

## ***Interactive comment on “Automatic monitoring of weather and climate in mountain areas. The case of Peñalara Meteorological Network (RMPNP)” by L. Durán and I. Rodríguez-Muñoz***

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Replies to Referee #1 on Interactive comment on “Automatic monitoring of weather and climate in mountain areas. The case of Peñalara Meteorological Network (RMPNP)” by L. Durán and I. Rodríguez-Muñoz Anonymous Referee #1 Received and published: 31 May 2016 1. Referee #1. Review of the manuscript Number: AMT-2015-248 Automatic monitoring of weather and climate at mountain areas. The case of Peñalara meteorological network (RMPNP) by L. Durán and I. Rodríguez-Muñoz submitted for publication to the Atmospheric Measurement Techniques The paper presents a network of five automatic weather stations located in complex terrain, at moderate altitude (between 1102 and 2079 m MSL). The paper is quite well written and organized, but,

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in my opinion, it is more suitable as a technical report than as a scientific paper, as no clear elements of novelty are present. 1.r. Authors: We agree that the paper has a strong bias on technical and operational aspects, some of them very basic ideas. But we found important to give maximum diffusion to them in a scientific forum like this since sometimes are scientist, with not necessarily a deep technical background, who design these mountain networks. On the other hand, since this network produced a public access data base, we think that a citation and open source paper would be a good background for future users. 2. Referee #1. A review from an English native speaker is strongly recommended. 2.r. Our apologies for the numerous spelling and grammar errors found on this version of the paper. We hope that with this new version this is solved. 3. Referee #1. Most of the manuscript discusses the difficulties in establishing a network of weather stations in mountain areas, repeating some concepts that are not new in the mountain meteorology community (icing conditions, remoteness, ecc.). Moreover, in the present case it seems that there are some problems associated with this meteorological network, especially for what regards wind and precipitation measurements. In fact non-heated mechanical anemometers and non-heated automatic rain gauges were installed, even though icing conditions may occur in many months of the year. For example in the paper it is said that “the non-heated rain-gauge used at RMPNP have been blocked with snow during many winter, fall and spring precipitation events” and “[precipitation] observations should be used with precaution during winter, spring and fall”. So, why are heated instruments not used in this meteorological network? Are there limitations associated with the power needed by this kind of instruments? This aspect is not mentioned in the paper. 3.r. Authors. The reason for not using heated sensors is mainly due to the fact that only solar power is available. There as an attempt to use a heated Lambrecht rain gauge at Zabala site (2079) and it was concluded that a separate solar power system would be necessary with a much higher solar power collecting surface that was difficult to defend from the environmental point of view. Regarding wind measurement since this was not a specific wind assessment network, first option was to use NRG Maximum

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40 anemometers. At that time (1999) this anemometer was the standard and it is important to mention that during the first years of operation, loggers used here were powered with two nine volts not rechargeable batteries. Sonic anemometers require more power and probably out of budget. Maximum anemometers were affordable and made possible to replace them every two years. This solved also the “calibration” problem. Additionally, sonic anemometers are expected to do better during the first minutes of freezing, but they will freeze the same way after some hours if not heated. Here there is not enough power for heating sensors. This network has been installed, operated (telecommunications, servers), maintained (preventive, corrective and evolutive), and managed (data validation, reporting, on line web graphs, statistics, reports, conferences, data dissemination, papers) with a very low budget (<20 k€/year). Helicoid wind anemometers/vanes were found as an intermediate solution. With higher budget we would surely recommend: aspirated temperature wind shields, sonic anemometry like some compact anemometers used in wind turbines, snow height sensors and gravimetric rain gauges. Whether heating the sensors or not requires a deep solar power system analysis and probably the installation of a pilot system to check feasibility.

4. Referee #1. The manuscript does not present new measurement techniques, nor algorithms to correct data collected in difficult conditions such as in mountain areas. In the paper the authors mention the fact that an algorithm to validate precipitation measurements and in particular to correct measurements of non-heated pluviometers during snow falls has been developed. However this algorithm is not presented. The manuscript would improve significantly by the presentation of this or similar algorithms, rather than enunciating quite common arguments about measurements in mountain areas.

4.r. Authors: The idea behind Figure 14 was to find a significant relationship between the under estimated precipitation performed by the unheated tipping-bucket rain gauges and the number of days with potential conditions for snow precipitation at one site where we have both: automatic and manual rain gauges. Since all rain gauges of the network are the same model, and temperature and humidity at every site is known, we thought we could calculate the underestimation of every rain gauge

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and have a better estimation of real precipitation. Even though the results shown by the figure are coherent with this concept, the scatter plot is far away from showing a linear relationship as mentioned by Referee #2. Since a deeper analysis of this might be necessary and probably is out of the scope of this paper, this graph has been removed. We have added new Figure 15 that summarizes the precipitation validation process which in some way condenses the acquired know-how. This was an attempt to give an answer to the non meteorology expert researchers working on the area and asking for an estimation of total precipitation on the area. Once assumed that non heated tipping bucket rain gauges are not very accurate from October to May, specially on the higher lands, it was decided to assess precipitation using physical modeling. Results will be published in the near future.

5. Referee #1. One of the motivations of this work seems very narrow in focus: in the abstract the author say that “discussion about the representativeness of the data are shown to be taken into account for future users of this data base”. 5.r. Authors. Probably the mentioned motivation is not clear enough on the text, we have gone through it again and made some minor changes. We hope it is clear now. Deciding if a meteorological observation is representative or not of the real conditions of the atmosphere is not always easy, specially at mountains. Some variables have less risk of being influenced by external and internal interferences (obstacles, wrong exposure) like air temperature or air pressure. But other variables, like precipitation, are more easily influenced. Very often, third users of meteorological data, specially those who are not observational meteorologists, are not aware of the loss on representativity of the data, which can be seasonal dependent or even negligible for his/her application. We think that aware future users of this data base about this is important.

6. Referee #1. Minor remarks. recommended. 2.r. Our apologies for the numerous spelling and grammar errors found on this version of the paper. We hope that with this new version this is solved.

Please also note the supplement to this comment:

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<http://www.atmos-meas-tech-discuss.net/amt-2015-248/amt-2015-248-AC2-supplement.pdf>

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