SELF- CORRECTING WEIGHING PRECIPITATION SENSOR

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ABSTRACT

Self- correcting Total Rain weighing Sensor TRwS 500 Fig.1

Our product weighing precipitation rain sensor TRwS 500 was launched in 2002 at Meteorex in Bratislava and took part in Laboratory Rain intensity intercomparison organized by WMO 2004-2005. Final test report (3) . From that time we have made many improvements and add additional features.

TRwS can measure and evaluate additional parameters:

- Air temperature
- Distinguish between snow and rain
- Rain duration
- Assessment of wind speed
- Corrected precipitation information against wind value
- Self emptying system

1. Introduction

In 2004 TRwS 500 was installed in National Weather Service of Slovak Republic as a part of Flash Flood Warning system on 76 stations with GPRS data communication and 7 automatic meteorological stations.

Not only in meteorology the achievement of reliable and accurate measurements is a continuing and never ending process. We are “playing” with our weighing sensor to have better product , because all weather conditions such as wind, temperature changes, evaporation and many others natural conditions act upon our effort.

Fig. 1 Self correcting weighing sensor TRwS500

Data from field test under various conditions are most important and necessary to guarantee technical parameters of sensor. We have tested our weighing sensor at open flat area and also on the mountains from 200m to 2600m. Example of the installations Fig.2.

2. New developments

Total Rain weighing Sensor TRwS 500 was equipped with external air temperature sensor and rain detector. Negative influence of wind to the measurement of weight was utilised to produce corrected data upon wind speed. Theory and algorithm is based on the published (1) research results.

3. Air temperature measurement

Accurate air temperature sensor is situated into radiation shield under the rain gauge. This information is needed from hydrological service in order to distinguish between solid and liquid state. Rain gauge automatically generates status information of the precipitation type. This information comes also into correction algorithm which is different for solid and liquid precipitation.

4. Rain detector

Sensitivity of the rain intensity measurement is one of the most important parameters. Our weighing sensor is very sensitive, but through adding rain detector to the gauge we can improve its sensitivity and have information for sensor to start measurement. Thanks to this solid particles are eliminated. Weighing sensor processes data produced by the rain detector and calculates rain duration in seconds.

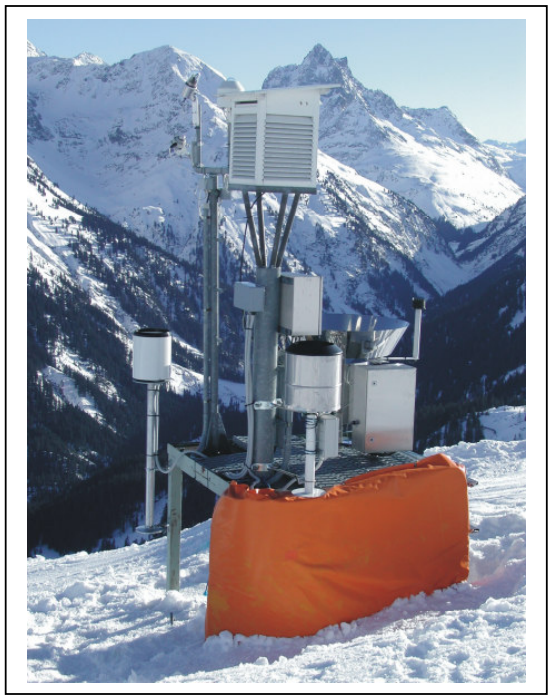

Fig.2 Example of the installation

5. Assessment of the wind gust

Self-correcting weighing sensor measures and generates information of wind force. This measurement is not so accurate as an independent wind sensor, but as we can see from the Fig.4, there is a plot of instant data measured by wind sensor installed at the 1m above surface and corresponding wind information called as a Wnoise from the TRwS500.

We installed two precipitation sensors one as a pit one and second one meter above surface. Fig. 3.

From data on Fig.4 TRwS 500 can generate several levels of wind force.

Our goal is that one sensor can generate various data without adding extra sensor.

Fig.3 Testing polygon

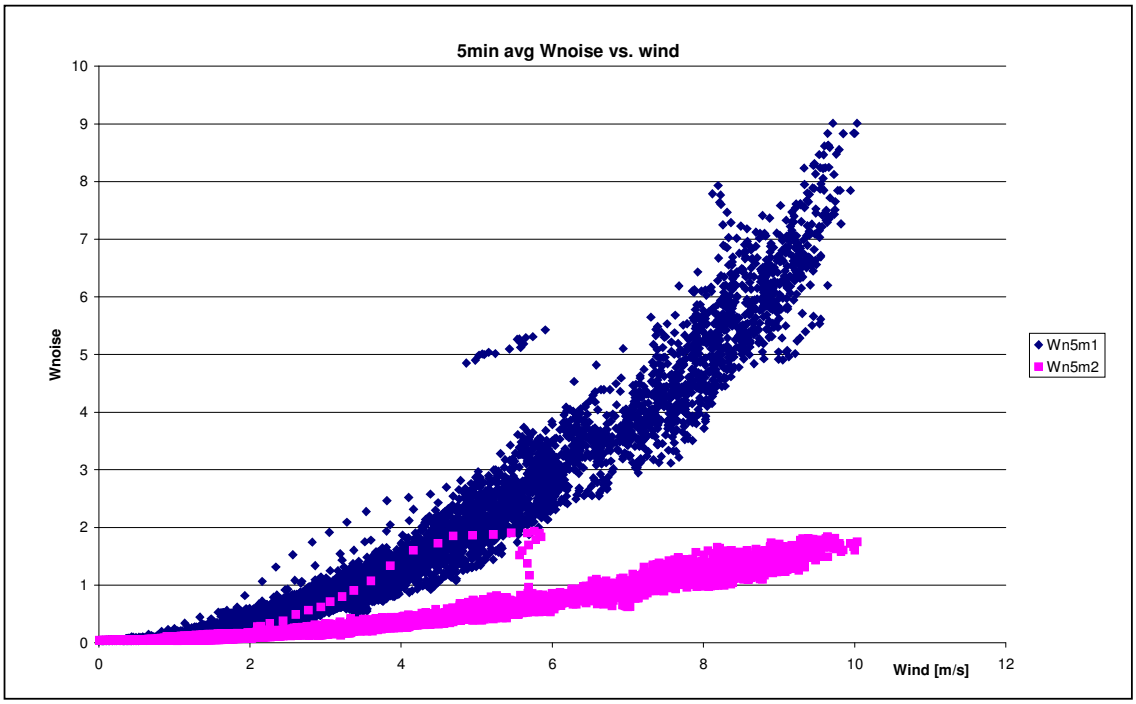

Fig.4 Plot of the wind data and Wind noise

6. Corrected precipitation information against wind value

Many attempts with wind shield were done in order to obtain better results. Construction of the wind shield is rather complicated and evaluation of improvement is not so easy. See literature (2).

Our approach is to implement algorithm from the work (1) directly to the rain gauge. Information of the wind force is measured by the weighing sensor, distinguishing of solid or liquid precipitation is also available.

Data from the sensors installed on the test polygon shows us two curves one for pit gauge and one for 1m above surface. We can see, that pit gauge measures also wind force (theoretically it should be zero). Data from the rain gauges are measured each 10 sec. Wind speed measured by the anemometer is measured each 2sec. On the Fig. There are plotted 5 min. average of the Wind noise.

7. Conclusions

In this article there is described one very complete precipitation sensor, with several new features and this time patent pending procedure is going on. Basic parameters, advantages of our sensors are not included in this article but they are available on the web page.

References.

1. Nešpor,V. (1997). *Investigation of Wind-Induced Error of Rain and Snow measurements using numerical simulation* (short version) Department of Geography, Swiss Federal Institute of Technology, ETH Zurich
2. Sevruk,B. (2004). *Niederschlag als Wasserkreislaufelement. Theory und Praxis der Niederschlagmessung* .Zurich-Nitra 2004
3. WMO LABORATORY INTERCOMPARISON OF RAINFALL INTENSITY GAUGES 2004-2005.