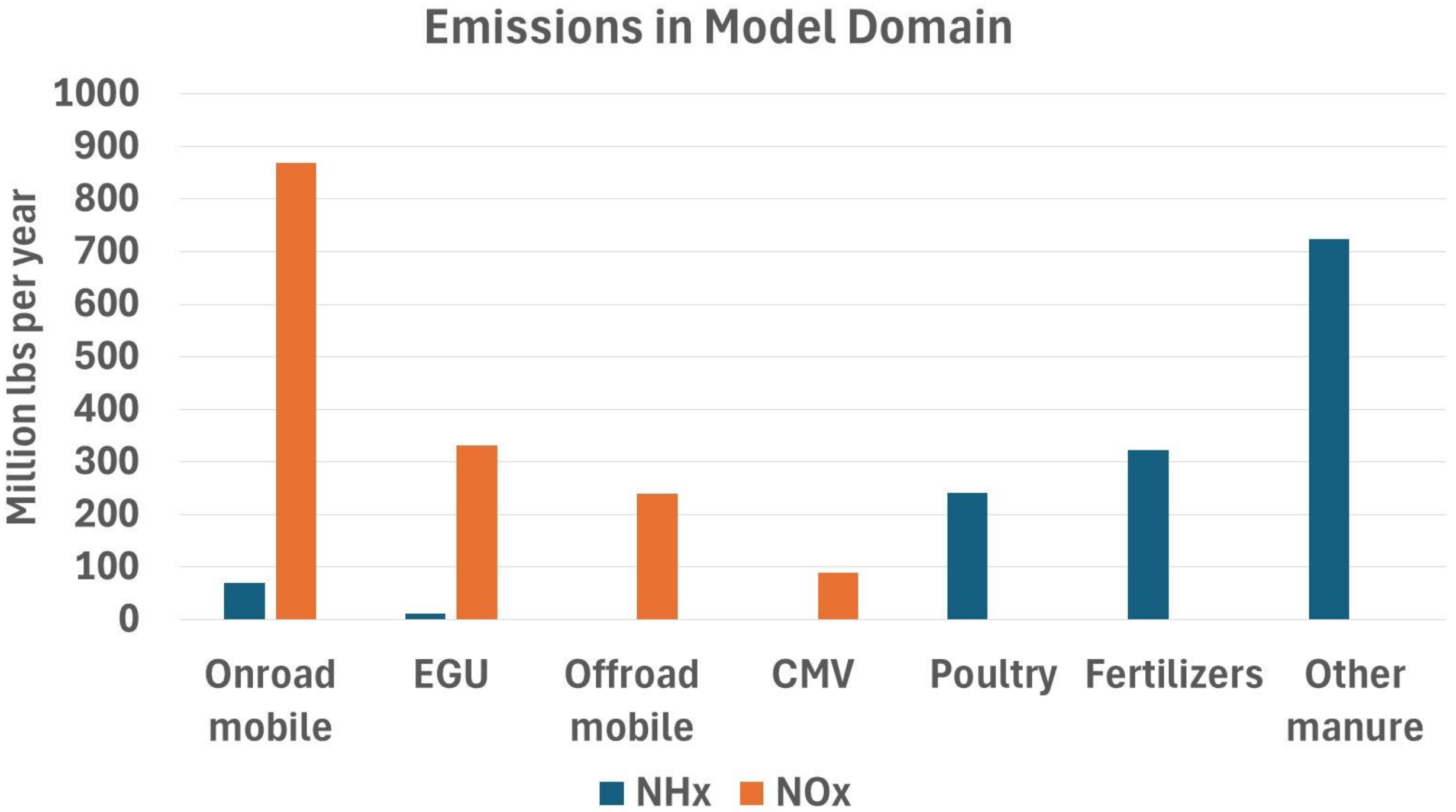


Emission source categories



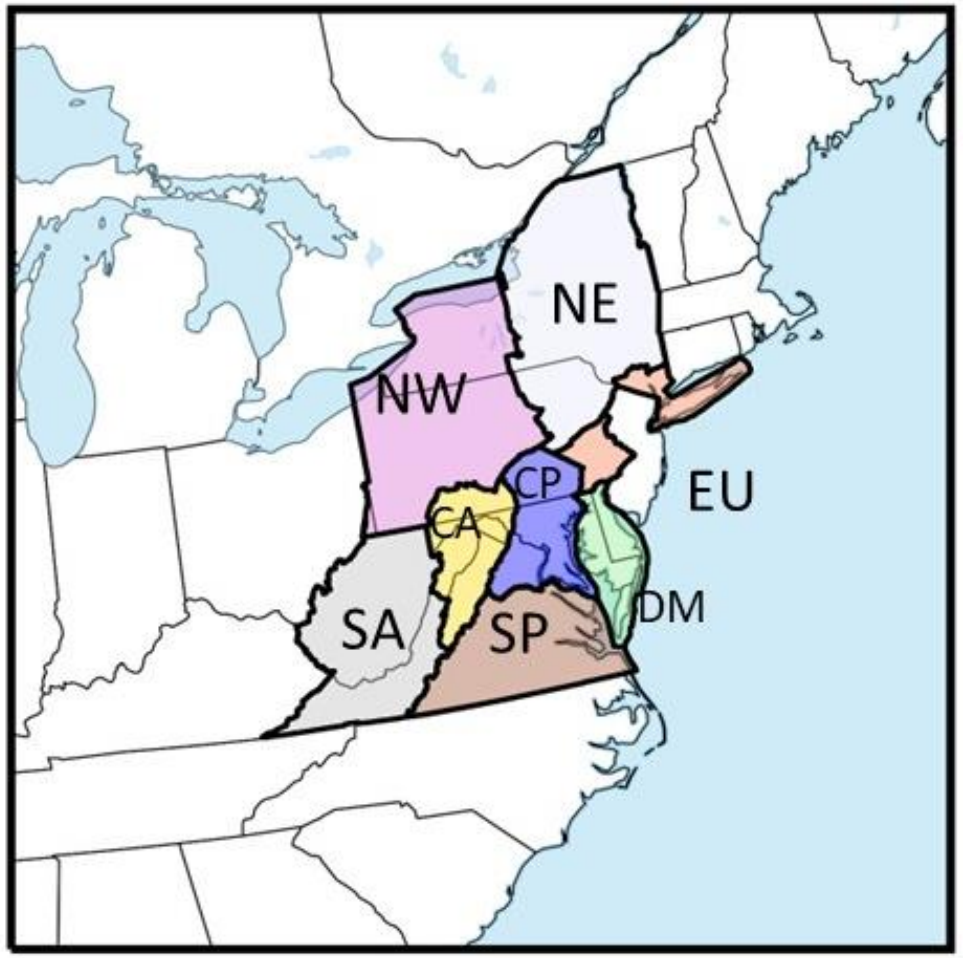
Fertilizer assumed equal to the weighted average of manure and poultry

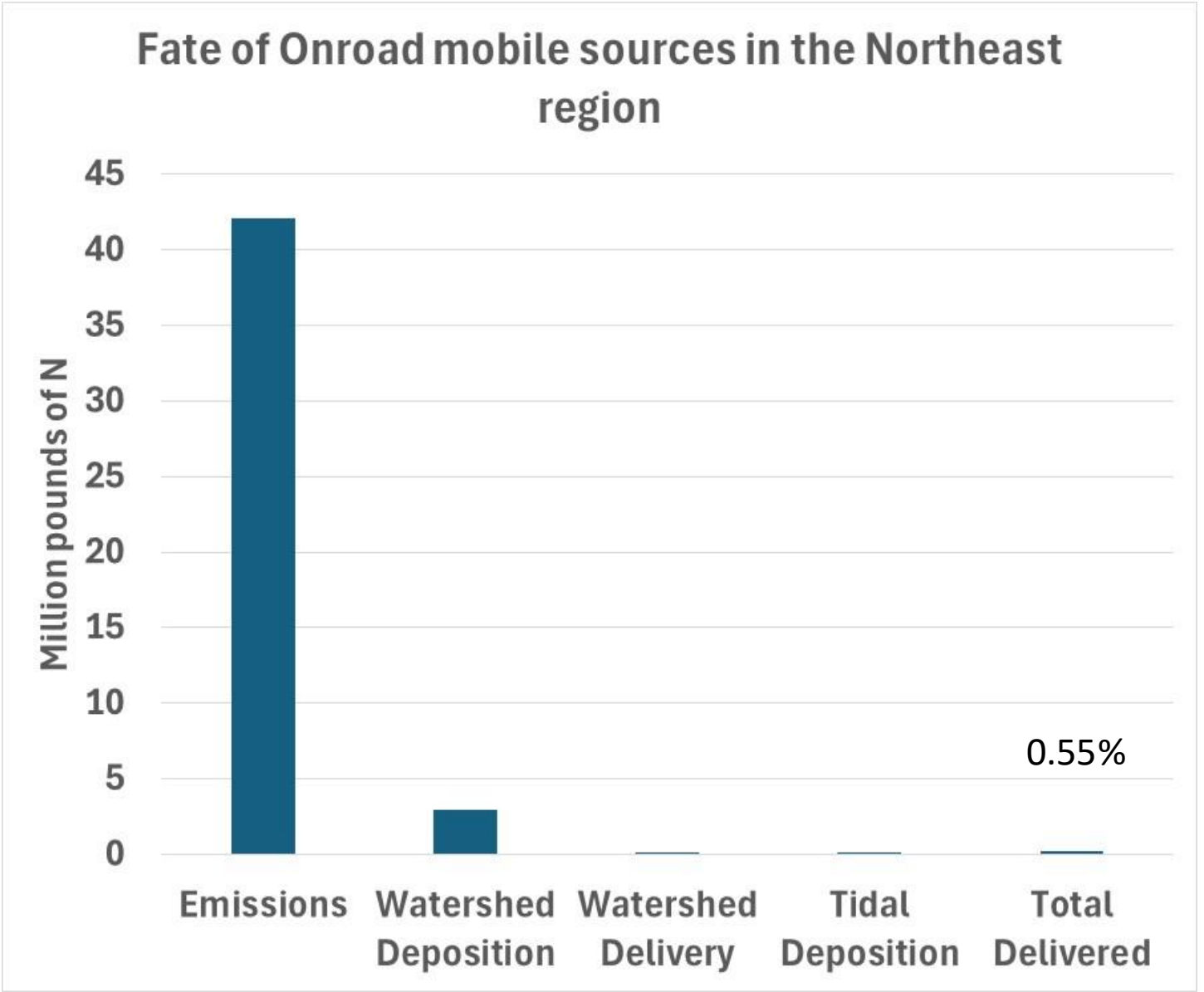
Benish et al., 2023 *in review*


Emissions in Model Domain
Million lbs per year
1000
900
800
700
600
500
400
300
200
100
0
Onroad mobile
EGU
Offroad mobile
CMV
Poultry
Fertilizers
Other manure
NHx
NOx

CMAQ Integrated Source Apportionment Method (ISAM)

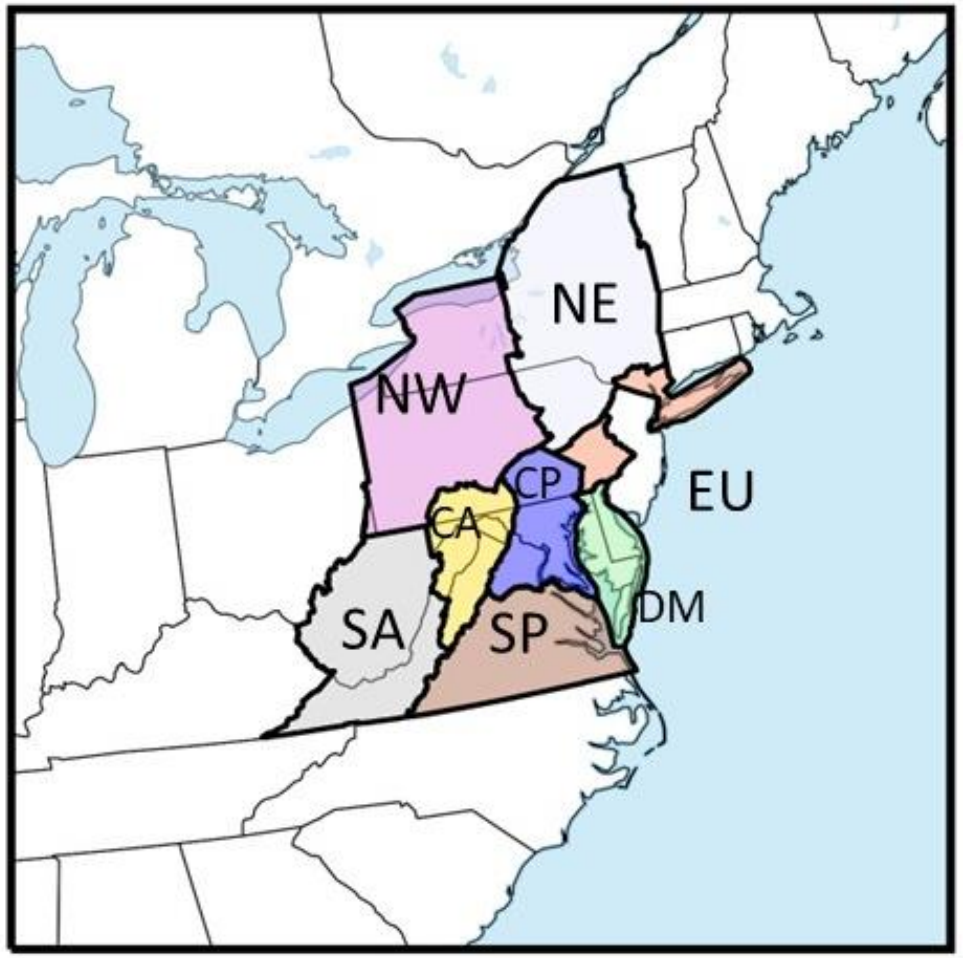
Geographic emission source regions

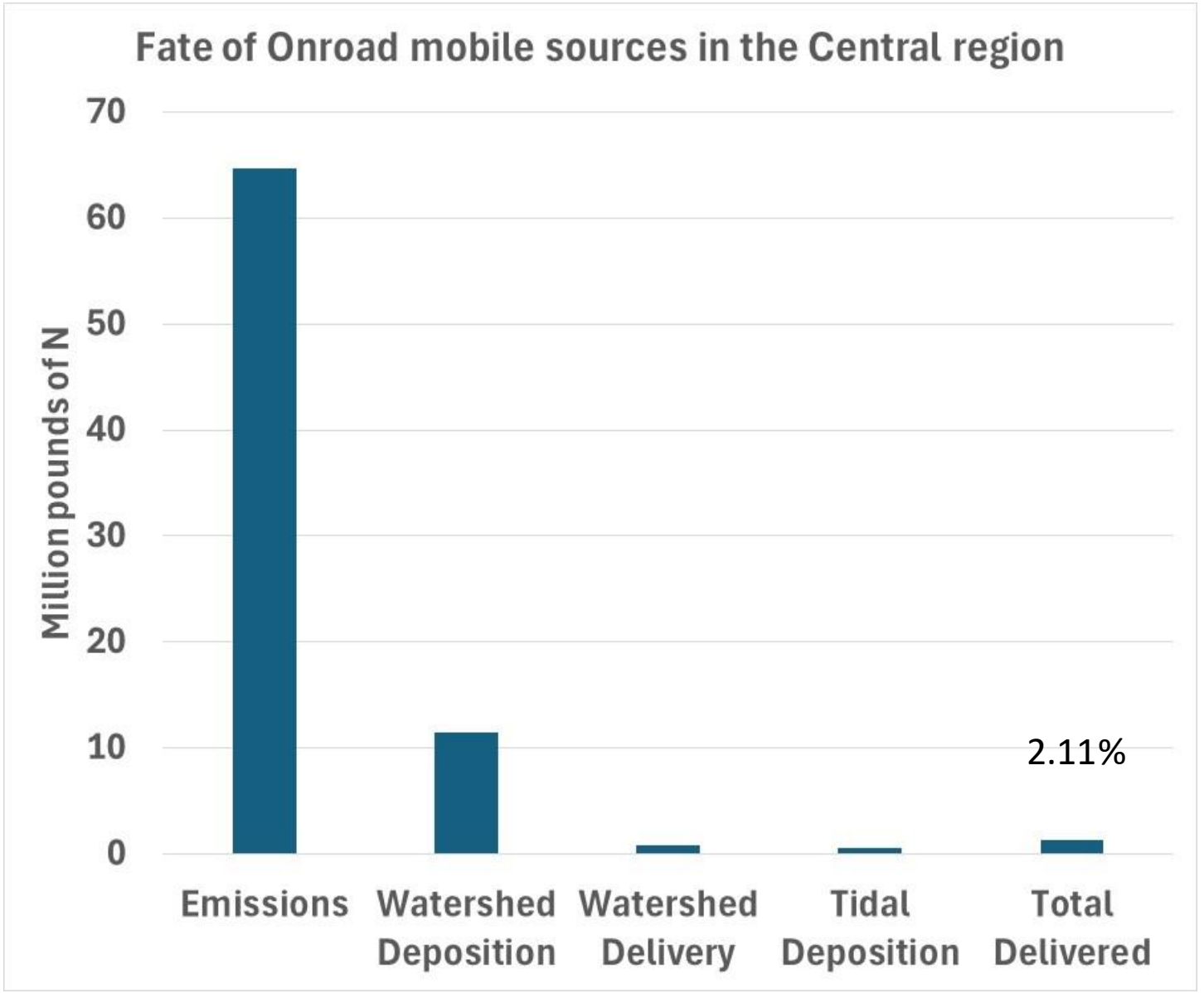




CMAQ Integrated Source Apportionment Method (ISAM)

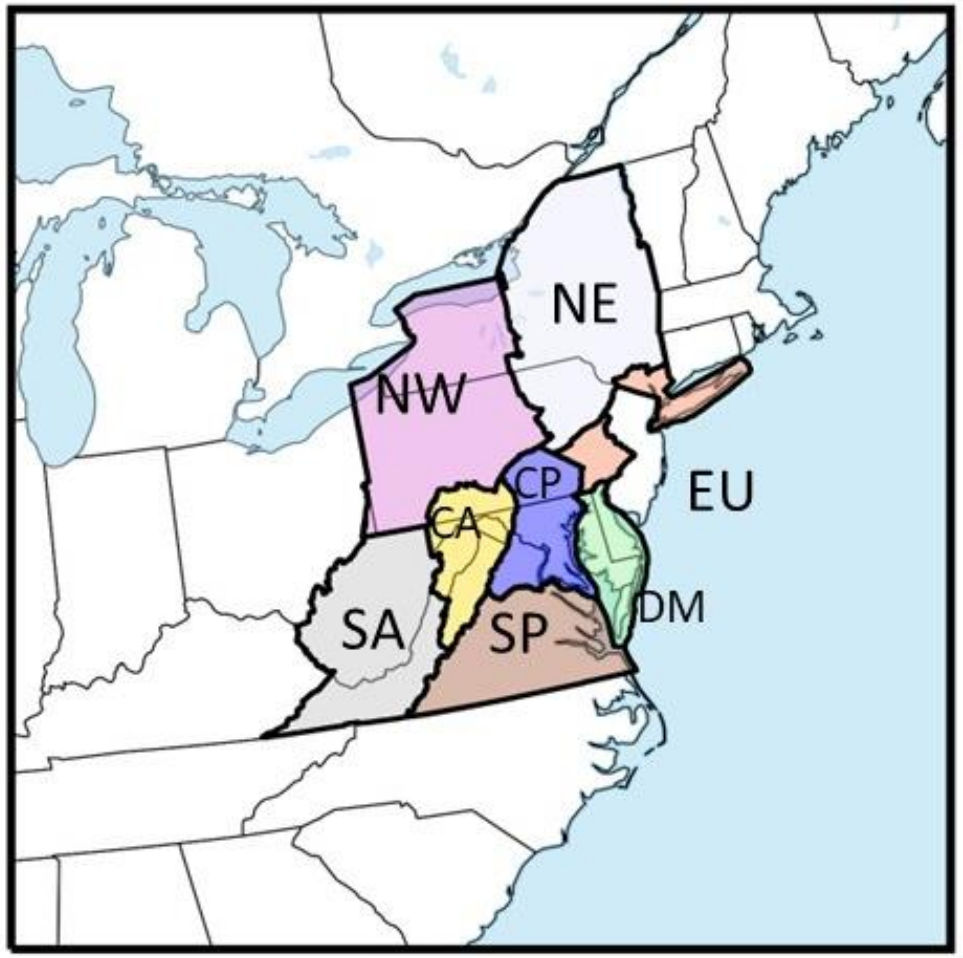
Geographic emission source regions

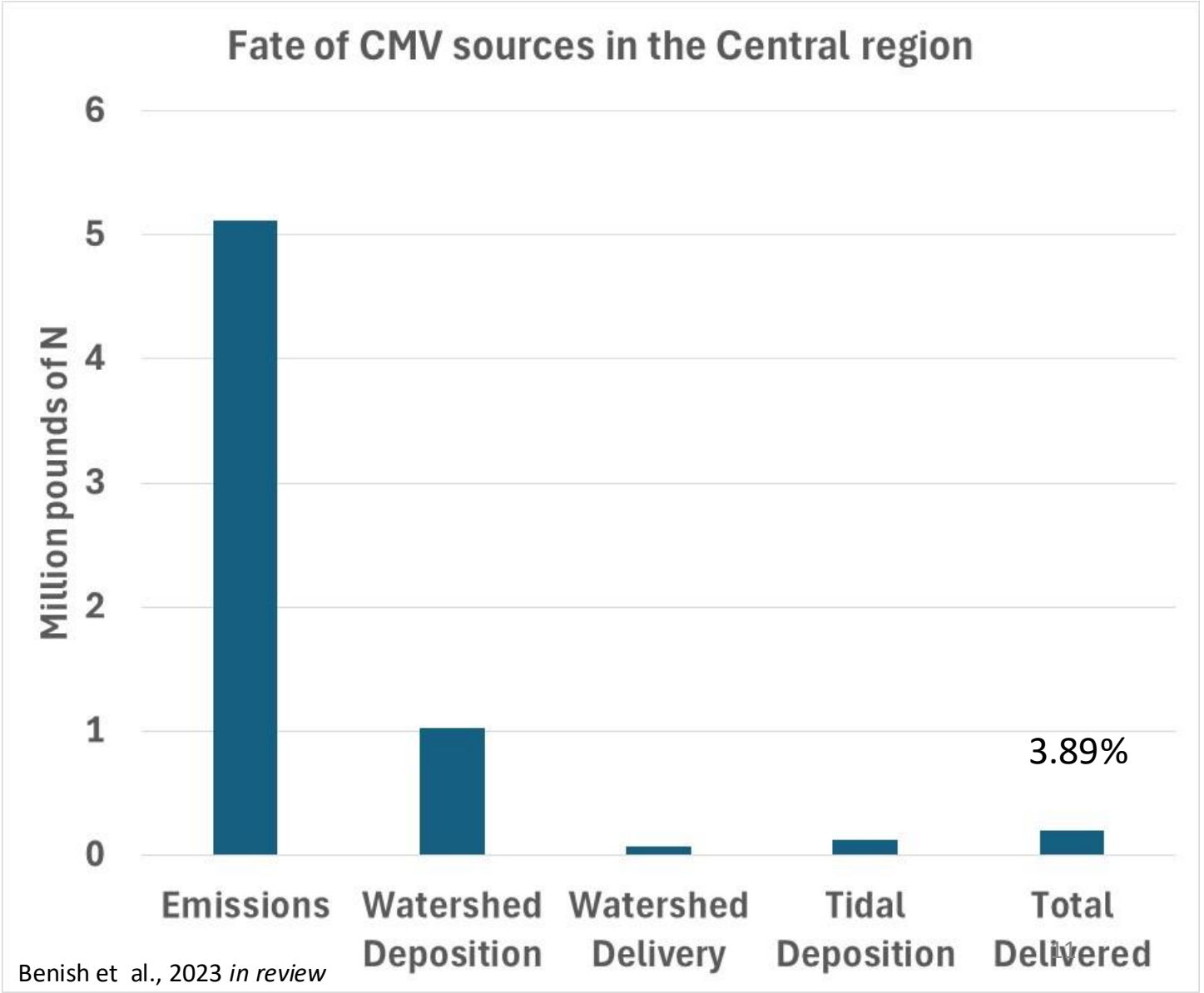




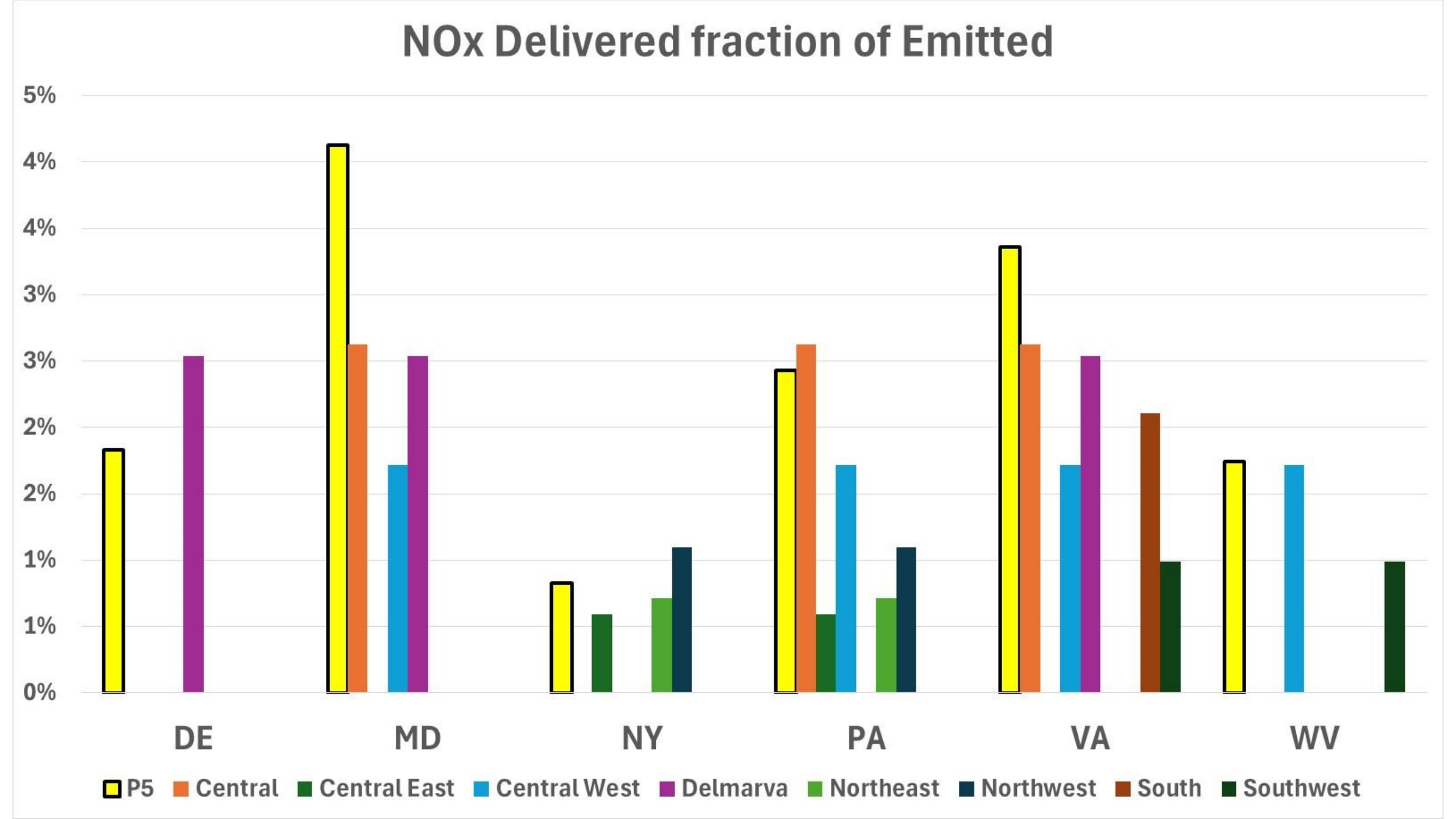
CMAQ Integrated Source Apportionment Method (ISAM)

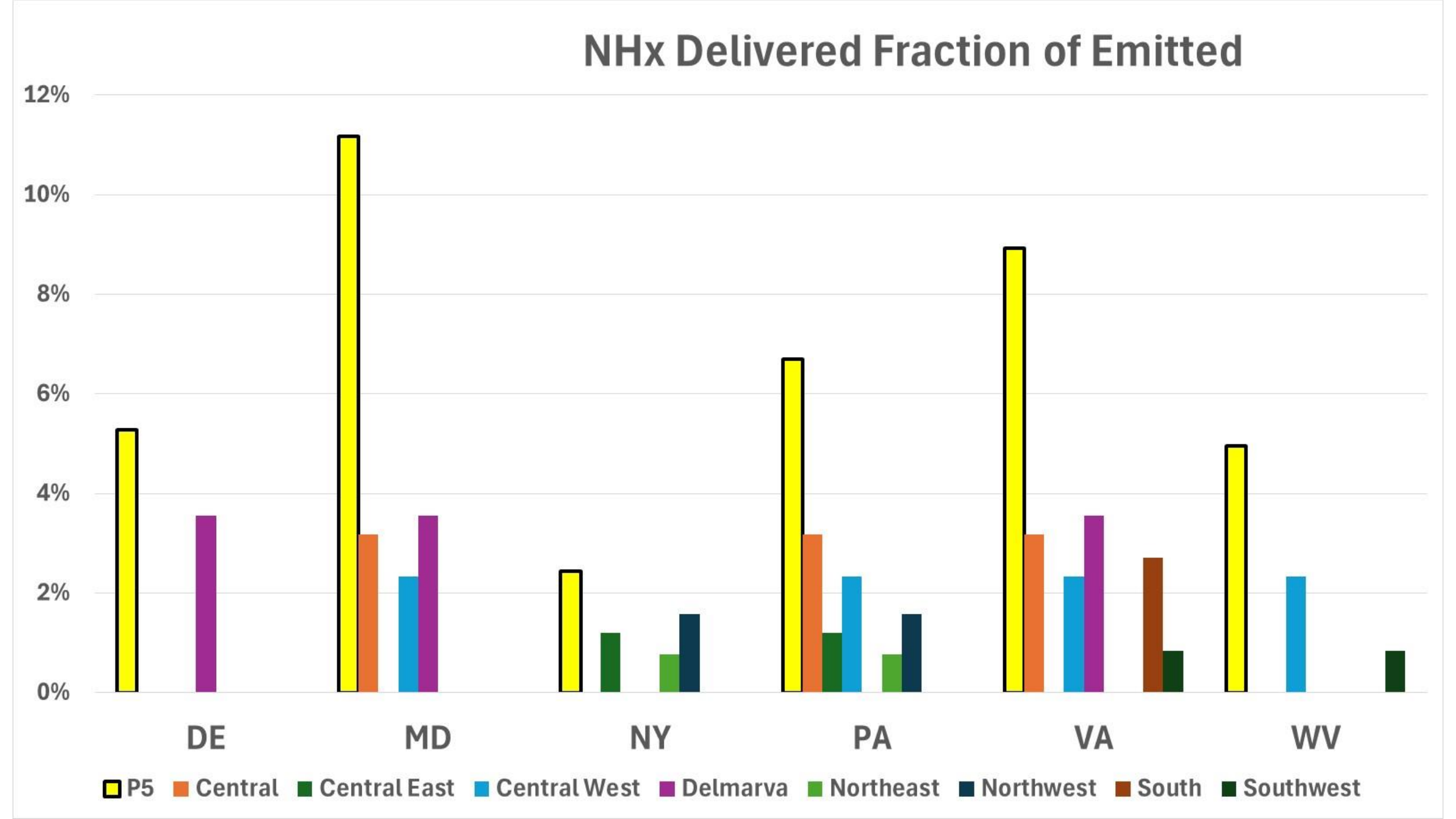
Geographic emission source regions





Benish et al., 2023 *in review*


NOx Delivered fraction of Emitted
5%
4%
4%
3%
3%
2%
2%
1%
1%
0%
DE
MD
NY
PA
VA
WV
P5
Central
Central East
Central West
Delmarva
Northeast
Northwest
South
Southwest


NHx Delivered Fraction of Emitted
12%
10%
8%
6%
4%
2%
0%
DE
MD
NY
PA
VA
WV
P5
Central
Central East
Central West
Delmarva
Northeast
Northwest
South
Southwest

Summary

- Atmospheric deposition is a large, but decreasing, source of nitrogen to the Bay watershed.
- New model runs allow us to identify source-receptor relationships between regions for different types of emission sources with more specificity than previous runs
- New model runs are similar to earlier runs for NOx
- Earlier assumptions for NHx are proving too optimistic
- Transport between emission and tidal waters is not efficient

Decisions

- MWG asked to approve this ***method***
  - Values will be updated once P7 CAST is finalized

- WQGIT will be asked if it should be used in P6 as well as P7