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Geoscientific Instrumentation Methods and Data Systems
Discussions

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Interactive comment on "Innovations and applications of the VERA quality control" *by* D. Mayer et al.

Anonymous Referee #2

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General Comments

The present manuscript focuses on the operational applications of VERA-QC, a sophisticated Quality Control (QC) method based on self consistency, through the presentation of several case studies.

The "newborn" research area (as stated by the authors in their introduction) of QC has drawn increasingly attention in recent years, nevertheless when using measured data the influence of "bad" observations is often underestimated because "if measurements are biased or error affected, they may be interpreted wrongly as a climate trend or may conceal existing climate signal" as the authors wrote in the introduction of this paper. In this sense, the availability of novel QC methods can be used to complete the information provided by the measurements process on the atmospheric state. In particular, the attractive VERA-QC modular design should meet a wide range of user needs. Furthermore, a reliable QC process performed routinely in an operational contest helps the data management centre to readily activate the network maintenance procedures in order to ensure minimal loss of precious atmospheric data.

Among the several interesting conclusion reported in the paper, it is worth remarking two items. Firstly, the benefit related to the combination of human and automatic quality control. In fact, on the one hand this combination allows the development of more refined tests (new QC module) providing the expert users with powerful tools easing their demanding activity, on the other hand the eventually increased confidence in the tests performance can be useful in real-time application where the human control is not feasible. Secondly, the authors states that the quality of the precipitation field can benefit from a spatial consistency check, both in bias reduction and gross errors detection. However, the authors warn the reader that this matter needs careful handling, especially about the station density evaluation (see Section 3.3). In my opinion the QC applied to precipitation demands a great deal of efforts and more research is needed but this manuscript presents some encouraging results.

In conclusion, the subject of data quality control is within the scopes of GI and the paper present novel tools and ideas applied to the well-known concept of spatial (and in this case also temporal) consistency test. The manuscript is well written, concise, understandable and of reasonable length. Furthermore, it is illustrated with several figures backing the ideas and the examples exploited in the text.

I recommend the paper of Mayer et al. for publication in GI with only few revisions. In

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the following the authors will find a few remarks addressing individual scientific issues.

Specific Comments

- *The continuously bias correction and variable station specific limits setup using the collected deviations*. I can recognize the validity of using the past collected and available observations to setup a station-dependent QC and also to correct the data for systematic error (both proper systematic error and the systematic component of the micrometeorological error) but this procedure has also some disadvantages: the potential (and unpleasant) rejection of extreme-weather related observations, among the others. Due to the fact that extreme weather events -although by definition they are rare events- have high impact on human activities the authors are required to comment about the unavoidable tradeoff between the necessity of accounting for unusual atmospheric phenomena without using exceedingly permissive thresholds. In addition, a remarkable weak point for the manuscript is the lack of sufficient details concerning the threshold values chosen for the implemented tests. This issue regards the traceability of results and tests reproduction by the fellow scientists. The author are requested to provide further details regarding the choice of threshold values: + the reduction of the cost function and recognition of gross error thresholds; + pag 211: Dh= 400 m; r= 15 m/Km; h= 1500 m + pag 220: the authors indicate 4 ℃ as a threshold value. Is this choice related to the station network density?
- *Station selection algorithm.* The author's goal is to identify the stations likely to be affected by hard-to-manage errors (most micrometeorological error but also related to the so-called reduction error) prior to the use of any station observed data. Noticeably, the observations measured by the excluded stations are not affected by gross errors but they contains valuable information about the true atmospheric state. The proper use of that information is an awkward task for

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the authors due to the poorer station density in complex orographic areas and also for some limitations intrinsic in the non-dynamical modelling approach used. The authors choice is then to relate the selection algorithm to the stations geographical location. In fact, the authors identify areas where the interpolation algorithm cannot correctly describe the true atmospheric state. The authors are requested to comment the decision to exclude from VERA-QC those stations that don't complain the selected criteria but to eventually deliver an information concerning these areas within the analysis field. Besides, why in Figure 4 the authors report bias correction also for stations with elevation higher than 1500 m? In effect, in Sec 2.2 the authors states that those stations are excluded from the analysis.

- *"...adapt automatically to varying station densities" Pag 213, line 11*. The authors define the interesting concept of local neighborhoods. Introducing the local neighborhoods concept in the method, the QC can adapt automatically to varying station densities within the considered domain. In other words, the methods can be used to apply a spatial filter with variables spatial properties within the domain. In higher station density areas, the QC can be more demanding (considering a wider range of meteorological scale) while in poorer station density areas the QC can be more permissive (considering only large scale). Can the authors quantify these differences? in the case of temperature, for instance, can the authors give an idea of the deviation values rejected by VERA-QC in high/low station density areas?

- *"...one would see nothing but the influence of the topography's height" Pag 210, line 6.* The reported statement seems to me rather negative about the temperature analysis field contents. Of course the elevation has the predominant influence in the temperature field nevertheless on the one hand this field can reveal many different influences apart from the the topography's height alone and on the other hand the availability of the temperature analysis field is a valuable information (for instance, the zero Celsius degree isoline height is of fundamental importance in winter during a snow event, both for nowcasting and for the potential QC of precipitation measurements). Then, I suggest to reformulate this statement.

- *Abstract Pag 206, line 15, "Applications and results are discussed for pressure, temperature ad wind as well as for precipitation..."*. I can't find a discussion about the application of VERA-QC for wind in this paper so I suggest to re-write this statement.

Technical corrections

- Pag 228, line 21. Gorgas, T. and Dorninger, M. -> The paper published in QJRMS has a different title.
- Pag 229, line 25. Steinacker, R., Mayer, M., and Steiner, A.: Data Qaulity...Why so many numbers in the volume record?
- Pag 212, line 6. exemple -> example
- Pag 220. line 4. "he user" -> "The user"
- Pag 216, line 3. In the text the authors report "June 2010" while in the Figure caption they write "June 2011"

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