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Supporting dataset for chloride source delineation in an urban-agricultural watershed, deicing agents versus agricultural contributions

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Table. 1 Data set information

Title of data set	Supporting dataset for chloride source delineation in an urban-agricultural watershed, deicing agents versus agricultural contributions
Abstract	Analyses (n = 535) of chloride (Cl ⁻), bromide (Br ⁻), nitrate as nitrogen (NO ₃ -N), sodium (Na ⁺), calcium (Ca ²⁺), and potassium (K ⁺) in stream water, tile-drain water, and groundwater were conducted in an urban-agricultural watershed (10% urban/impervious, 87% agriculture) to explore potential differences in the signature of Cl ⁻ originating from an urban source as compared to an agricultural source. Water samples were collected on a weekly interval from February 2018 to February 2019 at three station along the stream and from tile drains and wells. Nearly all surface water and tile water samples had Cl ⁻ concentrations above the calculated background threshold of 18 mg/l. Mann-Whitney U test revealed ratios of Cl ⁻ to Br ⁻ (p = 0.045), NO ₃ -N (p < 0.0001), Ca ²⁺ (p < 0.0001), and Na ⁺ (p < 0.0001) to be statistically significantly different between urban and agricultural waters. Cl ⁻ ratios indicate that road salt is the dominant source of Cl ⁻ in the watershed, while potassium chloride fertilizer is an important secondary source. This study demonstrated that while deicing in watersheds where urban land use is minimal can have a profound impact on Cl ⁻ dynamics, agricultural practices should not be ignored.
Keywords	Road Salt, Chemical Ratios, Land Use, High Frequency Sampling, Tile Drain, Chloride
Lead author for the dataset	Andrew Oberhelman
Title and position of lead author	PhD Student
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Organization associated with the data	Illinois State University
Usage Rights	Publicly available and free to use
Geographic region	McLean and Woodford Counties, Illinois (Lat. 40.595325, Lon. -89.01382)
Geographic coverage	Coverage of the data set is bounded by the combined drainage divides of Evergreen Lake Watershed (ELW) and Lake Bloomington Watershed (LBW)
Temporal coverage -begin date	February 17, 2018
Temporal coverage - end data	February 17, 2019
General study design	Major ion chemistry of waters discharging from an urban source was compared to that of waters discharging from an agricultural source to characterize Cl ⁻ signature and identify potential Cl ⁻ sources in an urban-agricultural watershed (10% urban/impervious, 87% agriculture). These data (n = 535) were used to assess the potential contribution of agricultural to the Cl ⁻ regime of the watershed, with the broader objective of determining the potential contribution of agricultural practices to Cl ⁻ salinization observed in northern regions.

Methods description	<p>Water samples were collected weekly from February 2018 to February 2019 at three points along Six Mile Creek, a low order urban-agricultural stream and main tributary to Evergreen Lake in ELW, as well as from tile drains and groundwater wells within ELW and LBW. Stream discharge was measured weekly at each station with a Stontek Flowtracker acoustic doppler velocimeter following the midsection method while a YSI Sonde was used to measure temperature, pH, dissolved oxygen, and specific conductance. Storm events were sampled at two locations using 24 bottle ISCO auto samplers. All water samples were passed through a 1.0 μm Pall type A/E 25 mm glass fiber syringe filter into an acid washed Nalgene polypropylene 30 ml sample bottle using a triple rinsed 60 ml syringe. Water samples were stored frozen. Anions concentrations (Cl^-, Br^-, NO_3^--N, PO_4-P, SO_4^{2-}) were measured on a Dionex ICS-1100 Ion Chromatograph (IC). Cation concentrations (Na^+, Ca^{2+}, K^+, Mg^{2+}) were measured on a PerkinElmer Optima 8300 Inductively Coupled Plasma Optical Emission Spectrometer (ICP).</p>
Laboratory, field, or other analytical methods	<p>In the field, one ISCO was permanently in place at the most downstream sample point and was triggered when stream turbidity measured by a DTS-12 digital turbidity sensor rose above or fell below certain threshold values (Lampo, 2017). Select storm events at the intermediate stream station were sampled with the second transportable ISCO auto sampler that was set to collect a sample every 2, 2.5, 3, or 3.5 hours depending on forecasted weather. Storm samples were manually selected for processing to achieve a representative set along an event hydrograph.</p> <p>The midpoint method calculates stream discharge by taking the sum of discharges estimated for at least 15 stream segments, where the mean water velocity at a point along the stream section, taken to be that measured at 0.6 of the depth below the water surface, is multiplied by the area for a stream segment defined as the depth at the current measurement point multiplied by the sum of half the distances from the current measurement point to the preceding and next measurement points. Tile discharge was measured by noting the time it took for a drain to fill a bucket to a known volume.</p> <p>Samples were thawed immediately prior to analysis by IC and the night before analysis by ICP. Standards for IC calibration were made using salts while the ICP calibration standard were made by diluting a purchased stock solution. Analyses were only run when calibration curves had $R^2 \geq 0.999$</p>
Quality control	<p>Data quality was assessed using a series of sample blanks, sample duplicates, calibration verifications, and matrix spikes during each analytical run. Chemical and discharge data should only be considered reliable to 3 significant figures.</p>
Additional information	<p>References: Lampo, L., 2017, Dynamics of Nitrate, Phosphorus, and Suspended Sediment Transport in Two Agricultural Streams in Central Illinois [M.S. thesis]: Illinois State University, 164 p.</p>

Table 2. Description of data set variables.

Dataset filename: 2019_09_04_supporting_chemical_and_field_data.csv

Dataset description: Water chemistry and field data collected from February 2018 to February 2019 in ELW and LBW. Dashes (-) mean a sample was not analyzed for that ion or that no corresponding field data was collected with that sample. Zero concentration indicates a sample was analyzed for that ion, but none was detected. The bromide detection limit was 0.05 mg/L.

Column name	Description	Units
location	Location where sample was collected. T1 denotes a tile drain in LBW.	
type	weekly sample (weekly), storm event (event), tile drain sample (tile), groundwater sample (gw), road salt runoff sample(rsr)	
date	Date and time of sample collection	
Q	Stream or tile discharge	m ³ /s
SpC	Specific conductance	μS/Cm
pH		
F-	Concentration of fluoride	mg/L
Cl-	Concentration of chloride	mg/L
Br-	Concentration of bromide	mg/L
NO3-N	Concentration of nitrate as nitrogen	mg/L
PO4-P	Concentration of phosphate as phosphorus	mg/L
SO42-	Concentration of sulfate	mg/L
Ca2+	Concentration of calcium	mg/L
Mg2+	Concentration of magnesium	mg/L
Na+	Concentration of sodium	mg/L
K+	Concentration of potassium	mg/L