

Constraining Mercury Oxidation Using Wet Deposition

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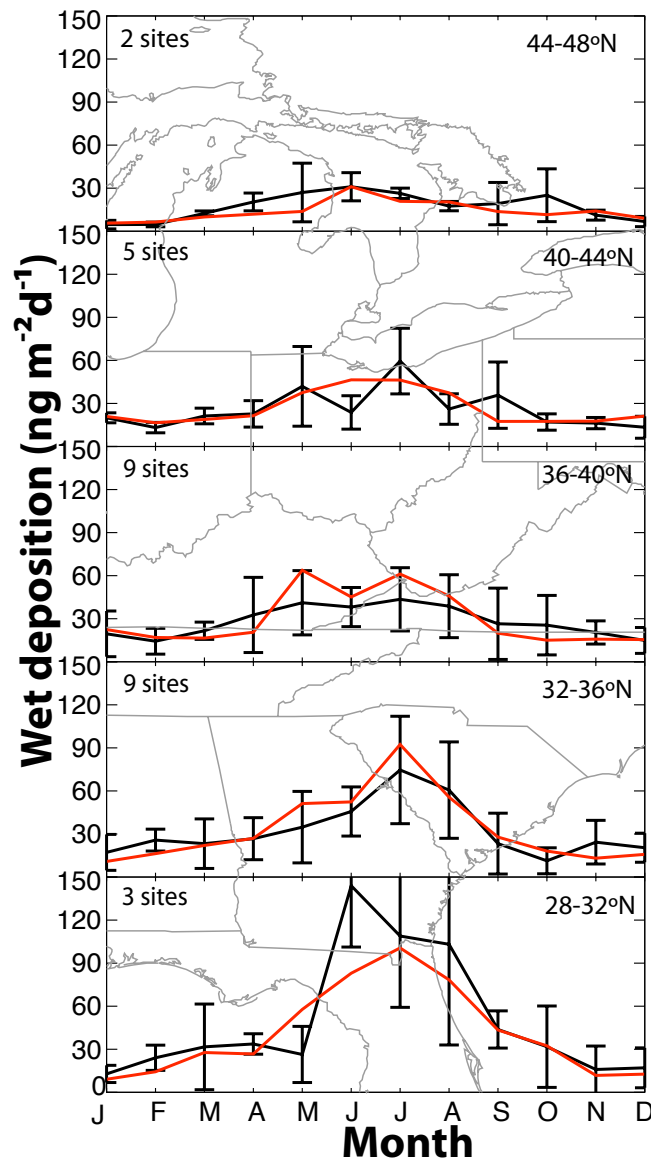
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Using deposition to constrain mercury oxidation



Measurements (MDN)

GEOS-Chem (OH oxidation pathway)

We previously used MDN data in combination with GEOS-Chem to constrain wet deposition processes and sources.

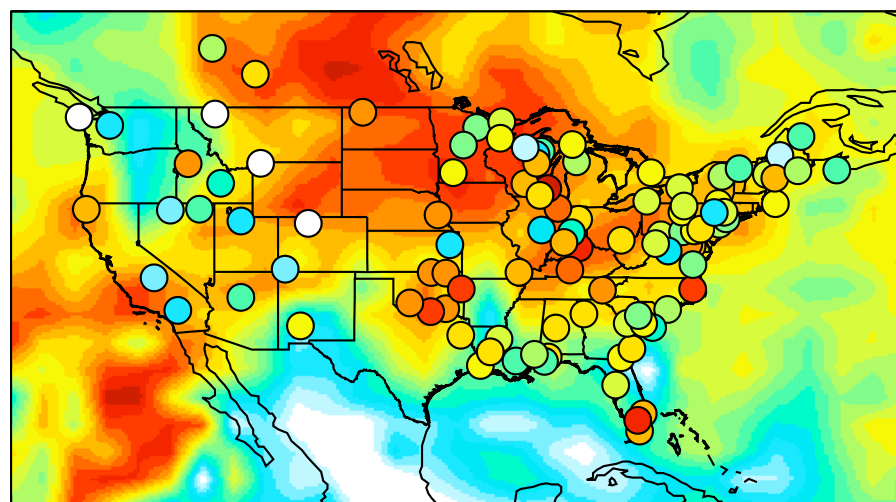
Holmes et al. (2010): Br oxidation mechanism on average does as well for this region, but less well where scavenging from free troposphere dominates (e.g. Gulf coast in summertime)

[Selin & Jacob, Atmos. Env. 2008]

Two Influences on Mercury Wet Deposition

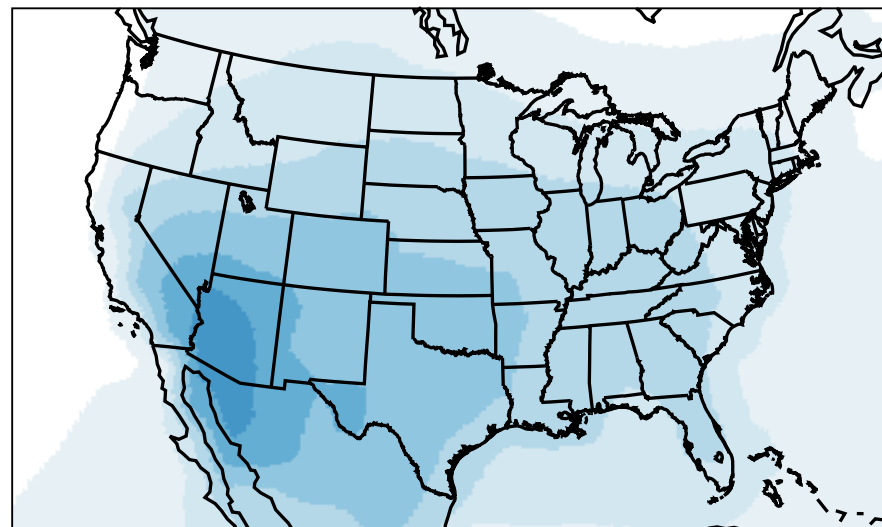
- $\text{Hg wet dep} = f(\text{precipitation}, [\text{Hg(II)} + \text{Hg(P)}])$

Correlation (r^2) between daily (weekly) wet deposition and precipitation



0.20 0.36 0.52 0.68 0.84 1.00

Delta-[Hg(II)]



-50 -30 -10 10 30 50 pg m^{-3}

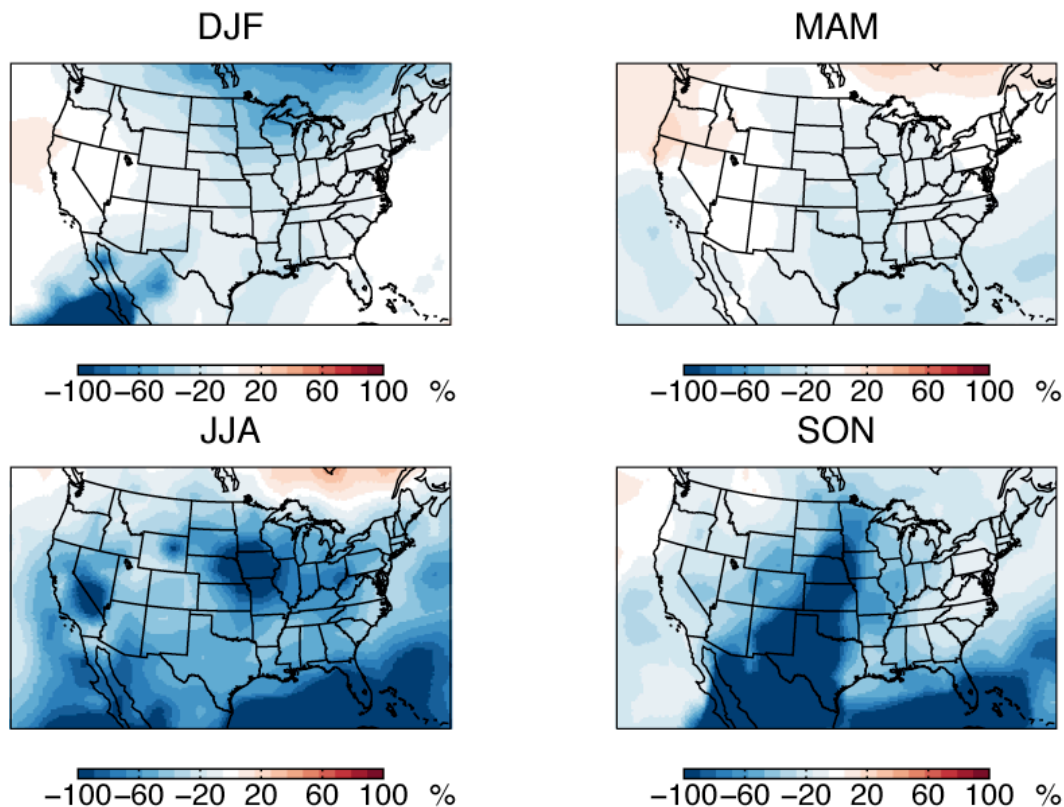
GEOS-Chem Br chemistry (MDN data) 2008

Br minus OH chemistry, GEOS-Chem

Largest differences are in western U.S.

Wet Deposition from GEOS-Chem: Difference (%)
between Br and OH mechanisms by season (Br-OH)

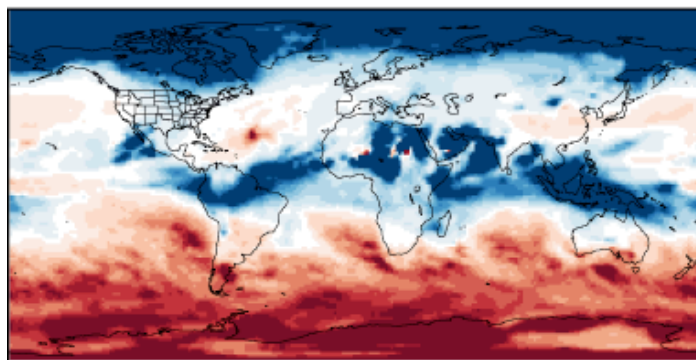
Largest
difference in
wet
deposition
between
mechanisms
is in Western
US, not East



Wet deposition difference has a seasonal cycle (greatest in summer/fall)
Few MDN stations in area of largest difference!

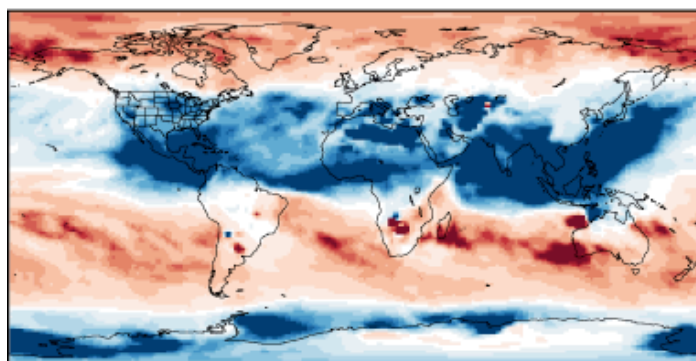
Difference between Br and OH Wet Deposition

DJF



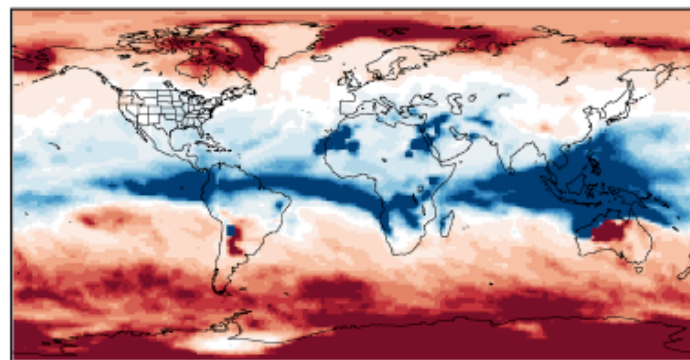
-100 -60 -20 20 60 100 %

JJA



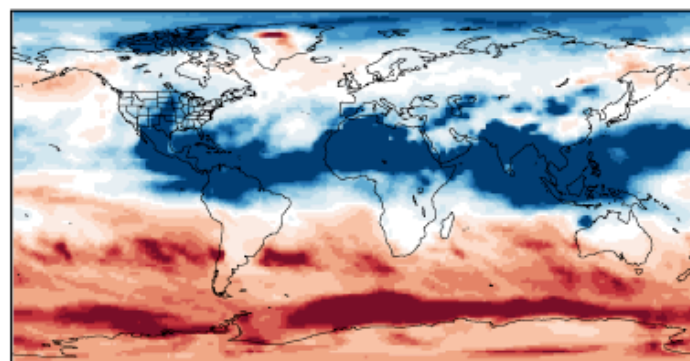
-100 -60 -20 20 60 100 %

MAM



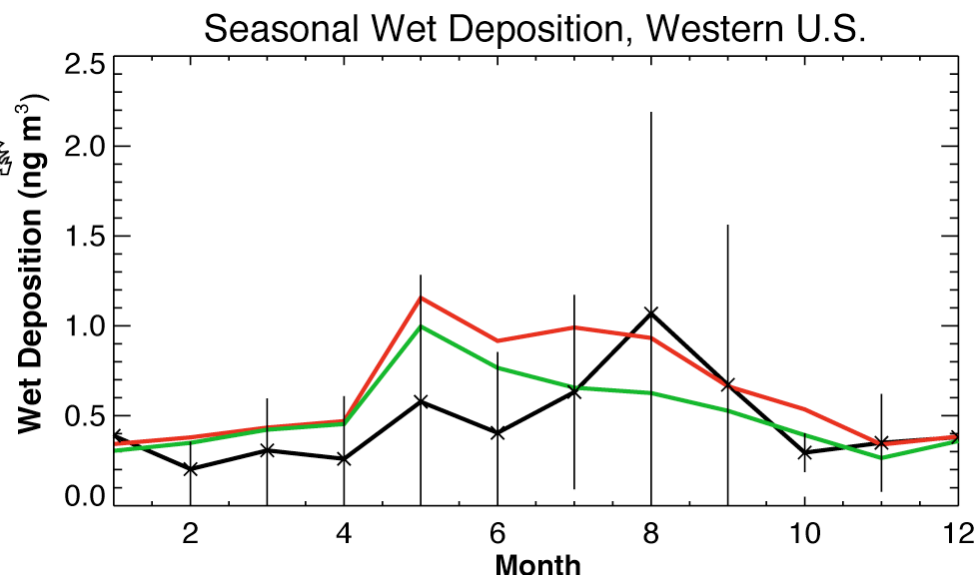
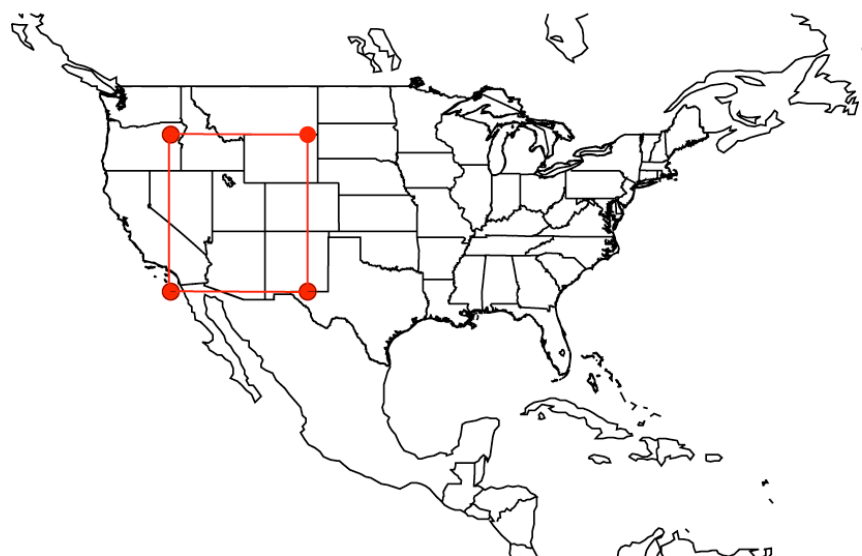
-100 -60 -20 20 60 100 %

SON



-100 -60 -20 20 60 100 %

Seasonal Cycle of Wet Deposition in the West



Measurements (MDN)

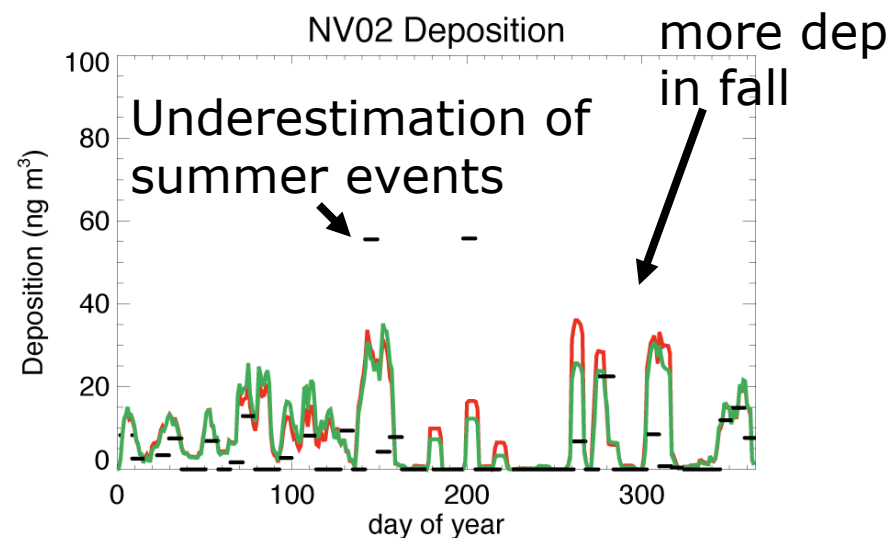
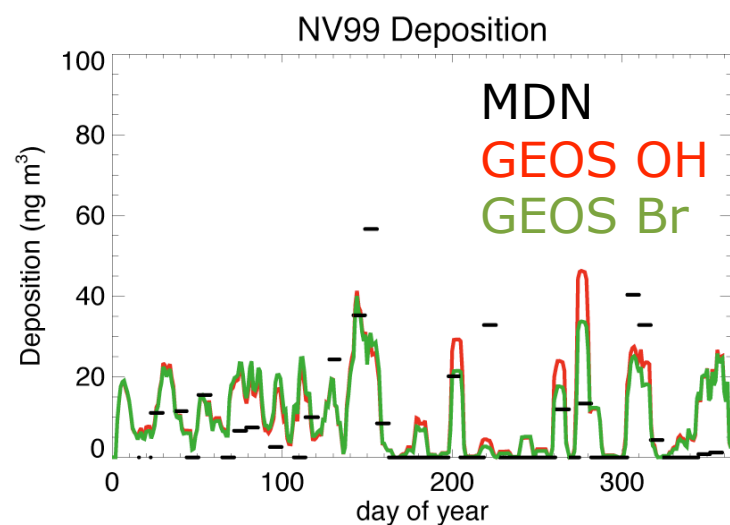
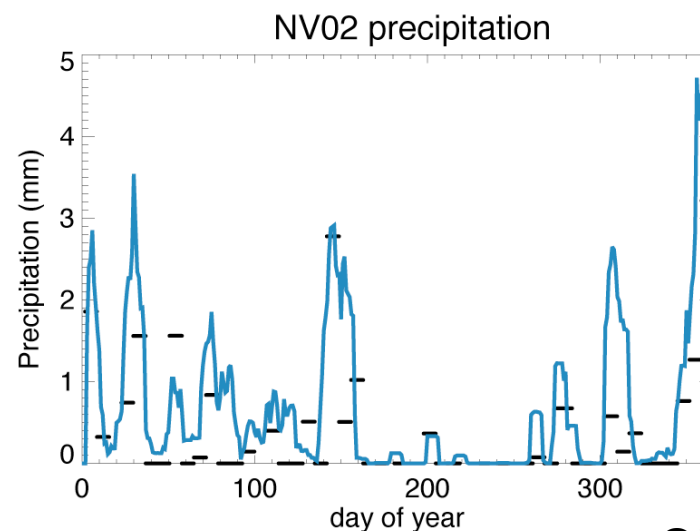
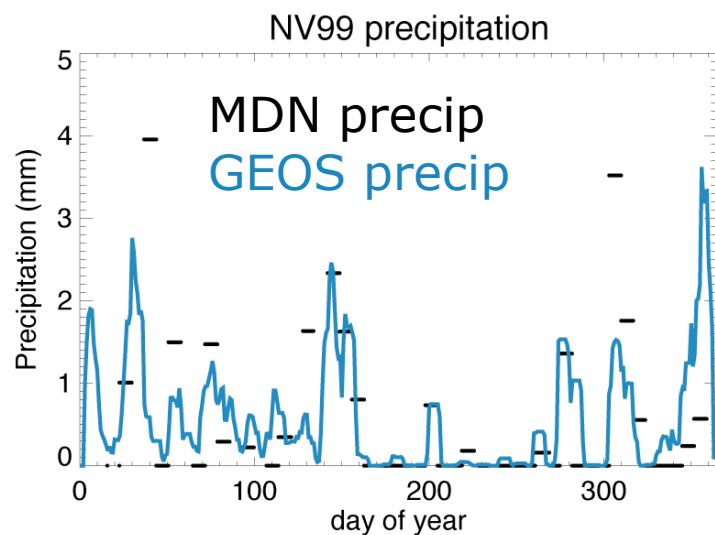
GEOS-Chem (OH oxidation pathway)

GEOS-Chem (Br oxidation pathway)

Monthly average wet deposition from GEOS-Chem is within ± 1 SD in the western U.S. for both mechanisms (11 sites, 2008)

Differences are in summer/fall, where there is large data variability

Addressing precipitation and variability



MDN: weekly samples, 2008; GEOS-Chem: 7-day running mean