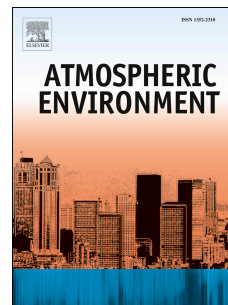


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1 Atmospheric Inputs of Organic Matter to a Forested Watershed: 2 Variations from Storm to Storm over the Seasons

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16 17 Abstract

18 The objectives of this study were to determine the quantity and chemical composition of
19 precipitation inputs of dissolved organic carbon (DOC) to a forested watershed; and to
20 characterize the associated temporal variability. We sampled most precipitation that occurred
21 from May 2012 through August 2013 at the Susquehanna Shale Hills Critical Zone Observatory
22 (Pennsylvania, USA). Sub-event precipitation samples (159) were collected sequentially during
23 90 events; covering various types of synoptic meteorological conditions in all climatic seasons.
24 Precipitation DOC concentrations and rates of wet atmospheric DOC deposition were highly
25 variable from storm to storm, ranging from 0.3 to 5.6 mg C L⁻¹ and from 0.5 to 32.8 mg C m⁻² hr⁻¹,
26 respectively. Seasonally, storms in spring and summer had higher concentrations of DOC and
27 more optically active organic matter than in winter. Higher DOC concentrations resulted from
28 weather types that favor air advection, where cold frontal systems, on average, delivered more
29 than warm/stationary fronts and northeasters. Using a mixed modeling statistical approach
30 revealed that factors related to storm properties, emission sources, and to the chemical
31 composition of the atmosphere could explain more than 60% of the storm to storm variability in
32 DOC concentrations. This study provided observations on changes in dissolved organic matter
33 that can be useful in modeling of atmospheric oxidative chemistry, exploring relationships
34 between organics and other elements of precipitation chemistry, and in considering temporal
35 changes in ecosystem nutrient balances and microbial activity.

36 **Keywords:** Precipitation; Organic matter; Dissolved organic carbon; Temporal variation;
37 Seasonal; Critical zone observatory.

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