IMPROVEMENTS OF THE QUALITY CONTROL SYSTEM AT THE NATIONAL METEOROLOGICAL INSTITUTE

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Abstract

Quality control of meteorological observations is fundamental to guarantee reasonable quality standards in meteorological information. That is the reason why the Quality Control Unit at the National Meteorological Institute (IMN) is working on the development of new strategies to quality-control data generated by Automatic Weather Stations (AWS). Quality Control Algorithms (QCA) are being applied in an operational context using scientific tools available (free source software technology). Quality Control Parameters (QCP) are being calculated by operational scripts developed by the IMN personnel. This allows to cope with large amounts of information in a creative and effective way. As part of this initiative, different methods to deal with missing data are applied. It is expected that these efforts will represent an important breakthrough in the development of a future operational database.

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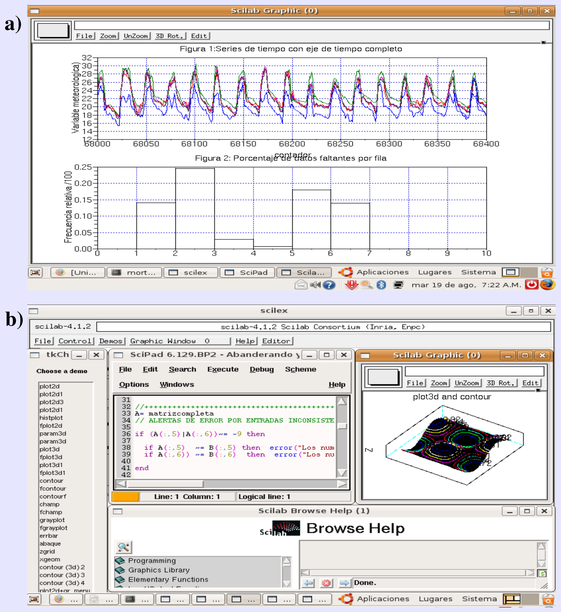

Fig. 1 – a) Development of operational tools for quality control applications: data sets are analized using quality control scripts. b) QCA are developed using Scilab, an open source software used in scientific computing.

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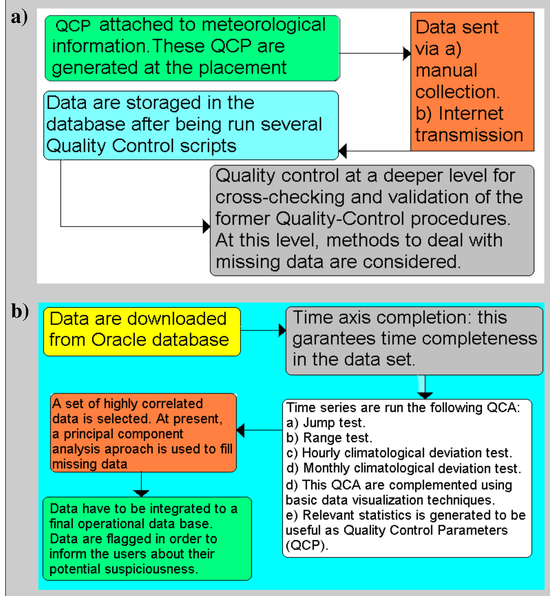

Fig. 2 –New quality control protocol at IMN: (a) Overview of the protocol. (b) Quality control at a deeper level. A number of suspicious values have been detected applying this procedure.

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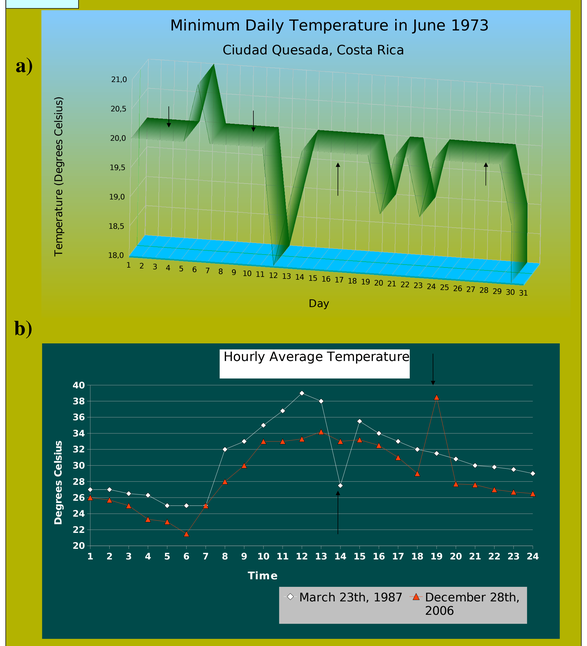

3 – Examples of atypical values detected using Quality Control Scripts: a) Sequences of repeated values. b) Atypical hourly jumps in data sets.

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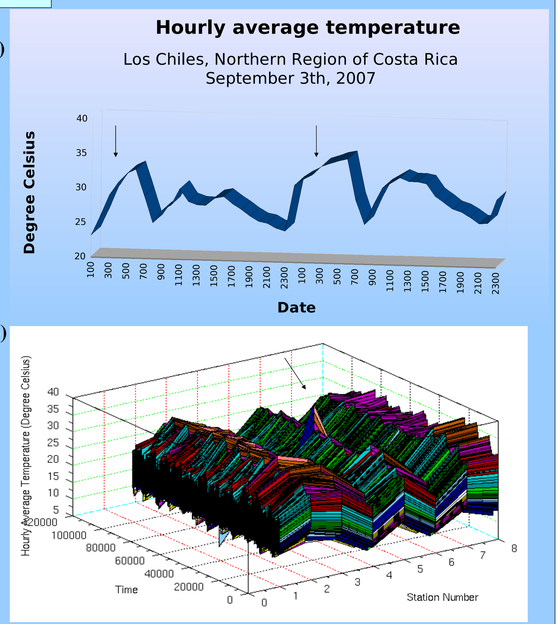

Fig. 4 – Examples of atypical values: a) Consistency check unveils technical problems at an AWS. The plot shows unexpected high values after midnight. b) Spatial quality control allows detection of outliers using 3D visualization tools. An outlier is visible at the centre of the surface.

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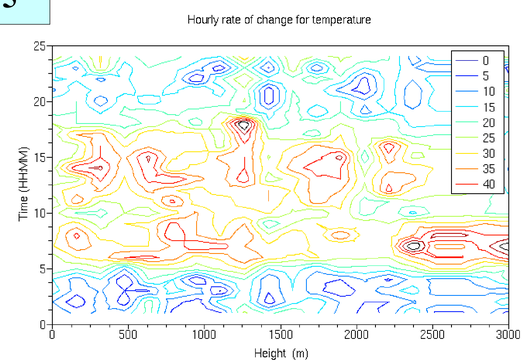

Fig. 5 – QCP are generated to be useful in quality-control activities. Fig. 5 shows a contour plot of hourly jump temperature values. The occurrence of suspicious values on a temporal and spatial basis is checked using parameters calculated for any particular placement.

In-situ Quality Control Tests

The new quality control system demands total redundancy. Basic QCA are included in the datalogger programme, along with QCP. This allows the technicians to detect gross errors by in situ-visual inspection, which is important in AWS installed in areas with no real-time transmission system. An important advantage is that it reduces the chance of gross errors going undetected, prompting immediate action to solve possible technical problems.

Discussion and Conclusions

Part of the policies of the new Quality Control Unit is to get the most out of new open source scientific tools available. Scientific computing tools are contributing significantly to improve the efficiency of the previous quality control procedures. Temperature data generated by mechanical and AWS have been checked. In both cases it has been found that the amount of flagged data is dependent on the kind of measuring system. A classic example is transcription errors found in conventional weather stations, which were normally detected as outliers similar to those shown in Fig. 3b. At the moment, errors found in AWS have to do with power supply deficiencies that have had an effect in data quality (Fig. 4a). It is been shown that some of these outliers have gone practically unnoticed, due to the fact that the former quality control procedures have relied on visual checking, along with very general QCP. This methodology seems not to be tenable when dealing with large amount of data generated after automation.

It is expected that other kind of errors could be detected as long as this quality control protocol is extended to other meteorological parameters. Part of the problems that have to be solved in the near future are:

1) Introduction of more quality control techniques. Testing of several methods to fill missing data for different meteorological parameters.

2) Capacity building on the new techniques to apply.

3) How to make this quality-controlled information available to different users.

4)Enhancement of quality control software applications, particularly those involving free software technology for data visualization, as well as real-time quality control applications.

6) A problem to tackle is the generational transition in the IMN personnel, which complicates capacity building to some extent. On the other hand, it gives new opportunities to the establishment of up-to-date perspectives from young scientists.

To sump up, operational tools running on data generated by conventional and AWS flag atypical values that went undetected due to technological and capacity-building limitations. This allows to take straightforward decisions and it contributes to the improvement of the quality control system as a whole.

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Acknowledgments. Special thanks to National Meteorological Institute for its support in this initiative. Thanks to Dr. Eric Alfaro and Dr. Javier Soley for their comments and suggestions. Their work on the development of the current applied tools for dealing with missing data is deeply appreciated.