

IMPLEMENTATION OF A QUALITY CONTROL SYSTEM FOR A NETWORK OF AUTOMATED WEATHER STATIONS AT CPTEC/INPE



WEATHER STATIONS AT CPTEC/INPE



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ABSTRACT

The observations from the Collecting Platforms (PCDs) network are important for several sectors of Brazilian Society. These data are available for free distribution in the CPTEC's webpage just after its processing. Because the automated meteorological stations can report in a high temporal frequency and its quantity is growing, they will be more important over the time. To keep the quality of the distributed data and to help the network management it is needed a complex automated quality control system. To meet these objectives we installed in the CPTEC/INPE the quality control system from MADIS (Meteorological Assimilation Data Ingest System). A software developed by the Forecast Systems Laboratory, from NOAA (National Oceanic and Atmospheric Administration).

QUALITY CONTROL SYSTEM

The system performs a three-level the quality control:

Level 1 checks are validity checks or absolute limits, which compare the observed values to specific tolerance limits.

Level 2 checks are internal consistency checks. The data from different instruments for the same station must have an acceptable relation;

Level 3 checks are spatial consistency checks. At each observation location, the difference between the measured value and the value analyzed by interpolation are compared. If the magnitude of the difference is small, the observation agrees with its neighbors and it is considered correct

After the quality control the observations are marked with a "flag", following the table below:

Z - Preliminary, no QC
C - Coarse pass, passed level 1
S - Screened, passed levels 1 and 2
V - Verified, passed levels 1, 2, and 3
X - Rejected/erroneous, failed level 1
Q - Questioned, passed level 1, failed 2 or 3

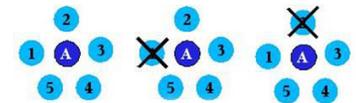
Level 1: Low and High Limits

Variable	Low limits	High limits	Units
air temperature	263,0	327,6	K
dewpoint temperature	210,9	305,4	K
relative humidity	0,0	100,0	%
station pressure	56800,0	110000,0	Pa
sea-level pressure	97550,0	110000,0	Pa
maximum temperature	263,0	327,6	K
minimum temperature	263,0	327,6	K
wind direction	0,0	360,0	deg
wind speed	0,0	128,6	m/s
wind gust	0,0	128,6	m/s
maximum wind direction	0,0	360,0	deg

Level 2 - Internal Consistency

- 1- Sea-Level pressure vs. Station pressure
- 2- Pressure change vs. Station pressure
- 3- Air temperature vs. Dewpoint temperature
- 4- Air temperature vs. Max/min temperature
- 5- Air temperature vs. Sea surface temperature
- 6- Wind direction vs. Wind speed
- 7- Wind Speed vs. Maximum gusts

Level 3 - Spatial Consistency



A = observation being checked Analysis location
1 ... 5 neighboring observations

RESULTS

The QC system produces some statistical reports for rejected observations and stations reporting bad data.

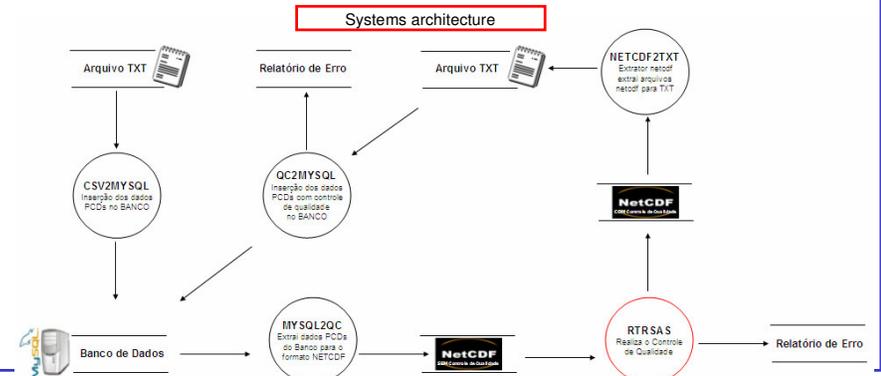
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*                               LOG DE ERROS                               *
-----
Variável: V-T Estação: 31909 Data: 2006-10-10 00:00 Valor: 398.65
-----
Variável: V-T Estação: 31955 Data: 2006-10-10 00:00 Valor: 259.65
-----
Variável: V-T Estação: 32002 Data: 2006-10-10 00:00 Valor: 224.65
-----
Variável: V-T Estação: 32493 Data: 2006-10-10 00:00 Valor: 243.15
-----
Variável: V-T Estação: 32594 Data: 2006-10-10 00:00 Valor: 247.15
-----
*
    
```

- QC SUMMARY FOR AIR TEMP

B1909	PCDINPE	062830000	AIR TEMP	398.65	FAILED VALIDITY
B1955	PCDINPE	062830000	AIR TEMP	259.65	FAILED VALIDITY
B2002	PCDINPE	062830000	AIR TEMP	224.65	FAILED VALIDITY
B2493	PCDINPE	062830000	AIR TEMP	243.15	FAILED VALIDITY
B2594	PCDINPE	062830000	AIR TEMP	247.15	FAILED VALIDITY
---		2.55 % AIR TEMP	FAILED-MASTER	CHECK (5 OF 196)	
---		2.55 % AIR TEMP	FAILED-VALIDITY	CHECK (5 OF 196)	
---		0.00 % AIR TEMP	FAILED-INTERNAL	CHECK (0 OF 0)	
---		0.00 % AIR TEMP	FAILED-TEMPORAL	CHECK (0 OF 0)	

The PCDs' data are available in a MySQL Database from CPTEC/INPE. These data are extracted and used to feed the Quality Control software. The resulting flags are ingested into the Database, being available to the users.



CONCLUSIONS

Quality Control is a process to identify and mark bad observations. Only after these checks we can distribute validated data to users. The Automated Stations' data have problems that do not affect the conventional ones. However, as they can report data with a high temporal frequency and its numbers are growing, the importance of these data will grow. An automated quality control system is needed in order to evaluate these data and to help the network maintenance.

Thanks to the founding of the Program of Information Technology Applied to Meteorology (PROTIM) and the cooperation with the FSL/NOAA we were able to implement a system for Quality Control for automatic weather stations, the PCDs network. This system will benefit several sectors of the society that will have access to meteorological data with better quality.