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Direct Measurement of Mercury Deposition at Rural and Suburban Sites in Washington State, USA

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Citation: Lastname, F.; Lastname, F.; Last-name, F. Title. *Atmosphere* **2021**, *12*, 35. https://doi.org/10.3390/atmos12010035

Received: 26 November 2020
Accepted: 22 December 2020
Published: 30 December 2020

Table S1. Atmospheric Hg PM10 concentrations measured near the Puyallup sampling station in 2011 based on data from the National Air Toxics Trends Stations (NATTS) database. Study period in gray.

Date	Hg PM10 ng/m^3	Date	Hg PM10 ng/m^3
1/3/2011	0.01	7/24/2011	0.01
1/9/2011	0	7/26/2011	0.01
1/15/2011	0	8/1/2011	0.01
1/21/2011	0	8/7/2011	0.01
1/27/2011	0.01	8/13/2011	0.01
2/2/2011	0.02	8/19/2011	0.01
2/8/2011	0	8/25/2011	0.01
2/14/2011	0	8/31/2011	0.01
2/20/2011	0.01	9/6/2011	0.01
2/26/2011	0	9/12/2011	0
3/4/2011	0	9/18/2011	0.01
3/10/2011	0	9/24/2011	0.01
3/16/2011	0	9/30/2011	0.01
3/22/2011	0	10/6/2011	0.01
3/28/2011	0	10/24/2011	0.01
4/3/2011	0.01	10/30/2011	0.01
4/9/2011	0.04	11/2/2011	0.01
4/15/2011	0.01	11/5/2011	0.02
4/21/2011	0.01	11/8/2011	0.01
5/3/2011	0.01	11/11/2011	0.01
5/9/2011	0.01	11/17/2011	0.01
5/15/2011	0	11/20/2011	0.01
5/21/2011	0	11/23/2011	0.01
5/27/2011	0.01	11/29/2011	0.01
6/2/2011	0.01	12/5/2011	0.01
6/8/2011	0.01	12/11/2011	0.01
6/14/2011	0.03	12/14/2011	0.02
6/20/2011	0.03	12/17/2011	0.01
7/13/2011	0.03	12/23/2011	0.01
7/20/2011	0.01	12/29/2011	0.01

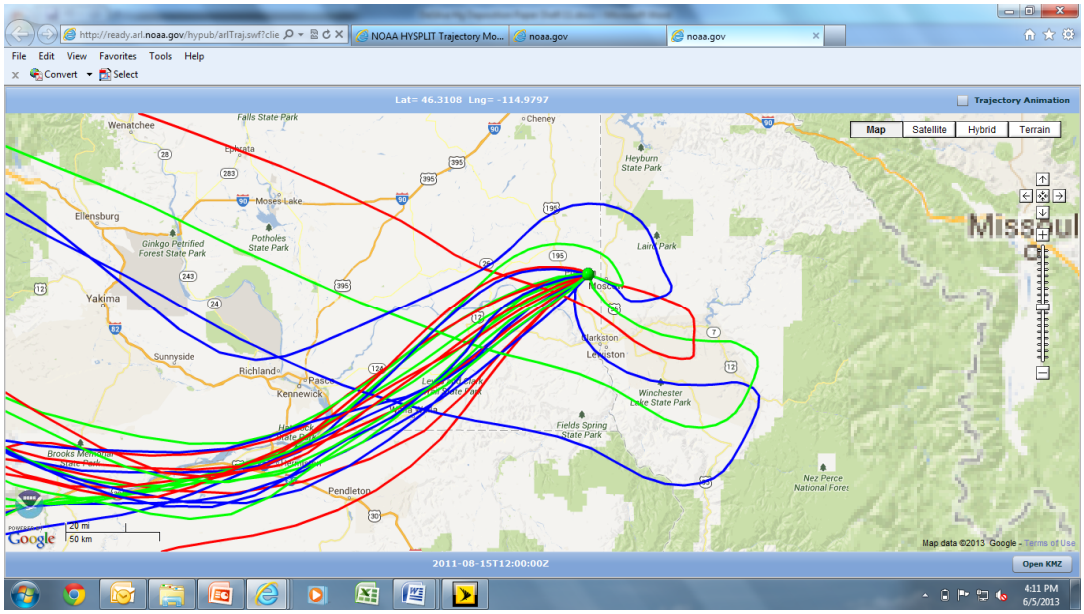

Figure S1. Example HYSPLIT back trajectories starting every 6 hours from Pullman, WA (green point) for August 15, 2011. Note most of the back trajectories pass over the Walla Walla region (red circle) and likely transported smoke and associated atmospheric Hg from agricultural burns to the Pullman area. Figure provided by Dr. Brian Lamb, Washington State University.

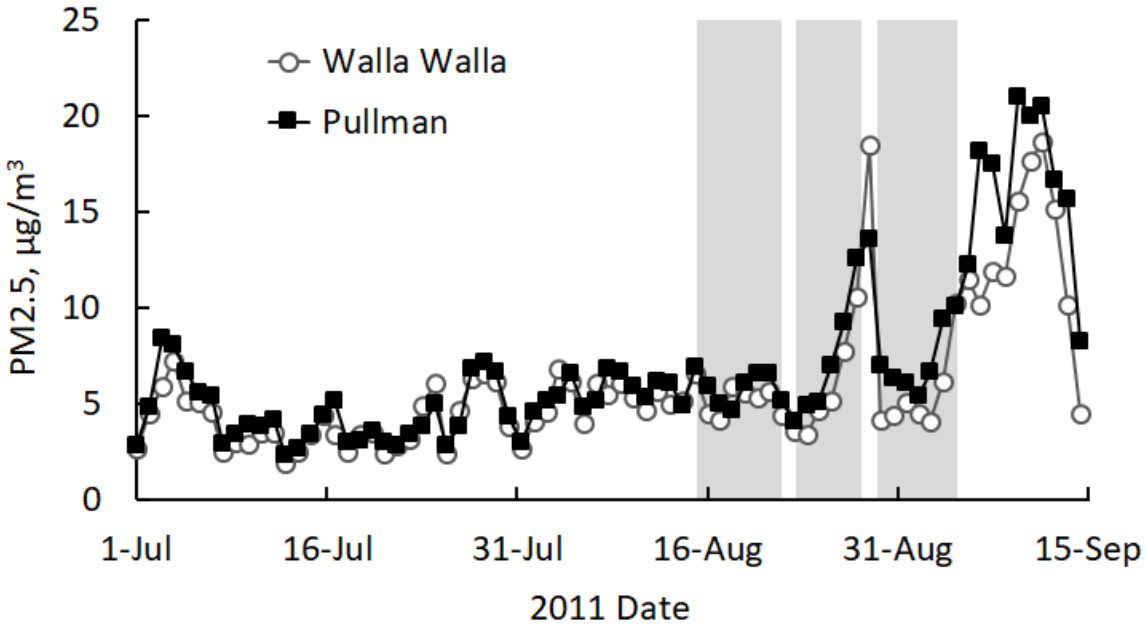

Figure S2. PM2.5 data for Pullman and Walla Walla, WA for July-September 2011. Note generally elevated levels in PM2.5, potentially related to agricultural field burning, in late August and early September. Gray bars show Hg deposition sampling events in Pullman.

S1. Ephemeral Storm Events as Source of Hg Deposition

We assessed patterns of dry season rainfall in Pullman, WA (http://mesowest.utah.edu/; mean daily values for Station KPUW) combined with our observed rates of wet and dry deposition rates to assess the importance of ephemeral storm events in regard to net Hg

deposition. An estimated 32 ephemeral storm events with small amounts of precipitation (< 3 mm) over a short duration (< 6 hr) occurred between May and September 2011. There were approximately 7 additional larger long-duration (> 6 hr) storm events. Assuming that each storm event deposited an average of 40 ng/m^2, the wet Hg deposition total for the dry period was 1.3 μg/m^2 for ephemeral storms and 0.3 μg/m^2 for long-duration storm events. Using a dry deposition rate of 1.4 ng/m^2·hr for the remaining 142 days of the 5 months dry period, dry Hg deposition was estimated at 5.7 μg/m^2. Based on this analysis, dry-season Hg deposition in Pullman in 2011 consisted of around three-fourth from dry deposition, one-fifth from wet deposition associated with ephemeral storm events, and a small amount (< 5%) from wet deposition associated with long-duration storm events.

S2. AIRPACT-3 Air Quality Model

AIRPACT (Air Indicator Report for Public Access and Community Tracking) is a numerical air quality forecast system that operates daily for the Pacific Northwest [1] (http://lar.wsu.edu/airpact). The version used in this study, AIRPACT-3, integrates the Community Multi-Scale Air Quality (CMAQ) Chemical Transport Model, the Mesoscale Meteorological/Weather Research Forecast model (MM5/WRF), and Sparse Matrix Operator Kernel Emissions (SMOKE) to simulate a wide range of atmospheric pollutants for a domain consisting of 95 by 95 grid of cells, each 12 km square. The model covers the states of Washington, Oregon, and Idaho and surrounding areas. The CMAQ Chemical Transport Model includes Hg chemical reactions [2,3]. Dry deposition is simulated using the resistance analogy scheme with simulated atmospheric Hg concentrations. CMAQ also incorporates a cloud chemistry component, which determines in-cloud and below-cloud processes related to wet deposition for both convective and non-convective storms. The model outputs hourly dry and wet Hg deposition for Hg0, RGM, and two size classes of Hgp by cell in kg/ha. To compare measured and modeled Hg deposition rates, daily modeled Hg deposition rates were estimated in ng/m^2·d as the sum of the modeled Hg deposition rates over the field sampling period of interest for the grid over each sampling station.

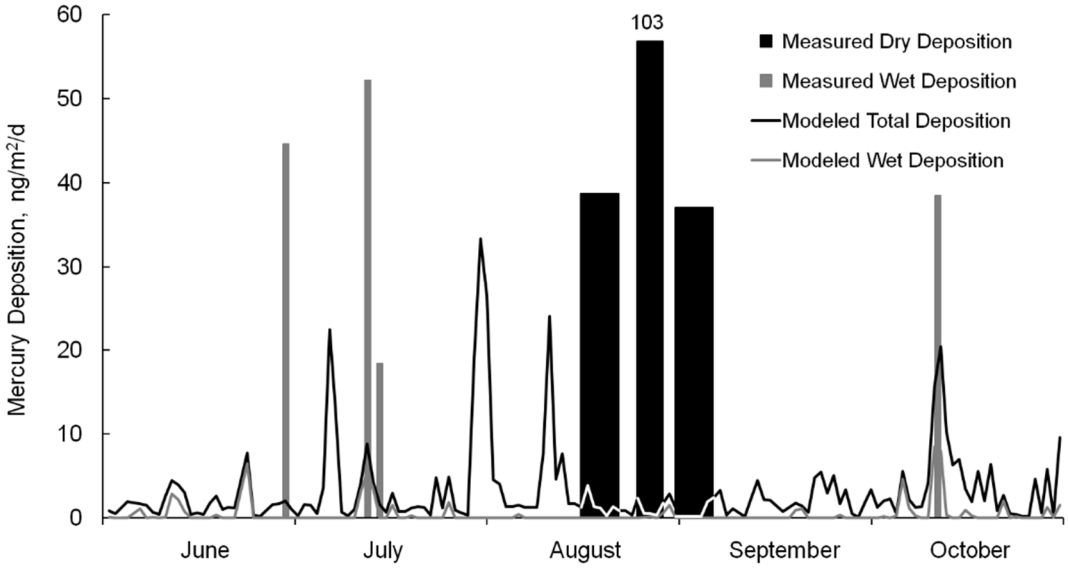

Figure S3. Measured and modeled dry and wet Hg deposition for Pullman, WA in 2011. Modelled data provided by Dr. Joseph Vaughn, Washington State University.

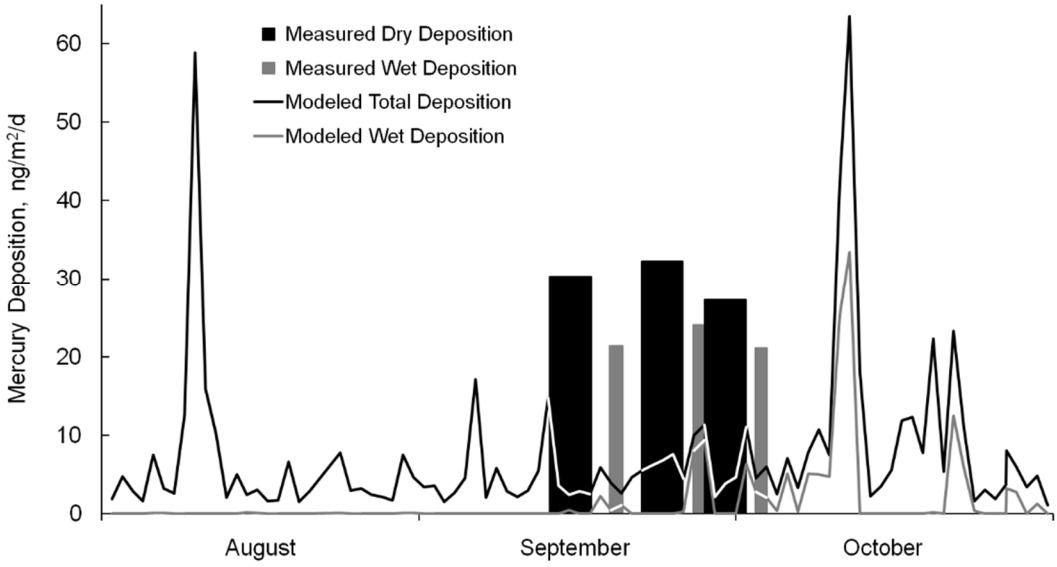

Figure S4. Measured and modeled dry and wet Hg deposition for Puyallup, WA in 2011. Modelled data provided by Dr. Joseph Vaughn, Washington State University.

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