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Index

Status
Plans for the autumn months of 2013

Page 2
Page 4

Status

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, and IG=install gauge.

Date	Gauges Visited	Technicians	Comments
19 Jun 2013	306, 308	Greg, Doug	DD, MN, CV
29 Jun 2013	1, 3	Doug, Thomas	DD, MN, CV
1 Jul 2013	2, 5, 8, 106	Doug, Bobby	DD, MN, CV
2 Jul 2013	4, 10	Greg, Bobby	DD, MN, CV
6 Jul 2013	100, 100T, 303, 105, 107, 109	Doug, Thomas	DD, MN, CV
7 Jul 2013	104, 108, 111, 112	Greg, Bobby	DD, MN, CV
8 Jul 2013	101, 102, 103, 110	Greg, Doug	DD, MN, CV
13 Jul 2013	303s, 306, 311	Greg, Bobby, Mike	DD, MN, CV
15 Jul 2013	305, 309, 310	Greg, Doug, Bobby	DD, MN, CV, IG
18 Jul 2013	304, 307	Greg, Doug, Bobby, Mike	DD, MN, CV, IG
29 Jul 2013	300, 301, 302, 308	Greg, Doug, Bobby, Mike	DD, MN, CV, IG
30 Jul 2013	1	Greg, Doug, Peter Ward	DD, MN, SL
5 Aug 2013	4, 114	Greg	DD, MN, SL
14 Aug 2013	301, 302	Greg, Doug	DD, MN, SL

Gauge visitation in support of the Great Smoky Mountain Rain Gauge Network (GSMRGN) during the summer 2013 occurred over 13 days spanning a period of over seven weeks in the June – August 2013 period. The primary purpose of the visits was [1] to perform downloads of gauge tip observations since the previous gauge visits in the spring 2012, [2] to complete maintenance tasks, and [3] to clear vegetation during a rainy summer growing season. Six 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 [MN in Table 1], and (3) clearing of vegetation from the gauge site [CV in Table 1]. Specialized tasks were to download data from the remaining T/RH sensors in the Great Smoky Mountain National Park (GSMNP), to install three new rain gauges at three locations in the GSMNP [IG in Table 1], and to swap out ML1 data loggers [SL in Table 1] demonstrating consistent trouble in keeping accurate time (g#1, 4, 114, 301) or showing problems related to a corrupted upgrade of logger software (g#302). 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 summer 2013 gauge visits to coincide with the EDT given by the GPS locator and a test of the logger time accuracy can continue to be assessed during the autumn 2013 gauge visits. Task (2) required the cleaning of debris from the funnel filter, cleaning the tipping buckets of debris (if necessary), cleaning the gauge drain ports, re-leveling the gauge if it has come unlevelled, and fixing or replacing the gauge mesh if it had been damaged (g#301, 302). Task (3) is required to insure that none of the surrounding vegetation overgrows

the funnel top during the growing season, thereby reducing the catchment of the gauge. A hand-saw and trimming shears were carried to each location to allow effective clearing of the gauge fields of view. No substantial vegetation overgrowth was observed at any of the gauge site locations in the summer 2013.

The challenges encountered during some of the gauge visits in the summer 2013 were related primarily to abnormally cool and rainy weather conditions. The trails and creek beds were consistently muddy or had water running in them. They are normally dry during the summer months. The mud or water added hiking time due to poor traction on foot or by the four-wheel-drive vehicle (e.g., at Camp Daniel Boone). A tornado survey occurred on 19 June 2013 to investigate the potential damage in the GSMNP to two gauges (g# 306, 308) after a confirmed EF1 tornado passed through the GSMNP on 13 June 2013. No gauge damage was found, but tree damage pictures and their corresponding coordinates were passed to forecasters at the National Weather Service offices in Morristown, TN and Greer, SC. New 0.1 mm rain gauges were installed at the locations of three rain pre-existing gauges in the GSMNP (g#302, 307, 310) to allow for an inter-comparison of rainfall at three distinct ridgelines in the GSMNP (Balsam Mountain Ridge, Mount Sterling Ridge, and along the AT ridgeline). A bear had snapped one rain gauge off of its stainless steel posts (g#5) in the Waynesville Watershed that will require a more permanent repair with new stainless steel posts during the gauge visits in the autumn 2013.

Details of every gauge visit along with each gauge precipitation and calibration data record can be found at http://www.atms.unca.edu/dmiller/sum2013_visits.zip 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 each gauge visit.

Plans for the autumn months of 2013

Table 2: Planned gauge visits during the autumn 2013. Comments: DD=gauge data download, MN=general gauge maintenance (cleaning, re-level), CV= clear vegetation, and CA = calibration with two nozzles.

Date	Gauges Visited	Technicians	Comments
9/27/2013	4, 10, 104	Greg, TBD-1	DD, MN, CV, CA
9/28/2013	1, 3	Greg, TBD-1	DD, MN, CV, CA
9/29/2013	100, 100T, 105, 109, 303	Greg, TBD-1	DD, MN, CV, CA
10/4??/2013	2, 5, 8, 106	Greg, TBD-1	DD, MN, CV, CA
10/5/2013	111, 112, 107	Greg, TBD-1	DD, MN, CV, CA
10/6/2013	101, 102, 103	Greg, TBD-1	DD, MN, CV, CA
10/7/2013	108, 110	Greg, TBD-1	Fall Break
10/8/2013	305, 309, 310, 400	Greg, TBD-2	Fall Break
10/19/2013	301, 302, 402	Greg, TBD-2	DD, MN, CV, CA
10/20/2013	300, 308	Greg, TBD-2	DD, MN, CV, CA
10/26/2013	303s, 306, 311	Greg, TBD-2	DD, MN, CV, CA
10/27/2013	304, 307, 401	Greg, TBD-2	DD, MN, CV, CA

Gauge visitation in support of the GSMRGN during the autumn 2013 will occur over at least twelve days spanning a period of nearly six weeks in September and October 2013. 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 June-August 2013, checking if the ML1 logger times have drifted between visits, and calibrating the gauges a final time before the winter season. 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. The higher elevation gauges during the autumn period will be visited last as they were most recently visited during the summer 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], (3) clearing of vegetation from the gauge site [CV in Table 2], and (4) the calibration of the gauges using two nozzles [CA in Table 2]. Careful attention will continue to be given to the time drift problem 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 2013 appear to keep time more accurately under the trying environmental 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/fall2013_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.

Bobby Taylor is a new undergraduate research student at UNC Asheville who has been added to the technician team during the summer 2013 gauge visits to help replace students who will graduate in December 2013 (Duncan Belew).