

Pluvio Weighing Bucket Gauge data processing during Olympic Mountain Experiment (OLYMPEX)

For instrument descriptions, locations in the field, and status during data collection see:

<http://olympex.atmos.washington.edu/>

<https://ghrc.nsstc.nasa.gov/home/field-campaigns/olympex>

OTT Pluvio200 (heated) and OTT Pluvio400 weighing bucket gauges were operated at 3 sites. OTT Pluvio200 operated prior to intensive operation period and did not included here. All Pluvios were collocated with autonomous Parsivel² units (APU). No wind fences (Alter and Tretyakov) were installed at the Pluvio sites and that due to the remote location and very heavy snow, occasional swamping of the instruments by heavy snow, or prolonged down periods did occur.

Apu04 - Neilton Point site (47.389 degree N, 123.867 degree W) had also PIP, 2DVD, MRR, and dual tipping bucket gauges. This site had pluvio400

Apu10 – Wynoocheer Trailer site (47.497 degree N, 123.581 degree W). This site had pluvio400.

Apu30 – Enchanted Valley (47.680 degree N, 123.841 degree W). This site had Pluvio400.

Pluvio400 gauge outputs report melted equivalent of mixed and frozen precipitation at 1-minute intervals.

1.0 olympex_apuXX_pluvio400_YYYYMM_data.txt

Where XX indicates the APU unit number, and MM and YYY shows month and year of the database. This file intended to output the time stamp of the data so the reader can distinguish whether or not the instrument was functioning in the follow-up files. For instance, Pluvio400 at apu04 site did not operate from December 18, 2015 through January 5, 2016. The files have four columns: Year, day of the year, hour, minute.

1.1 olympex_apuXX_pluvio400_YYYYMM_precip.txt

Where XX indicates the APU unit number, and MM and YYY shows month and year of the database. This file outputs the time stamp and 4 different precipitation rates if any of the first three precipitation rates are above zero. This files does not print the time stamp if there is no precipitation at the time of observations. As noted below, there is a 5-minute delay in the record for the accumulated precipitation (please see c and d). Given the fact that these accumulative precipitation accumulations are the most accurate observations, the time stamp adjustment has been implemented to represent the precipitation occurrence correctly. The files have ten columns: Year, day of the year, hour, minute, four different precipitation rate in mm, and real and non-real time bucket

content. Precipitation rates are determined through manufacturer output and they are quoted as:

a) Real time precipitation intensity in mm per minute. Discrimination threshold is 0.2 mm/min or 12 mm/hr for Pluvio200 and is 0.1 mm/min or 6 mm/hr for Pluvio400. This measurement is considered suitable to determine the heavy precipitation for alarm management and not for daily and monthly totals.

b) Accumulated real time precipitation that has equal to or larger than 0.1 mm/min precipitation, and non real time precipitation where the accumulation is less than 0.1 mm/min. Discrimination threshold is 0.2 mm within an hour for Pluvio200 and is 0.1 mm within an hour for Pluvio400. If the amount of precipitation exceeds the discrimination threshold, Pluvio outputs the measurement result in real time. Otherwise, it collects the fine precipitation over a maximum of an hour and outputs the measured value in non-real-time. If the fine precipitation does not reach the discrimination threshold within an hour, there is no output. This is particularly suitable for daily or monthly totals and for alarm management.

c) Accumulated non real time precipitation over the sampling interval with a fixed delay of 5 minutes. Discrimination threshold is 0.2 mm within an hour for Pluvio200 and is 0.1 mm within an hour for Pluvio400. If the amount of precipitation reaches the discrimination threshold within an hour, Pluvio outputs the measurement in 5-minute delay, otherwise there is no output. This is suitable for daily and monthly totals.

d) Accumulated total non real time precipitation since the Pluvio started operation with a fixed delay of 5-minutes. Discrimination threshold is 0.2 mm within an hour for Pluvio200 and is 0.1 mm within an hour for Pluvio400. If the amount of precipitation reaches the discrimination threshold within an hour, Pluvio outputs the measurement in 5-minute delay, otherwise there is no output. *No loss of collected precipitation amounts* and it is suitable for daily and monthly totals.

The real time bucket content is unfiltered and is related to the current bucket level. It is given in mm and is collected at one-minute interval. The Pluvio manual states that Pluvio² 400 outputs a value between 80-100 mm for an empty bucket, 610-630 mm for 70% full bucket, and 830-850 mm for 100% full bucket. Pluvio² 200, on the other hand, outputs 160-200 mm for an empty bucket, 1220-1260 mm for 70% full bucket, and 1660-1770 mm for 100% full bucket.

The non-real time bucket content is filtered and is suitable for determining the bucket level in calculating the evaporation. It is given in mm at one-minute interval.

2.0 olympex_apu04_pluvio400_YYYYMM_preciprate.txt

This file contains the precipitation rate based on 1.1 d. The file has six columns including year, day of the year, hour, minute, precipitation rate in mm per minute and precipitation rate in mm per hour.

2.1 olympex_apu04_pluvio400_YYYYMM_preciptable.txt

These files provide the precipitation event summaries. The events are separated by one-hour or longer rain free period in the precipitation time series that can be extracted from 1.1. The file has 7 columns: year, event start day of the year, event start hour and minute, event end day of the year, event end hour and minute, number of precipitation minutes, event precipitation totals based on 1.1 c and 1.1 d.