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Table 1: Gauge visits during the autumn 2016. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CA= rain gauge calibration, and BR = data logger battery replacement.

Date	Gauges Visited	Technicians	Comments
10/2/2016	1; 3	Doug, Carly, Ben	DD, MN, CA, BR
10/7/2016	2; 5; 8*	Doug, Jackie	DD, MN, CA, BR
10/15/2016	100T, 105, 104	Doug, Kyle	DD, MN, CA, BR
10/16/2016	300, 308	Doug, Samuel, William	DD, MN, CA, BR
10/21/2016	106, 10	Doug	DD, MN, CA, BR
10/22/2016	304, 307	Doug, Carly, Samuel	DD, MN, CA, BR
10/28/2016	4, 108, 109	Doug, Ben	DD, MN, CA, BR
11/4/2016	311, 110	Doug	DD, MN, CA, BR
11/5/2016	111, 112, 107	Doug, Kyle	DD, MN, CA, BR
11/6/2016	303s, 306	Doug, Rachel, Carly	DD, MN, CA, BR
11/11/2016	101, 102, 103	Doug	DD, MN, CA, BR
11/13/2016	305, 309, 310	Doug, William, Samuel	DD, MN, CA, BR
12/7/2016	109, 110	Doug	CA, MN
12/21/2016	301, 302	Doug, Daniel	DD, MN, CA, BR

Gauge visitation in support of the Duke Great Smoky Mountain Rain Gauge Network (GSMRGN) during the autumn 2016 occurred over 14 days spanning a period of 12 weeks from October – December 2016. The primary purpose of the visits in the autumn 2016 was [1] to perform downloads of gauge tip observations since the previous gauge visits in the summer 2016, [2] to complete maintenance tasks, [3] to replace the data logger lithium or HOBO battery and [4] to calibrate every rain gauge with three trials using the 50, 100, and 300 mm nozzles. Ten technicians and volunteers (listed on the front page) made the visits and performed the required work. It is important to note that the volunteers were NOT directly involved in any of the gauge visit tasks, but were volunteering to assist with personal safety should someone get injured during a particular series of gauge visits.

The general tasks completed at **every** gauge visit consisted of (1) gauge data download from the data loggers [DD in Table 1], (2) general gauge maintenance and ML1 logger condition monitoring [MN in Table 1], (3) replacement of lithium data logger or HOBO batteries [BR in Table 1], and (4) three calibration trials [CA in Table 1]. Specialized tasks were to re-install a gauge that had been pushed over (evidence of a bear) at the southernmost gauge on Cataloochee

Divide (g110), re-install a gauge cover that had been torn off (evidence of a bear) at the northernmost gauge on Lickstone Ridge (g010), remove insect cocoons that had incapacitated the tipping mechanism of the gauge buckets (g104 and g107), and re-visit a gauge (g109) that had registered missing tips during its initial calibration visit. Task (1) merely required a serial port link between the field study laptop and the gauge data logger and consisted of pulling the data (often in files having raw [* .txt] and CSV formats) onto a desktop folder on the laptop, checking for completeness of the data, and comparing the data logger time and date to the actual GPS time and date (making a screen capture of the time comparison). The standard that has been chosen for this study is to maintain the clocks on Eastern Daylight Time, since most of the “warm” precipitation will be occurring during the season when EDT is in effect. Most ML1-FL data logger times have been adjusted (using “TA” command) during previous gauge visits to coincide with the EDT given by the GPS locator. Most new ML1-420 loggers installed during the summer 2013 campaign were keeping *much* better time than did the older generation ML1-FL loggers and only required minimal adjustment. However, the lithium battery life of the ML1-420 loggers (one logger had a dead battery since the previous visit in the summer 2016; g301) is much less predictable than the ML1-FL loggers. Task (2) required the cleaning of debris from the funnel filter, cleaning the tipping buckets of debris (if necessary), cleaning the gauge drain ports and siphon, re-leveling the gauge if it has come unlevelled, and fixing or replacing the gauge mesh if it had been damaged. Task (3) consisted of replacing data logger lithium or HOBO batteries at ALL gauges during the autumn visit campaign. The Hydrological Services of America (HSA) logger draws power from the laptop while connected, so it is unknown if the voltage shown during a WinComLog (HSA software) session is accurate. Task (4) involved running three trials using the 50, 100, and 300 mm nozzles using the Duke #2 calibration tube. Calibration trials required the packing of water (one gallon per gauge) and slowed each gauge visit (1.25 extra hours) so that the total gauge visit campaign was spread out over a much greater period than usual.

The challenges encountered during some of the gauge visits in the autumn 2016 were the result of unusual weather; remnants of hurricane Matthew, northwest flow snow, severe drought, wildfires, and the windstorm of 28 November 2016. Since calibration trials require a lack of precipitation and relatively calm wind speeds, gauge visits had to be re-scheduled until favorable weather conditions could return. At least one gauge (g008) will need to have the calibration trials completed during the spring 2017 visit campaign as a return visit to the Waynesville Watershed was unable to be scheduled during the autumn 2016. A windstorm on 28 November 2016 resulted in the downing of numerous trees and the spreading of a significant wildfire in the Gatlinburg, TN region. As a result, entrance to the Cosby, TN campground in the GSMNP was closed until 15 December 2016. Visits to gauges #301 and 302 were delayed until 21 December 2016, the shortest day of the year.

Details of every gauge visit along with precipitation raw and CSV files can be found via Google Drive at <https://drive.google.com/open?id=0B9P8oUaRiBOWeG5VcU9wMVE3TDg> which contains sub-folders for each gauge that consist of the individual data files (often having at least two different formats), pictures taken at the gauge site during the visit, screenshots of the GPS (laptop) and ML1 logger time comparison, and a MS Word document that mirrors the notes made in the field journal during the visit.

Plans for the spring months of 2017

Table 2: Planned gauge visits during the spring 2017. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CV = vegetation clearing, and BR = data logger battery replacement (necessary loggers only).

Date	Gauges Visited	Technicians	Comments
3/??/2017	304, 307	Doug, Student #1, Student #2	DD, MN, CV, BR
3/??/2017	1, 3, 10	Doug, Student #1	DD, MN, CV, BR
4/??/2017	2, 5, 8, 106, 4	Doug, Don, Student #1	DD, MN, CV, BR
4/??/2017	111, 112, 104, 105, 106, 107, 109	Doug, Student #1	DD, MN, CV, BR
4/??/2017	101, 102, 103, 110, 108	Doug, Student #1	DD, MN, CV, BR
4/??/2017	305, 309, 310	Doug, Student #1, Student #2	DD, MN, CV, BR
5/??/2017	303s, 306, 311	Doug, Student #1, Student #2	DD, MN, CV, BR
5/??/2017	300, 301, 302, 308	Doug, Student #1, Student #2	DD, MN, CV, BR

Gauge visitation in support of the Duke GSMRGN during the spring 2017 will occur over at least eight days spanning a period of six weeks in March - April 2017. The primary purpose of the visits will be to download precipitation observations that were made since the previous gauge visits in October – December 2016 [DD in Table 2], perform maintenance and check if the ML1 logger times have drifted between visits and make the corresponding needed adjustments [MN in Table 2], clear vegetation (and tree branches) from overhanging gauges [CV in Table 2], and replace ML1 or HOBO batteries at the needed rain gauge location [BR in Table 2].

Details of every gauge visit along with each gauge precipitation and calibration data record will be posted online and shall contain sub-folders for each gauge that consist of the individual data files (often having at least two different formats), pictures taken at the gauge site during the visit, screenshots of the GPS (laptop) and ML1 logger time comparison, and a MS Word document that mirrors the notes made in the field journal during the visit.

New undergraduate research students at UNC Asheville will be recruited as field technicians for the Duke GSMRGN project during an informational meeting to be held in the ATMS Department early in the fall 2017 semester. The current technician roster during the academic year consists of William Clark, Rachel Dunn, Ben House, Jackie Hoyle, Carly Narotsky, Kyle Noel, Samuel O'Donnell, Zachary Tuggle, and Ethan Wright. Students William Clark, Ben House, Kyle Noel, and Ethan Wright will be graduating from UNC Asheville in May 2017.

Table 3: The Duke Great Smoky Mountain Rain Gauge Network is currently (valid as of 2 January 2017) comprised of 32 tipping bucket rain gauges.

Gauge #	Location	Latitude	Longitude	Altitude
RG001	Deep Gap	35°23.8' N	82°54.7' W	3794 ft.
RG002	Lickstone Bald	35°25.5' N	82°58.2' W	5680 ft.
RG003	High Top	35°23.0' N	82°54.9' W	5280 ft.
RG004	Lickstone Ridge S	35°22.0' N	82°59.4' W	6305 ft.
RG005	Deep Gap	35°24.5' N	82°57.8' W	4986 ft.
RG008	Double Spring Gap	35°22.9' N	82°58.4' W	5700 ft.
RG010	Beaty Spring Gap	35°27.3' N	82°56.8' W	4849 ft.
RG100T	Purchase Knob	35°35.1' N	83°04.3' W	4905 ft.
RG101	The Swag	35°34.5' N	83°05.2' W	4986 ft.
RG102	Hemphill Bald	35°33.8' N	83°06.2' W	5365 ft.
RG103	JR Property	35°33.2' N	83°07.0' W	5539 ft.
RG104	Cat. Ski Area	35°33.2' N	83°05.2' W	5208 ft.
RG105	KH Property	35°38.0' N	83°02.4' W	4412 ft
RG106	Pinnacle Ridge	35°25.9' N	83°01.7' W	3969 ft
RG107	Lookout Point	35°34.0' N	82°54.4' W	4459 ft
RG108	Utah Mountain	35°33.2' N	82°59.3' W	4188 ft
RG109	Eaglesnest Ridge	35°29.7' N	83°02.4' W	4922 ft
RG110	JH Property	35°32.8' N	83°08.8' W	5128 ft
RG111	Hurricane Ridge	35°43.7' N	82°56.8' W	4573 ft
RG112	Ore Knob	35°45.0' N	82°57.8' W	3884 ft
RG300	Camel Hump Knob	35°43.5' N	83°13.0' W	5110 ft
RG301	Mt Guyot	35°42.3' N	83°15.3' W	6570 ft
RG302	Snake Den Ridge	35°43.2' N	83°14.8' W	6104 ft

RG303s	Mt Cammerer	35°45.7'N	83°09.7'W	4887 ft
RG304	Big Cataloochee	35°40.2'N	83°10.9'W	5971 ft
RG305	Mt Sterling 1	35°41.4'N	83°07.9'W	5349 ft
RG306	Sunup Knob	35°44.7'N	83°10.2'W	5039 ft
RG307	Balsam Mountain	35°39.0'N	83°11.9'W	5327 ft
RG308	Cosby Knob	35°43.8' N	83°10.9'W	4826 ft
RG309	Mt Sterling 2	35°40.9'N	83°09.0'W	5262 ft
RG310	Mt Sterling 3	35°42.1'N	83°07.3'W	5761 ft
RG311	Big Creek	35°45.9'N	83°08.4'W	3398 ft