INTERCOMPARISON OF WINTER PERFORMANCE OF RAIN GAUGES

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Introduction

The network of Automatic Weather Stations (AWS) operated by the Austrian Central Institute for Meteorology and Geodynamics (ZAMG) will be extended with 50 new AWS in near future. For the selection of a reliable rain gauge, after preliminary field tests in Vienna, an intercomparison of tipping bucket and weighing gauges at a mountain test site was performed during the time period ranging form November 2005 to March 2006.

Requirements for precipitation measurement instruments

- Collecting orifice of 500cm² for for compatibility with the existing network equipped with tipping bucket gauge PAAR AP23 (now out of production)
- Minimum measurement resolution of 0,1mm/minute. Maximum delay of measurement less or equal 1 minute
- Reduced maintenance, easy operation and cleaning
- Sufficient and reliable heating for winter operation
- Availability of spare parts
- Maintenance, repairing and calibration with the available laboratory facilities of ZAMG
- Availability of 40-50 instruments within the end of year 2006

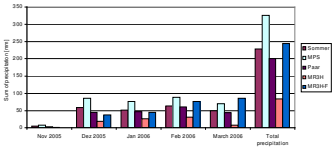
Test site

The site is situated in Western Austria at 2085 m above sea-level in the Arlberg region, where we often have severe weather conditions with low temperature rime and frost accretion in combination with high wind speed.

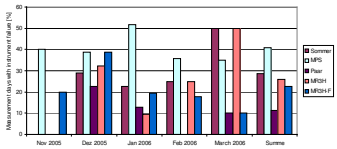
Tested instruments

manufacturer	type	measuring principle	orifice	reso-lution	heating
Sommer	NIWA MED K505	weighing	500 cm²	0,1mm	ring 50W
MPS System	TRWs	weighing	500 cm²	0,01mm	ring 30W
Meteoservis/ Kroneis	MR3H	tipping bucket	500 cm²	0,1mm	funnel 70W
Meteoservis	MR3H-F	tipping bucket	500 cm²	0,1mm	ring 56W, funnel 48W outflow, interior 31W
Paar	AP23	tipping bucket	500 cm²	0,1mm	ring 10W, funnel 50W outflow, interior 20W

Measurement results



Monthly sum of precipitation reported by the rain gauges under test in relation to Paar (standard rain gauge).



Percentage of days with more than one failure of operation for different instruments

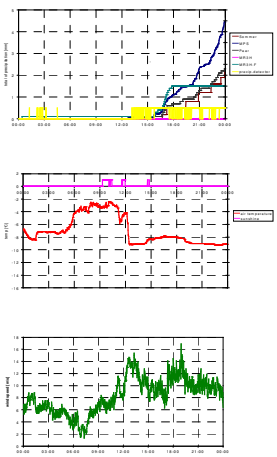
Definition of instrument failure

- Deviation of daily precipitation quantity >±300% from mean precipitation of all instruments
- Precipitation reported without signal from precipitation detector >1h
- Delayed output (software filter or insufficient heating)
- Omission of precipitation > 20min (blockage of instrument)

Weighing gauges

NIWA MED K505

- Sum of precipitation quantity close to standard rain gauge
- Delay of data output up to 30min
- Overestimation of precipitation intensities up to factor 4
- Non compensated temperature effects



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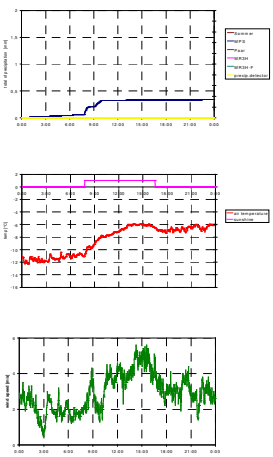
MPS TRWs

- Average overestimation of precipitation up to 50%, several days more than +300%
- Correlation of non real precipitation with temperature variation (e.g. sunrise)



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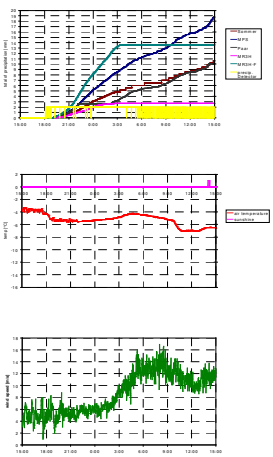
Tipping bucket gauges

Meteoservis/Kroneis MR3H

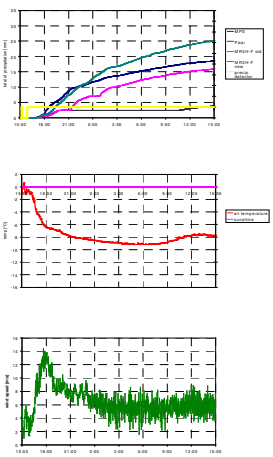
- No reliable operation at temperatures below –5°C
- Snow accumulation in the funnel due to inadequate heating



17.01.2006 15:00 to 18.01.2006 15:00.

Meteoservis MR3H-F

- In the standard version the outflow is blocked by ice accretion
- Improved version shows reliable operation



10.04.2006 15:00 to 11.04.2006 15:00.