



Wet and dry deposition of total mercury and methylmercury at an unpolluted site in Puerto Rico



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Outline

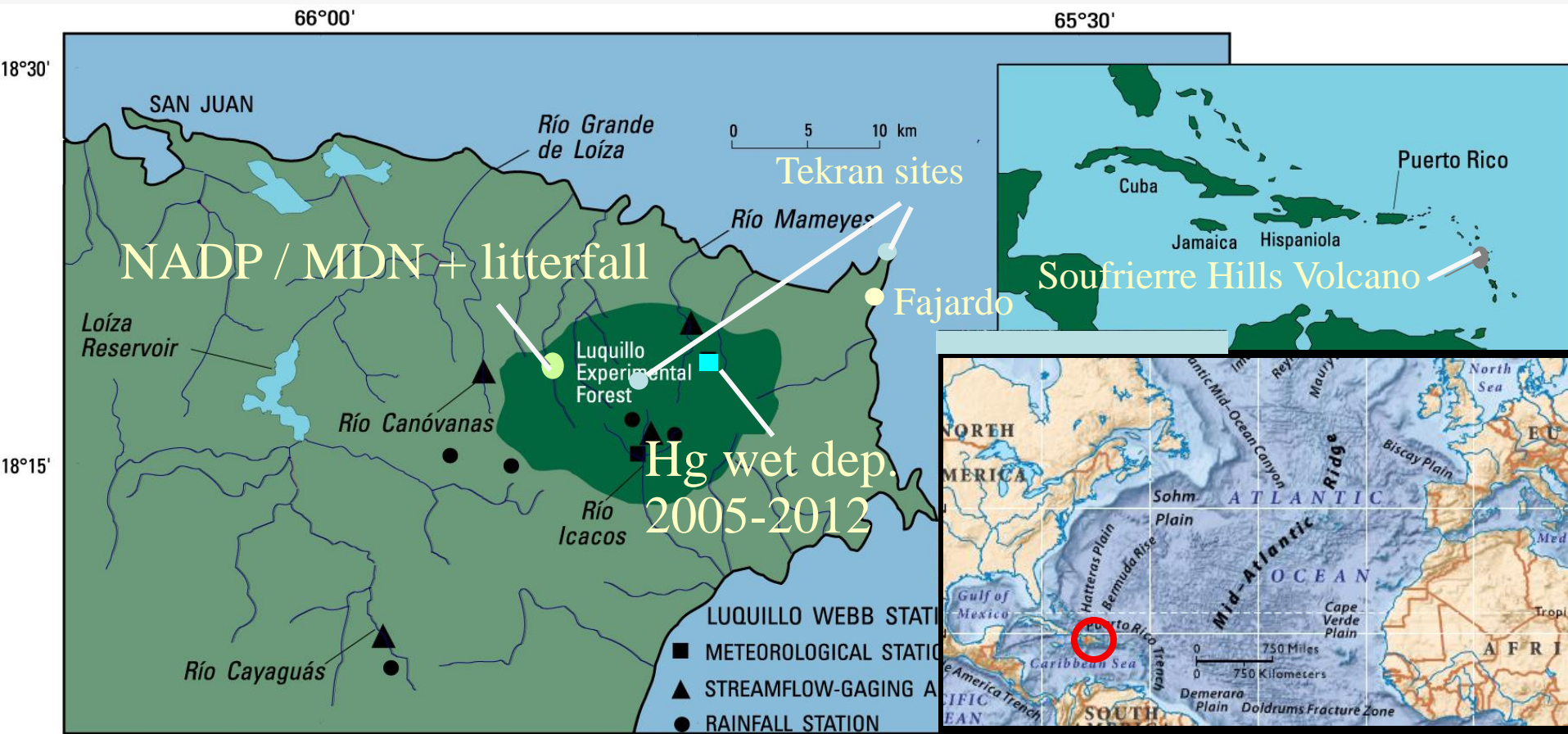
- Wet deposition
- Dry deposition
- MeHg
- Streams / biota



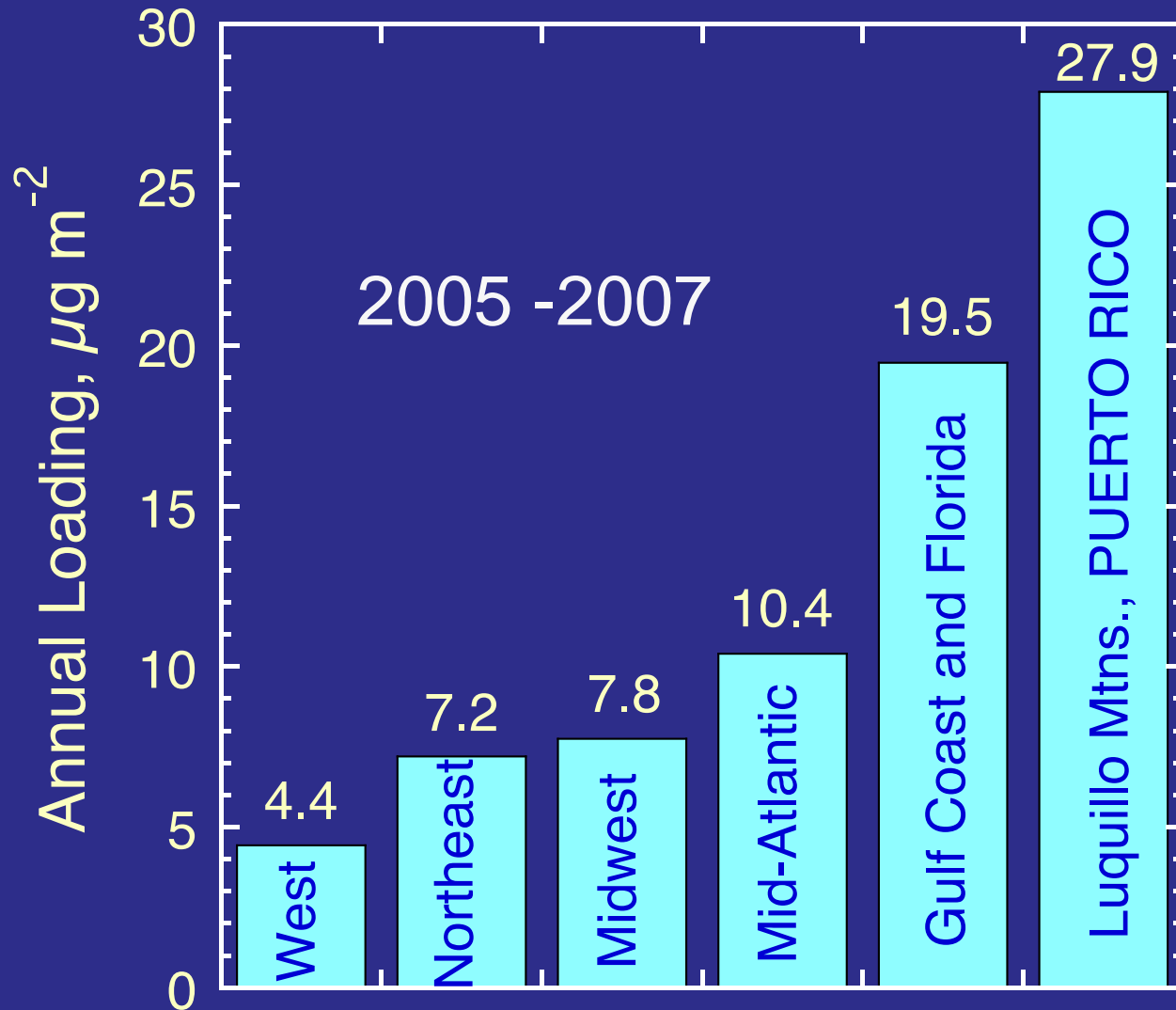
Puerto Rico Hg sites

An initiative of the USGS

Water, Energy and Biogeochemical Budgets (WEBB) program

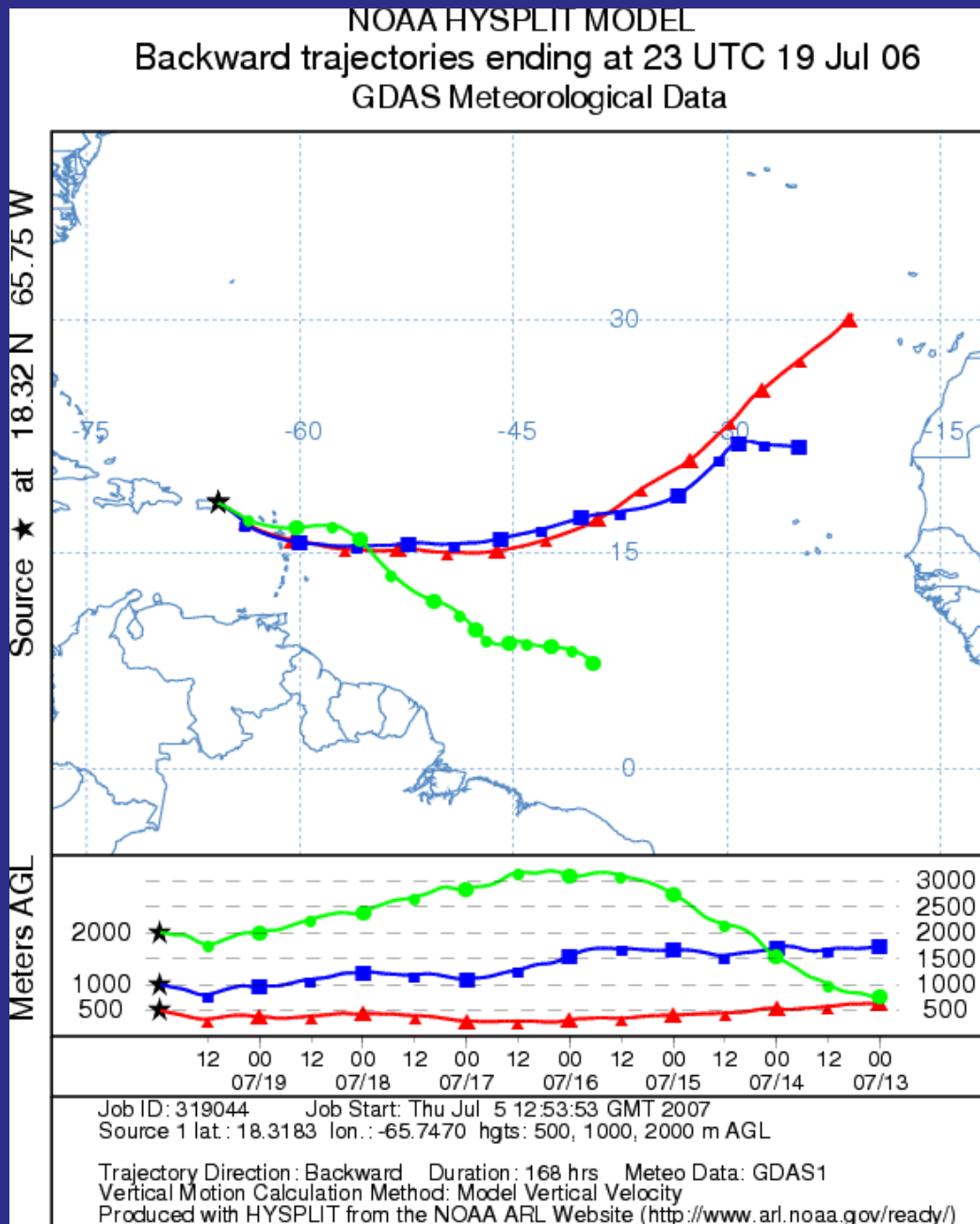


Hg wet deposition

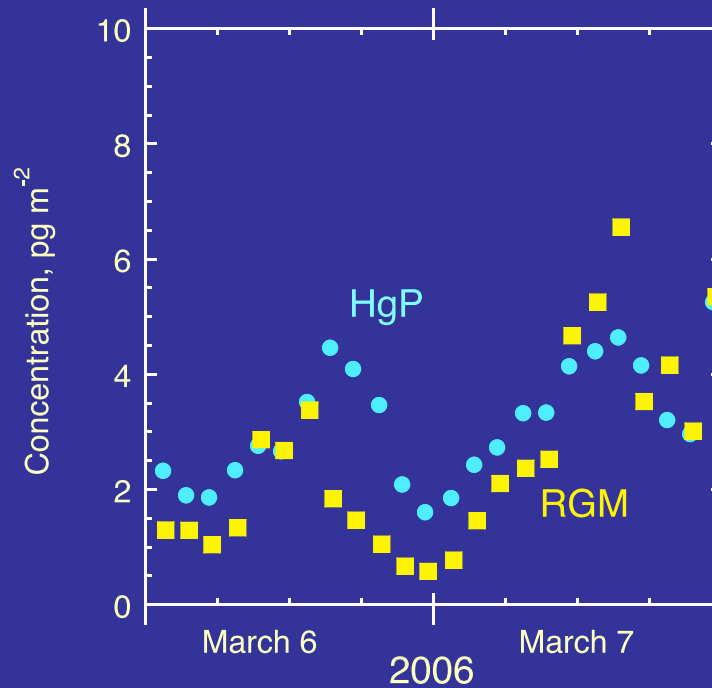
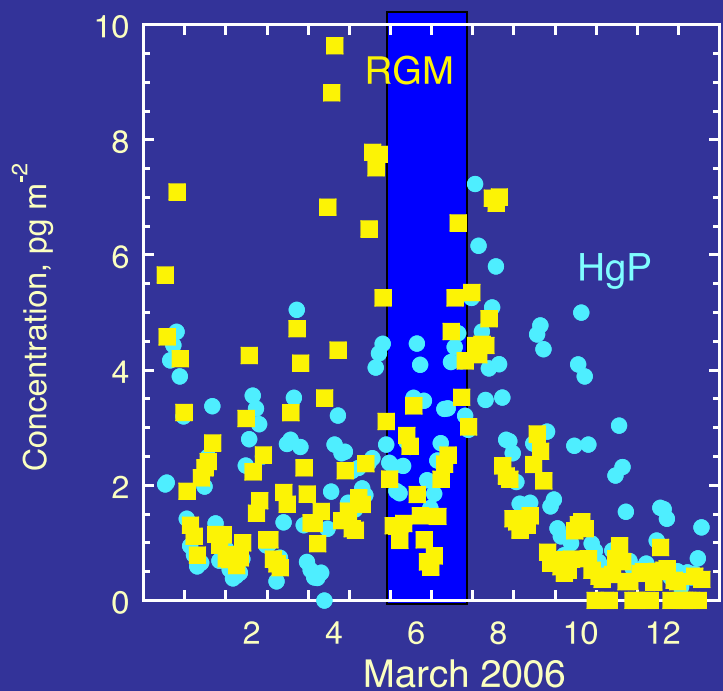


Shanley et al., 2015, ES&T

Hysplit back trajectories

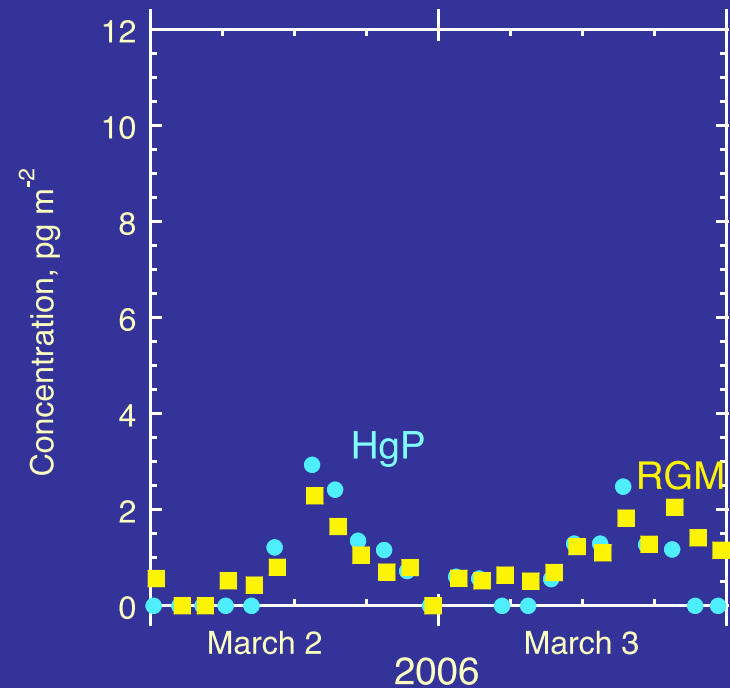
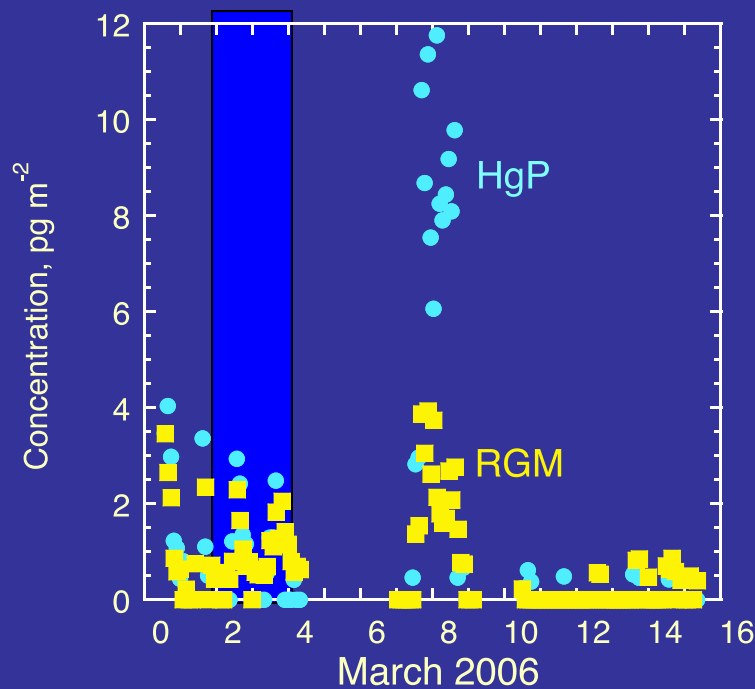


Atmospheric HgP and RGM -- Sea level site



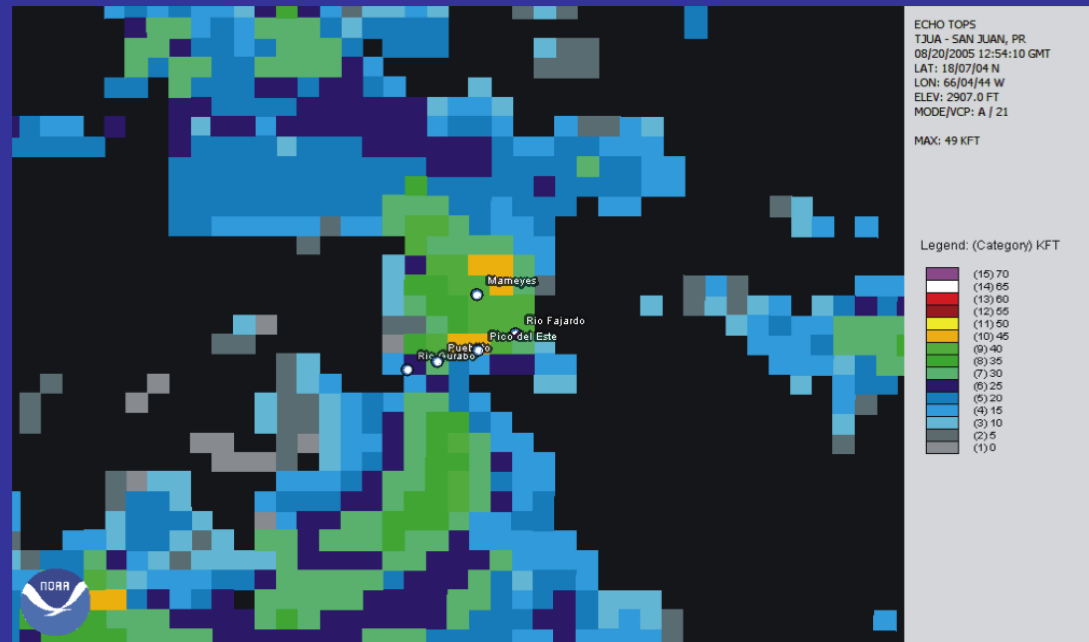
Atmospheric HgP and RGM -- Mountain site

800 m

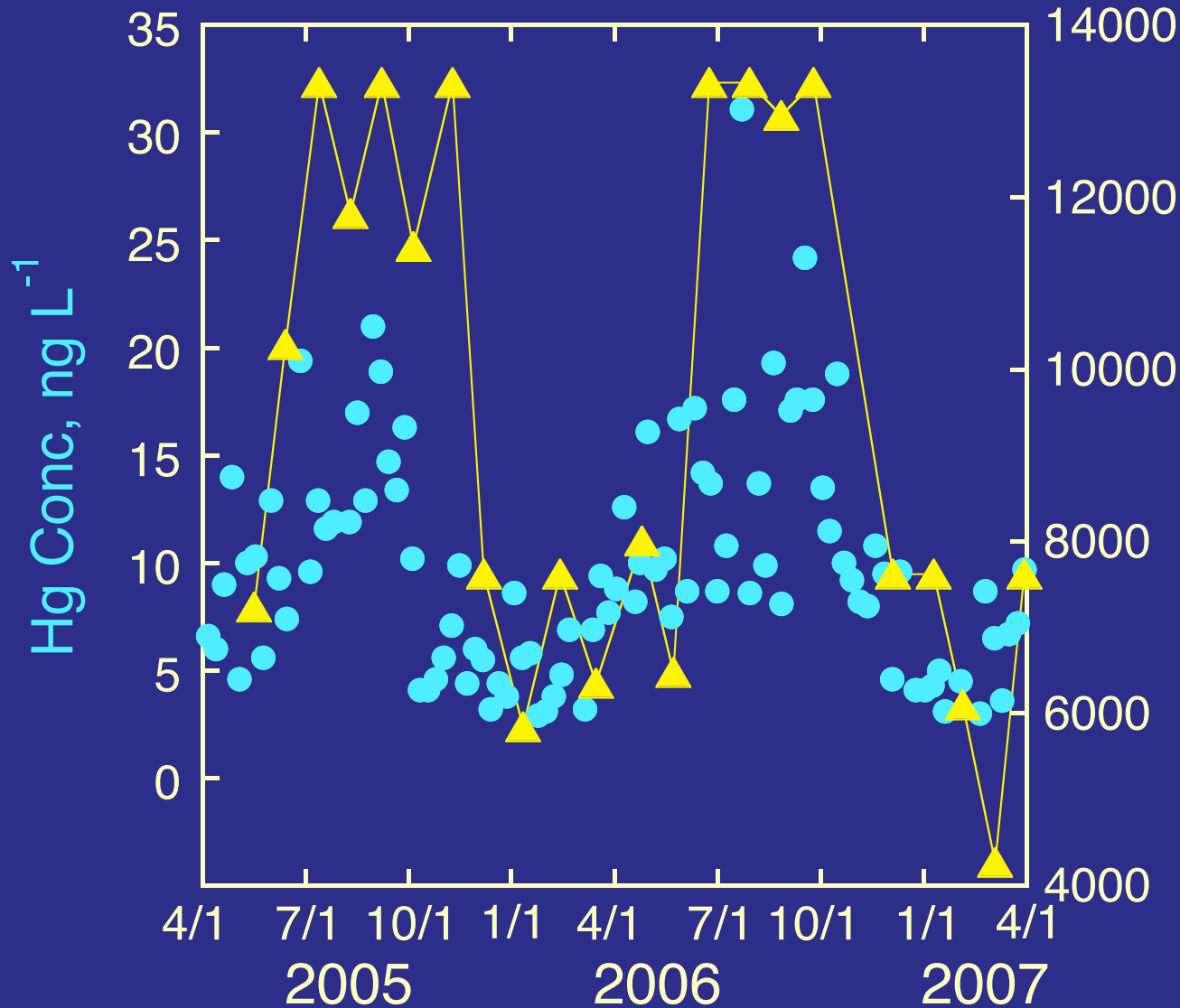


NEXRAD Echotops

- Represent the top of the rain-producing layer in a cloud.
- Available every 10 minutes during a rain event.
- Ranged from 762 – 16,763 m in Puerto Rico.



Echotops and rainfall Hg



Hg conc. tracks altitude of rain-forming clouds → Source in upper free troposphere

Timeline of Hg measurements

	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Rainfall - Bisley				← Data gaps →										
Rainfall - MDN											No MeHg			
Throughfall - Bisley				← Data gaps →										
Litterfall - MDN site														
Air speciation														
Stream sampling														
Biota sampling														
MeHg incubations														



Site characteristics

- 18 N, 66 W
- Elevation 485 m (PR20 = 380 m)
- Annual precipitation 3000 mm
- Tropical wet forest (Tabonuco)
- Mean temperature 22 C
- Clean NE Trade Wind air flow
- Ridge top open to ocean, mountains behind



Hg wet deposition collector on 20-meter Bisley tower

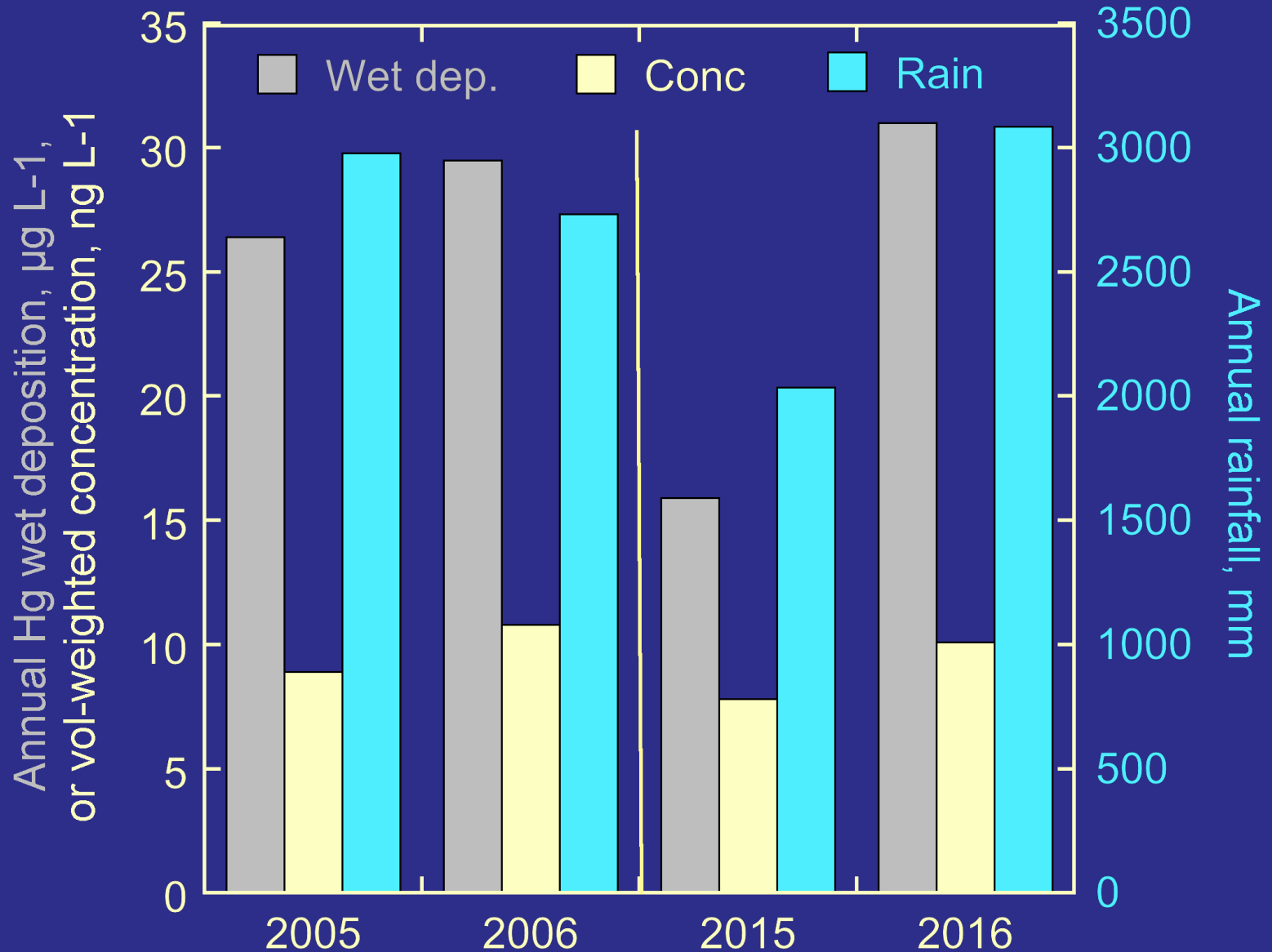


PR20 tower after Maria (9/20/2017)

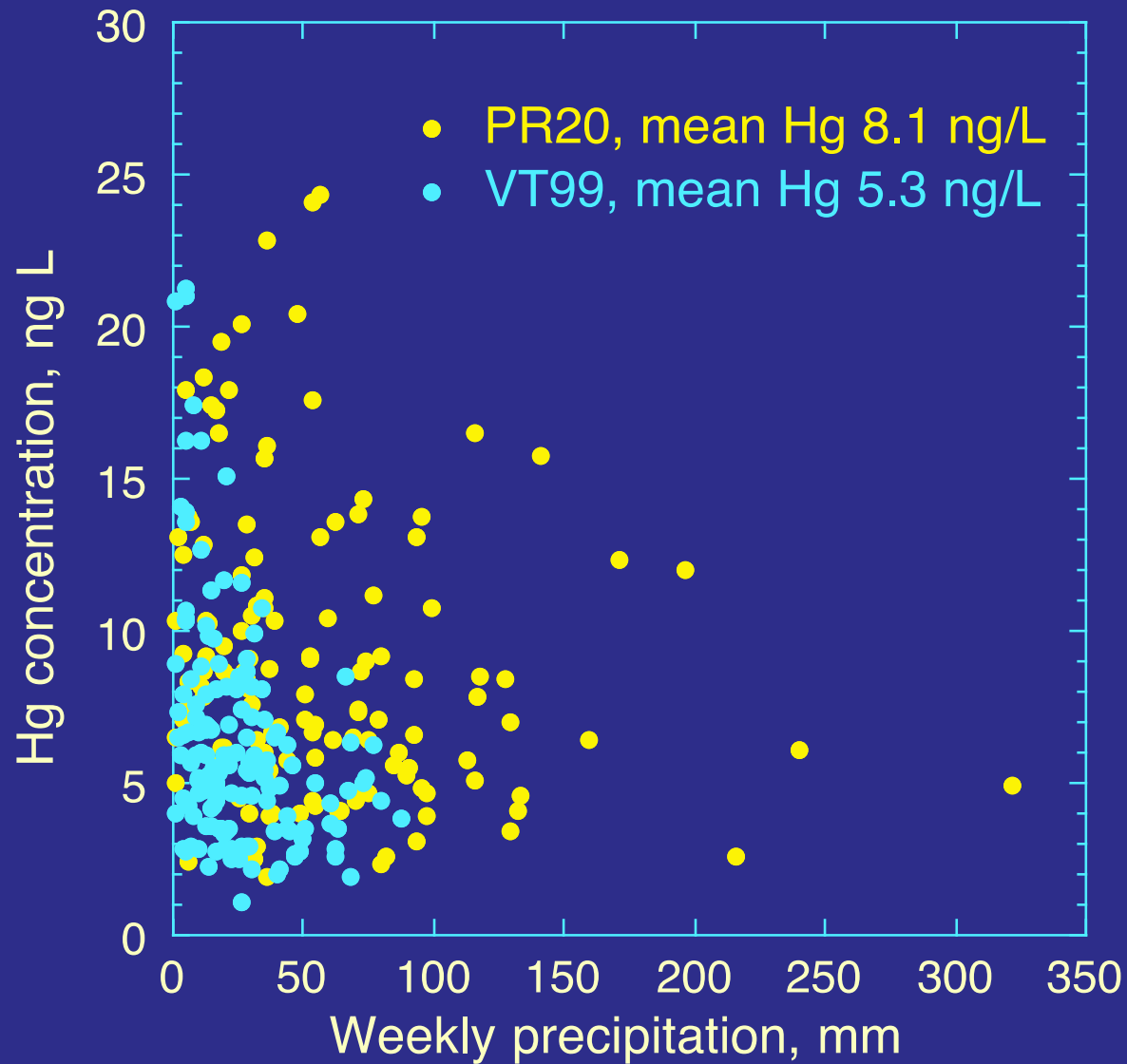


- Lost Maria sample (~400 mm rain)
- Compromised samples, next two months

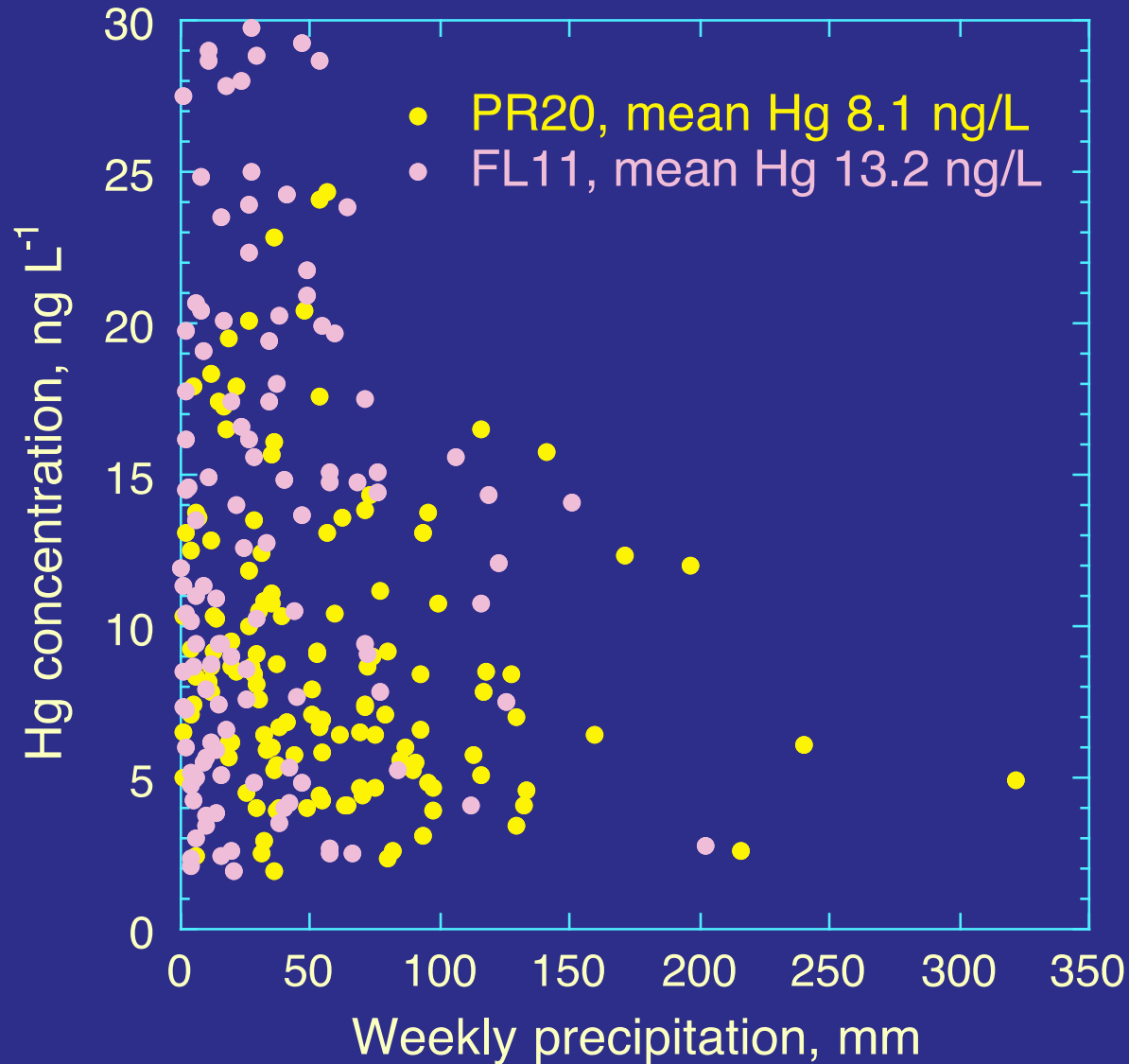
Wet deposition – old and new site



Hg wet deposition



Hg wet deposition

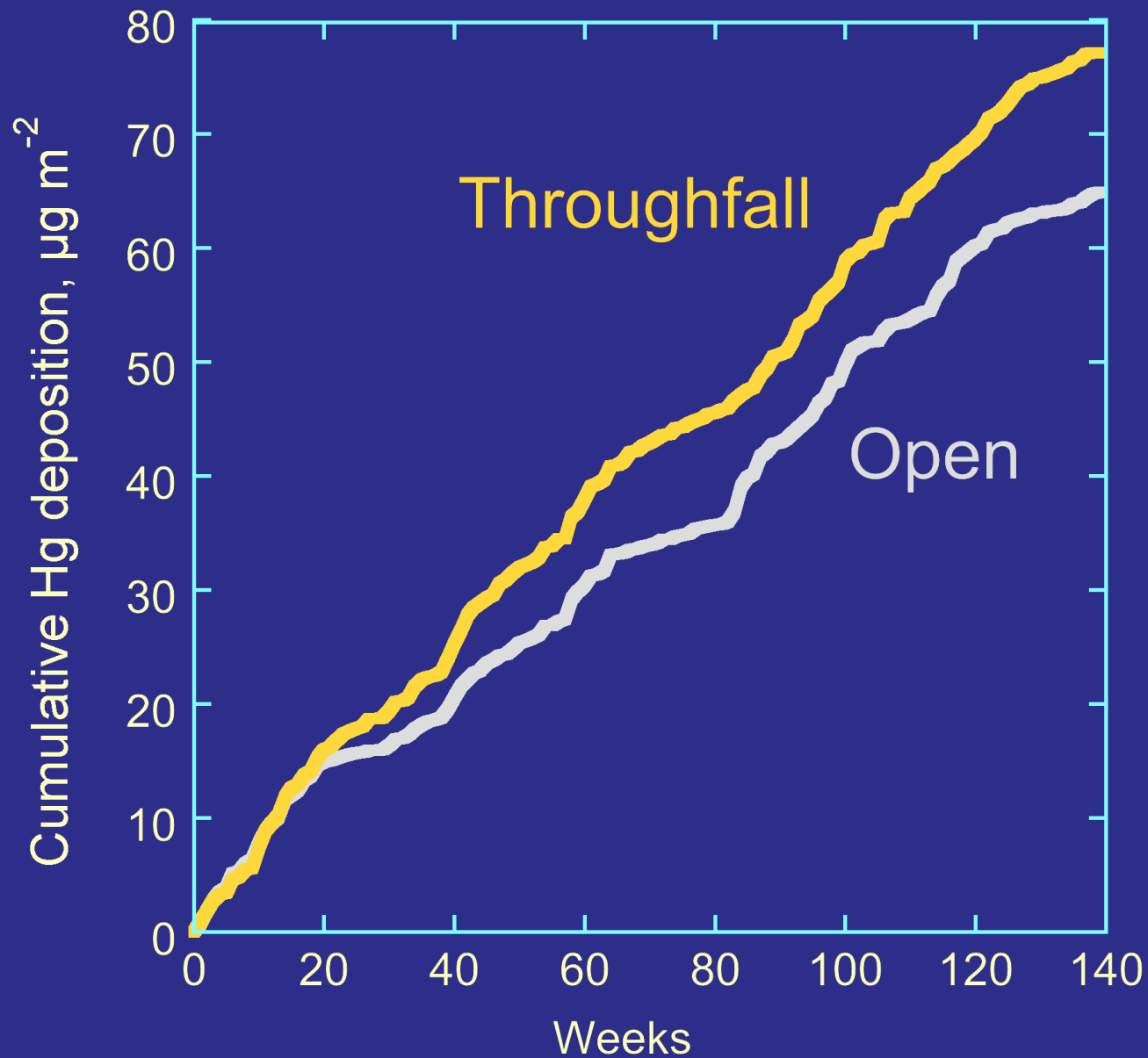


Dry deposition

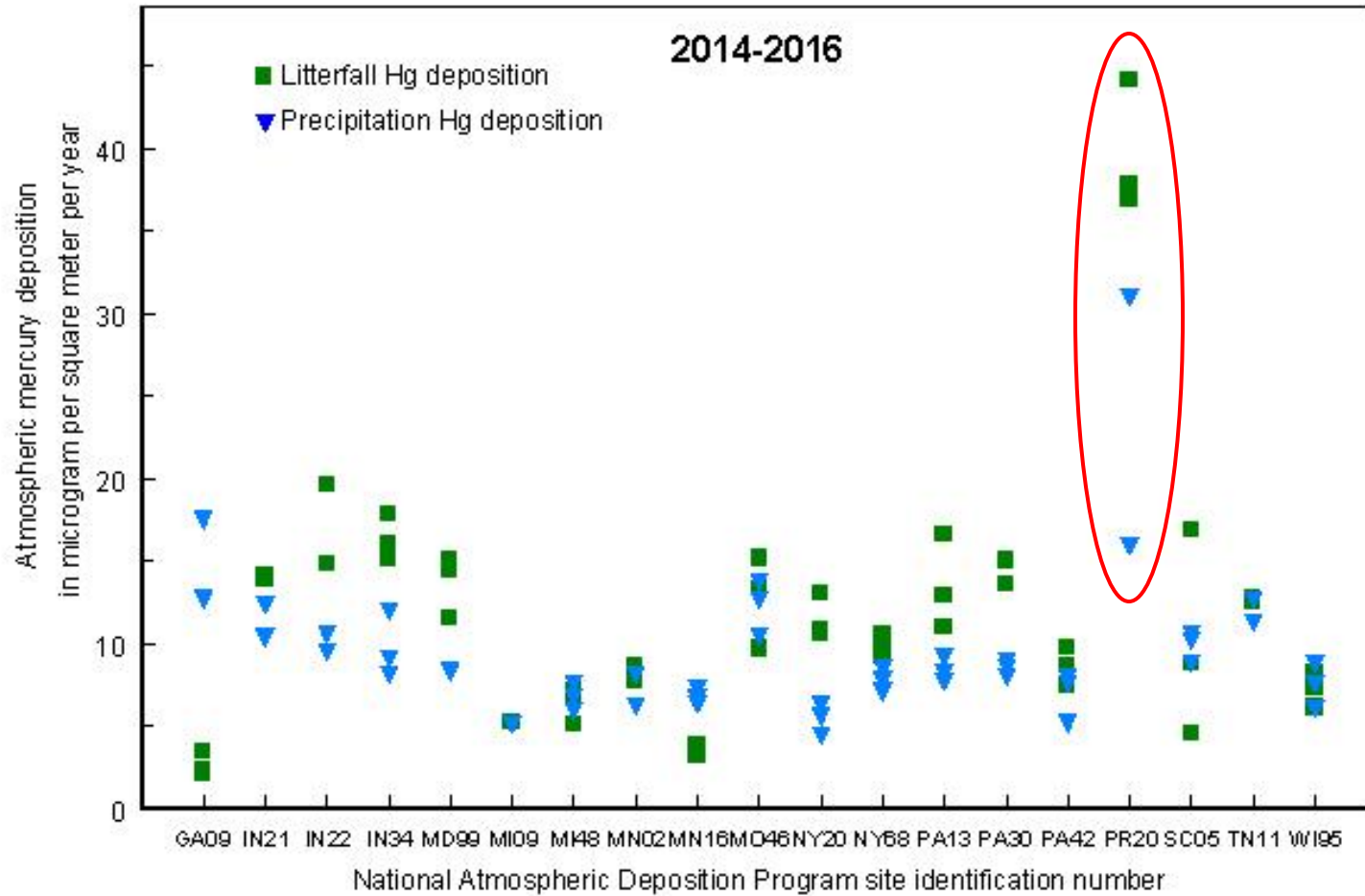
Where it rains 3000 mm per year, is dry deposition less important?



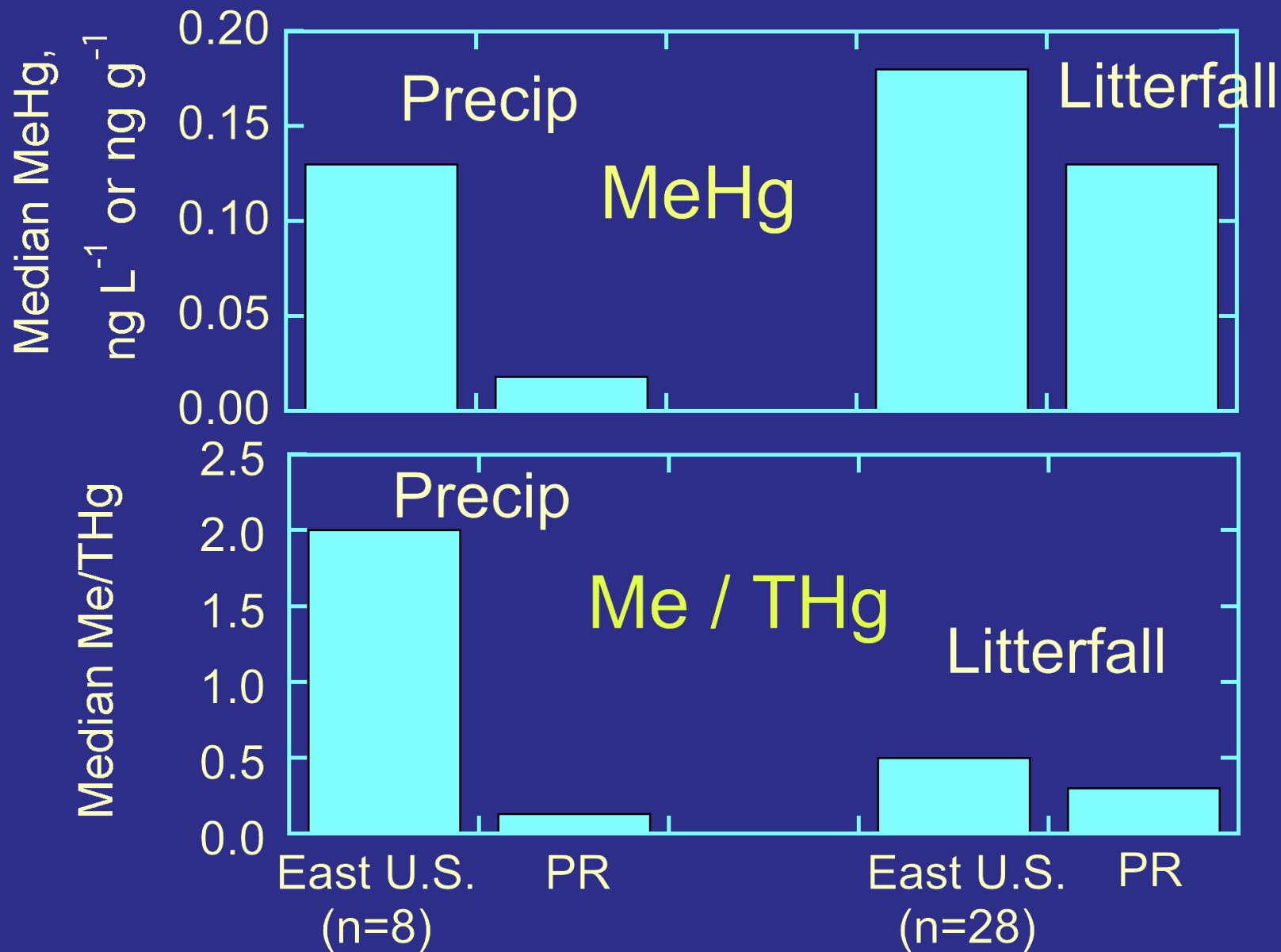
Cumulative open and throughfall THg



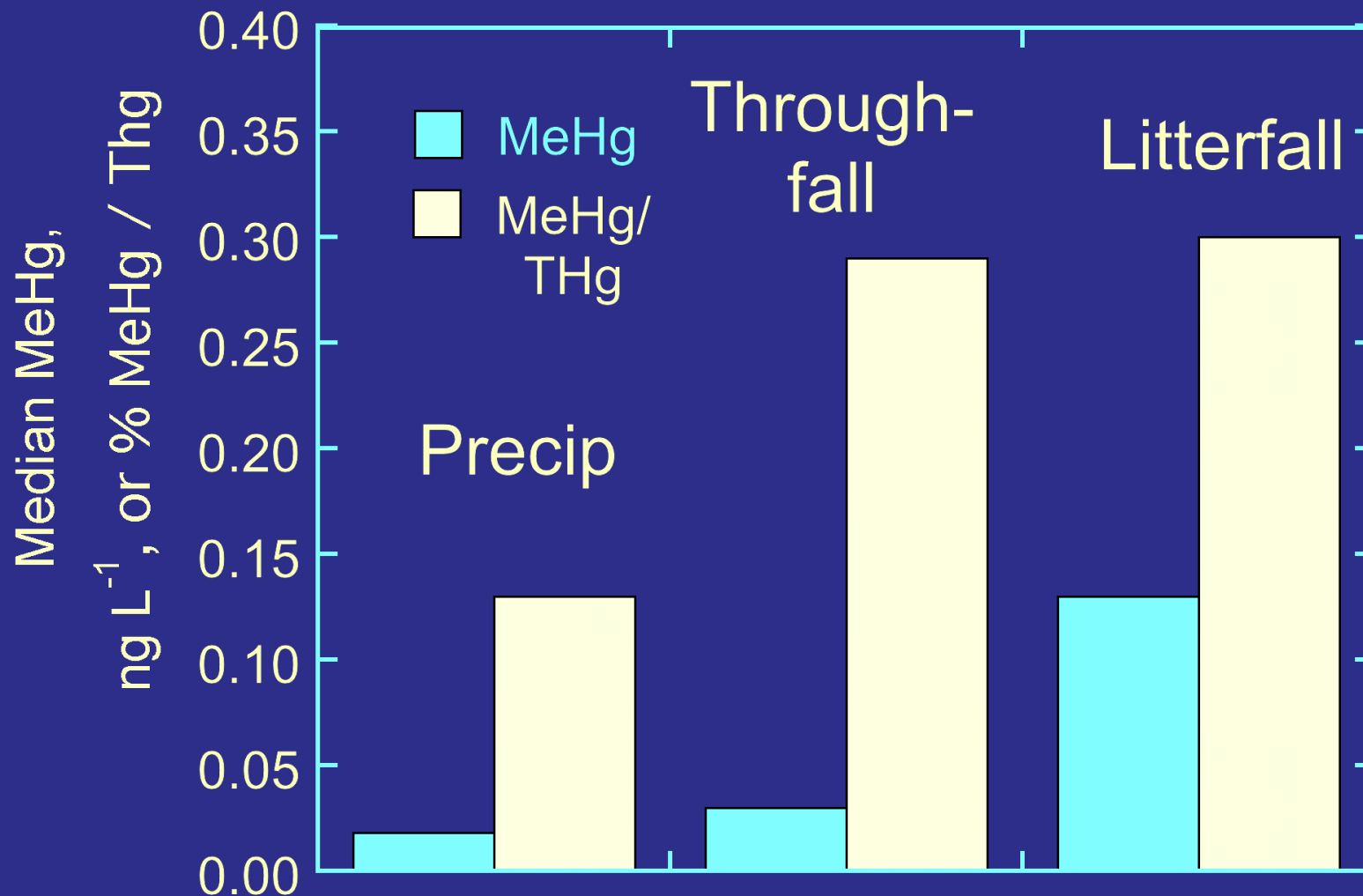
Litterfall



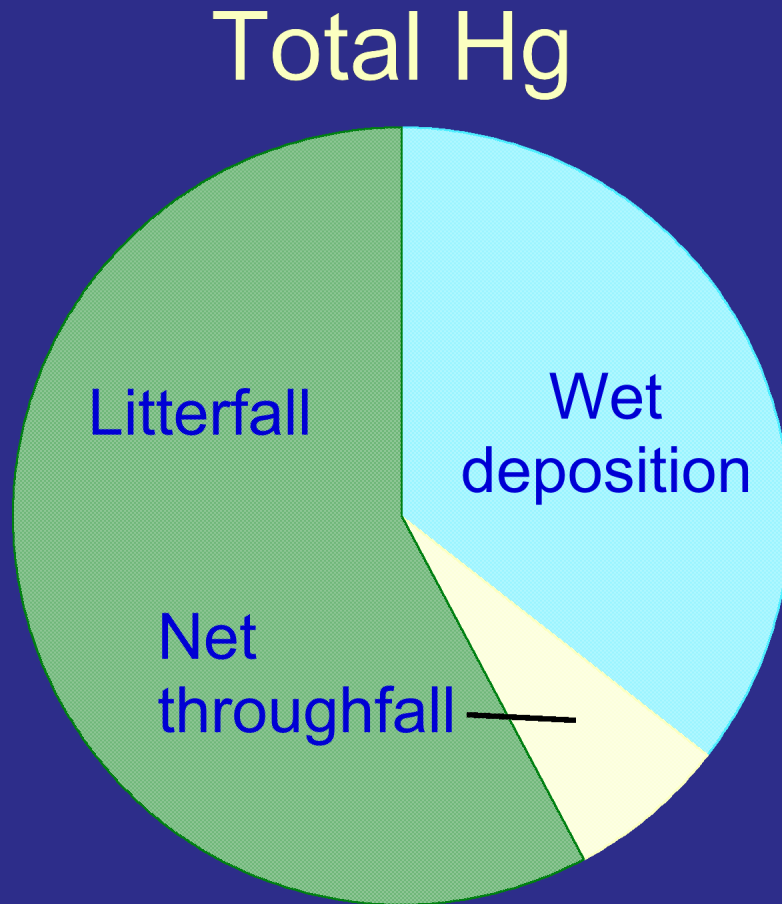
Methylmercury is low



MeHg and Me/THg in deposition



Apportioning Hg deposition

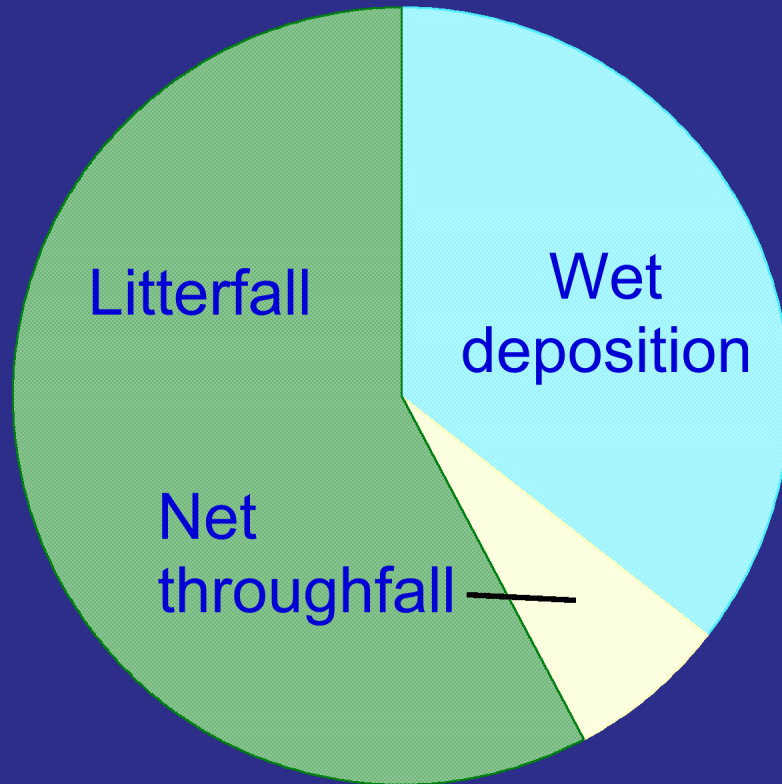


Overall $\sim 75 \mu\text{g m}^{-2} \text{yr}^{-1}$

Apportioning Hg deposition

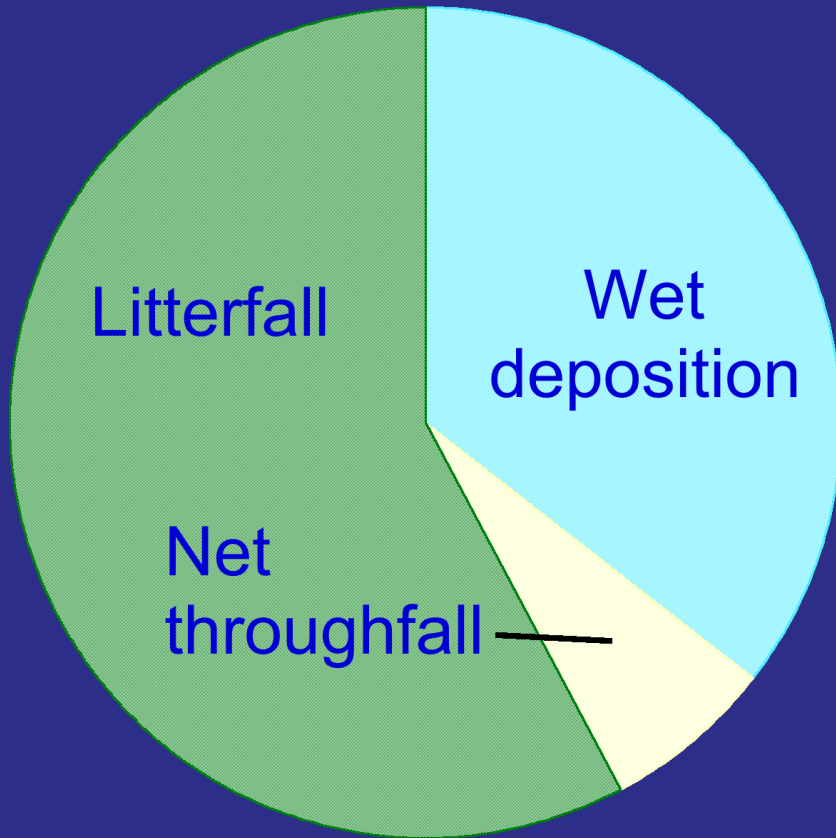
Total Hg

Methyl Hg

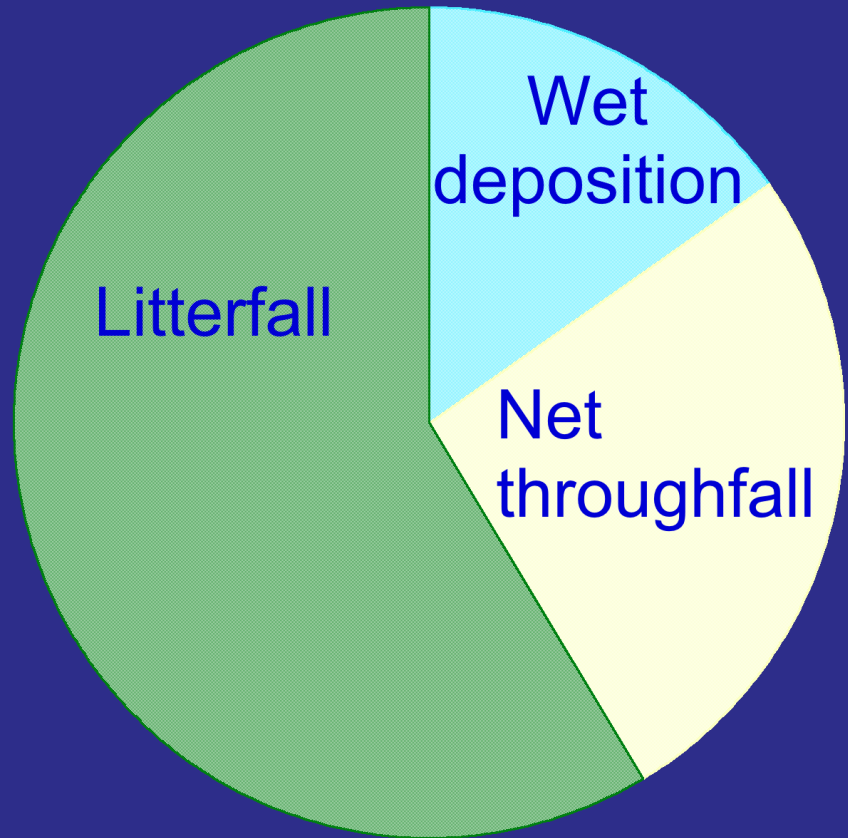


Apportioning Hg deposition

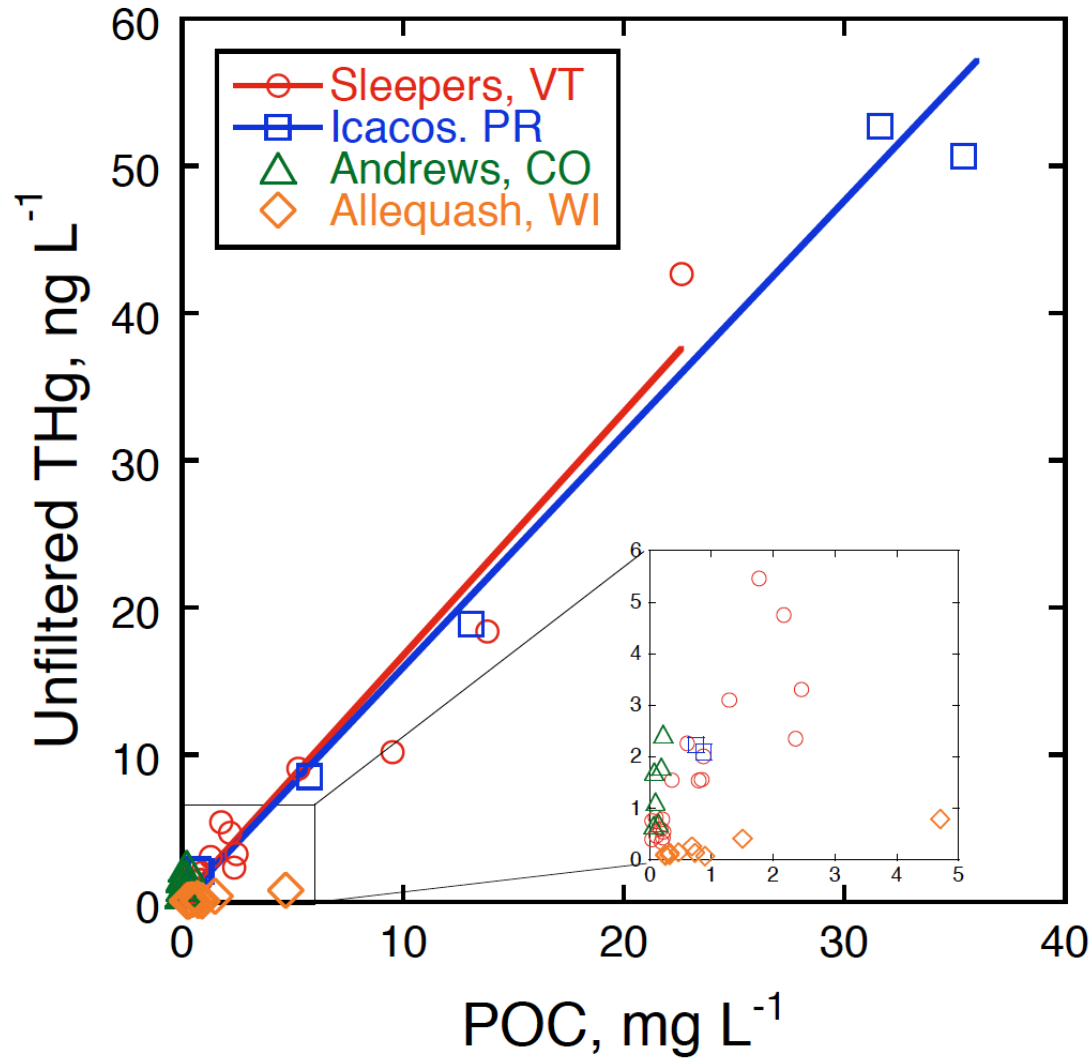
Total Hg



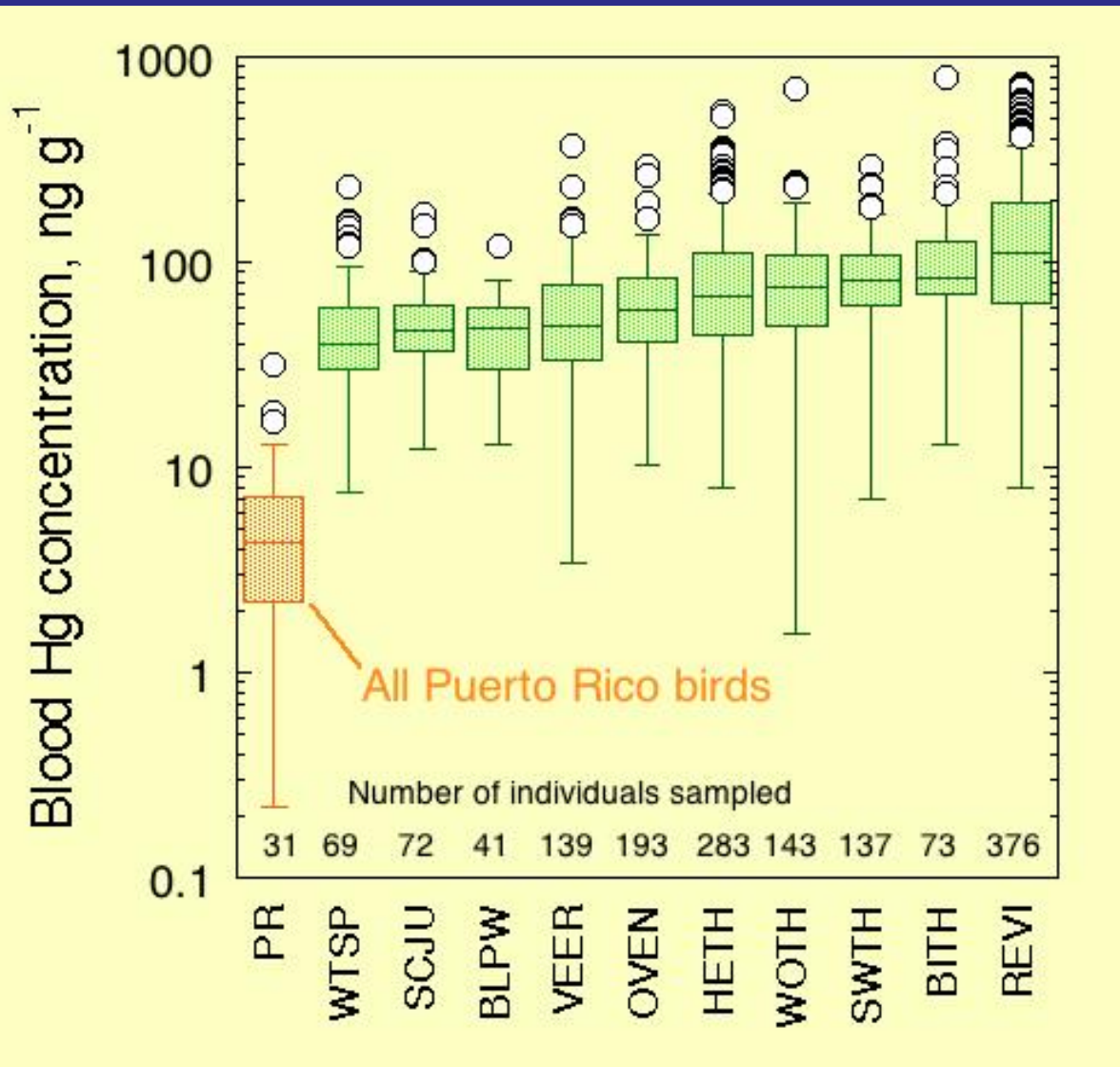
Methyl Hg



Hg in streamwater



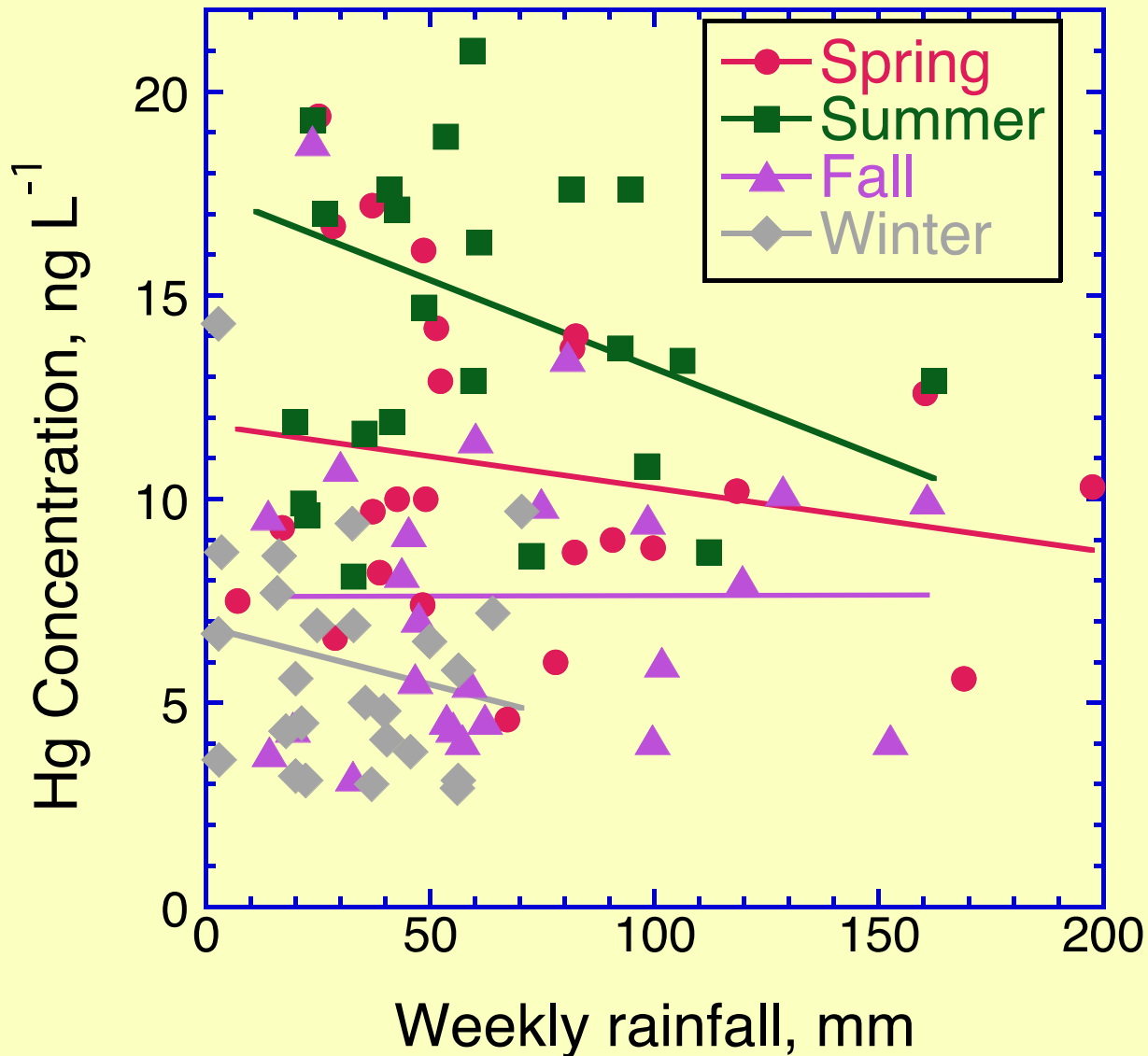
Bird blood Hg



Conclusions

- Puerto Rico -- highest Hg wet deposition in MDN
- High rain-forming clouds scavenge GOM from upper free troposphere
- Dry deposition (litterfall) higher than 28 U.S. sites
- Litterfall Hg > Wet Hg > Net throughfall Hg
- MeHg/THg is low ($\ll 1\%$) in rain, litter, and streams
- Canopy is a net source of MeHg
- Hg is high in runoff but low in biota
- Tropical sites underrepresented in global networks

Seasonal Concentration - Volume Relations



Hg wet deposition

Shanley et al., 2015, ES&T Figure 3

