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**Table 1: Gauge visits during the summer 2013. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CV= clear vegetation, SL=swap out ML1 data logger, IG=install gauge, and CA = calibration with three nozzles.**

Date	Gauges Visited	Technicians	Comments
9/27/2013	4, 10	Greg, Doug	DD, MN, CV, CA
9/28/2013	1, 3	Greg, Duncan	DD, MN, CV, CA
9/29/2013	100, 100T, 114, 303	Greg, Kurt	DD, MN, CV, CA
10/4/2013	2, 5, 8	Greg, Bobby	DD, MN, CV, CA
10/5/2013	111, 112, 107	Greg, Candice	DD, MN, CV, CA
10/7/2013	104, 106, 109, 110	Greg, Bonnie	DD, MN, CV, CA
10/8/2013	101, 102, 103	Greg, Kurt	DD, MN, CV, CA
10/13/2013	104, 105, 108	Greg, Ethan	DD, MN, CV, CA
10/18/2013	304, 307, 401	Greg, Doug	DD, MN, CV, CA
10/19/2013	303s, 306, 311	Greg, Ethan, Sky	DD, MN, CV, CA
10/20/2013	300, 308	Greg, Massey	DD, MN, CV, CA
11/2/2013	305, 309, 310, 400	Greg, Massey, Ethan	DD, MN, CV, CA
11/9/2013	301, 302, 402	Greg, Ethan, Doug	DD, MN, CV, CA
11/16/2013	406	Greg, Massey, Duncan	IG

Gauge visitation in support of the Great Smoky Mountain Rain Gauge Network (GSMRGN) during the autumn 2013 occurred over 14 days spanning a period of over eight weeks from September – November 2013. The primary purpose of the visits was [1] to perform downloads of gauge tip observations since the previous gauge visits in the summer 2013, [2] to complete maintenance tasks, [3] to calibrate the gauges and [4] to swap old ML1 data loggers with new ones or monitor the lithium battery voltage. Eleven 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** first-time gauge visit consisted of (1) gauge data download from the data loggers [DD in Table 1], (2) general gauge maintenance and ML1 logger swapping or monitoring [MN in Table 1], (3) clearing of vegetation products (e.g., leaves) from the gauge funnel [CV in Table 1], and (4) calibrating each gauge with three different nozzles [CA in Table 1], with Greg Cutrell leading the calibration efforts in order to maintain a consistent procedure. Specialized tasks were to download data from the remaining T/RH sensor in the Great Smoky Mountain National Park (GSMNP), to install one new rain gauge at Charlie’s Bunion in the GSMNP [IG in Table 1], and to deal with damaged (g#104, g#5, g#301) or fallen gauges (g#400, g#402). 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 two different formats) onto a desktop folder on the laptop, checking for completeness of the data, and comparing the data logger time to the actual GPS time (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 data logger times were adjusted (using “TA” command) during the autumn

2013 gauge visits to coincide with the EDT given by the GPS locator. Most new ML1 loggers installed during the summer 2013 campaign were keeping *much* better time than did the older generation ML1 loggers and only required minimal adjustment. Tasks (2) and (3) 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, fixing or replacing the gauge mesh if it had been damaged (g#301), and swapping out old filters that were attributed to gauge clogging with newer less coarse filters (e.g., g#114, 400, 401, 402, 303s). No substantial vegetation product blockage was observed at any of the gauge site locations in the autumn 2013. Task (4) consisted of calibration trials using the 50, 100, and 300 mm nozzles, with two trials using the 100 mm nozzle.

The challenges encountered during many of the later gauge visits in the autumn 2013 were scheduling issues related to the sequestration impacts which forced the closure of the GSMNP in early October 2013. As a result, the gauge visit schedule was delayed, ending about two weeks later than originally planned. A new 0.1 mm rain gauge was installed at Charlie's Bunion, offering precipitation observations 8.0 miles to the southwest of Mt. Guyot, within the GSMNP. Some of the data loggers (g#01 and g#10) had abrupt record endings and observations were not recoverable with the full logger dump command ("dur/+"). A squirrel had gnawed the edges of the gauge funnel at Mt. Guyot (g#301) and had likely stolen the stainless steel mesh filter from the center of the funnel. A partially damaged replacement mesh filter was put in the funnel and measures will be taken (installing a motion-activated flash and noisemaker) to try to discourage the squirrel from continued theft and damage to the upper edge of the gauge funnel. The calibration at one gauge location (g# 310) could not be completed due to the sudden development of a lightning storm overhead and will be done during the winter 2014 gauge visit campaign. The calibration at another location (g# 402) was incomplete due to one of our calibration water bottles being stolen and damaged by a bear while we were attending to the gauge calibration on Mt. Guyot.

Details of every gauge visit along with each gauge precipitation and calibration data record can be found at [https://dl.dropboxusercontent.com/u/57365479/fall2013\\_visits.zip](https://dl.dropboxusercontent.com/u/57365479/fall2013_visits.zip), [here](#) (8 Oct 2013), [here](#) (14 Oct 2013), [here](#) (20 Oct 2013), [here](#) (2 Nov 2013), and [here](#) (9 Nov 2013), which 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 each gauge visit.

Plans for the winter months of 2014

**Table 2: Planned gauge visits during the winter 2014. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), LM= logger monitoring, IG=install gauge, and CA = calibration with three nozzles.**

Date	Gauges Visited	Technicians	Comments
1/4/2014	4, 10, 104	Greg, TBD-1	DD, MN, CV
1/5/2014	1, 3	Greg, TBD-1	DD, MN, CV
1/6/2014	100, 100T, 105, 109, 303	Greg, TBD-1	DD, MN, CV
1/7/2014	2, 5, 8, 106	Greg, TBD-1	DD, MN, CV
1/11/2014	111, 112, 107	Greg, TBD-1	DD, MN, CV
1/12/2014	101, 102, 103	Greg, TBD-1	DD, MN, CV
1/18/2014	108, 110	Greg, TBD-1	DD, MN, CV
1/19/2014	305, 309, 310, 400	Greg, TBD-2	DD, MN, CV, CA, IG
1/20/2014	301, 302, 402	Greg, TBD-2	DD, MN, CV, CA
1/25/2014	300, 308	Greg, TBD-2	DD, MN, CV
1/26/2014	303s, 306, 311	Greg, TBD-2	DD, MN, CV
1/27/2014	304, 307, 401	Greg, TBD-2	DD, MN, CV
2/1/2014	406	Greg, TBD-2	DD, MN, CV

Gauge visitation in support of the GSMRGN during the winter 2014 will occur over at least twelve days spanning a period of five weeks in January and February 2014. The primary purpose of the visits will be to support the IPHEX field project by performing maintenance, downloading precipitation observations that were made since the previous gauge visits in September - November 2013, checking if the ML1 logger times have drifted between visits, calibrating some gauges that were missed during the previous visits (g#310 and g#402), and re-installing the new gauge at the Mt. Sterling fire tower (g#400) that had toppled sometime during the warm season in 2013. A primary maintenance issue will also be to examine the battery voltage of the ML1 and HOBO logger batteries and replace, if necessary. The newly “swapped” data loggers will be time adjusted (using “TA” command) and time drift will be documented to determine if the newer loggers are keeping more accurate time in the field. We’ll be installing a new generation ML1 logger at the Balsam Mountain gauge (g#307). The higher elevation gauges during the autumn period will be visited last as they were most recently visited during the autumn 2013 campaign.

The general tasks completed **at every gauge visit** will consist of (1) gauge data download from the data loggers [DD in Table 2], (2) general gauge maintenance [MN in Table 2], and (3) clearing of vegetation products from the gauge site [CV in Table 2]. Careful attention will continue to be given to the time drift challenges of the ML1 data loggers noted since it was first documented in detail in 2011. Of particular interest will be to examine if the newer generation data loggers swapped with the old ML1s during the summer and autumn 2013 campaigns appear to keep time more accurately under the cold wintertime conditions of the southern Appalachian Mountains.

Details of every gauge visit along with each gauge precipitation and calibration data record will be posted at [http://www.atms.unca.edu/dmiller/win2014\\_visits.zip](http://www.atms.unca.edu/dmiller/win2014_visits.zip) which 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 each gauge visit.

Kenneth Webb is a new undergraduate research student at UNC Asheville who has been added to the technician team during the winter 2014 gauge visits to help replace a student who has graduated in December 2013 (Duncan Belew).

**Table 1: The Great Smoky Mountain Rain Gauge Network is currently (valid as of 16 December 2013) comprised of 41 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.
RG100, RG100T, RG114, RG303	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
RG115	Zeis Hall (UNCA)	35°37.0'N	82°33.9'W	2182 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, RG402	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, RG401	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, RG400	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
RG406	Charlie's Bunion	35°38.3'N	83°22.3'W	5430 ft