Improved meteorological data for Air Quality forecasting models: assessment.

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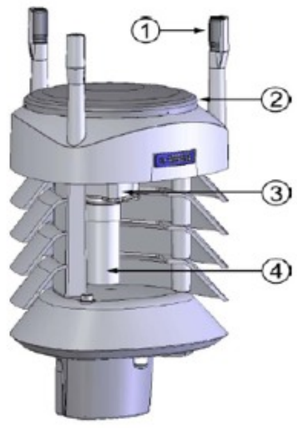
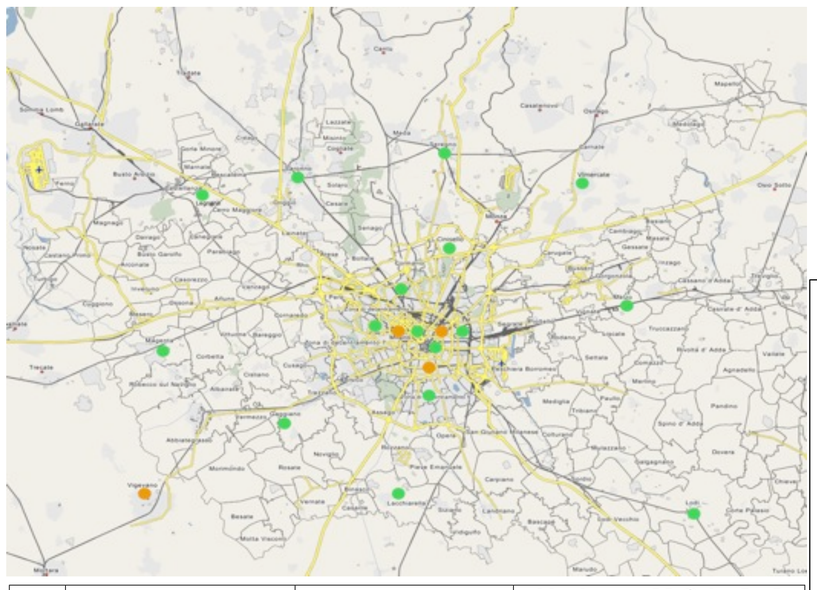
Transport and diffusion are consequences of the state and dynamical evolution of the atmosphere, that is, of large-scale circulation, local circulation and turbulent diffusion, which must be modelled for Europe at the level of accuracy and in the modalities prescribed by EU Directive (ref. 6).

In practical terms, this means that the meteorological information normally available is to be supplemented by quality measurements able to detect local effects.



1 = Wind transducers (3 pcs)
2 = Precipitation sensor
3 = Pressure sensor inside the PTU module
4 = Humidity and temperature sensors inide the PTU module



	Name	Site	H above M.S.L. [m]
1	Milano Centro	Univ. Statale	140
2	Milano I-N	Sempione	155
3	Milano E-E	Politecnico	149
4	Milano E-N	Broglio	152
5	Milano E-S	Noto	134
6	Milano E-W	San Siro	189

The "Climate Network®" has several stations of high quality standards over the Milan urban and suburban area, allowing characterization of the local variability of the main meteorological variables.

The so named "Climate Network®" (in the following briefly CN), still in an expanding phase, has been already presented at the last IEEE-EEMS Workshop (Borghi et al, 2011), and has been proposed to contribute to MeteoMet project (in the framework of EMRP-EURAMET) at Turin kick off Meeting, 12-13th October 2011.

CN's main characteristics:

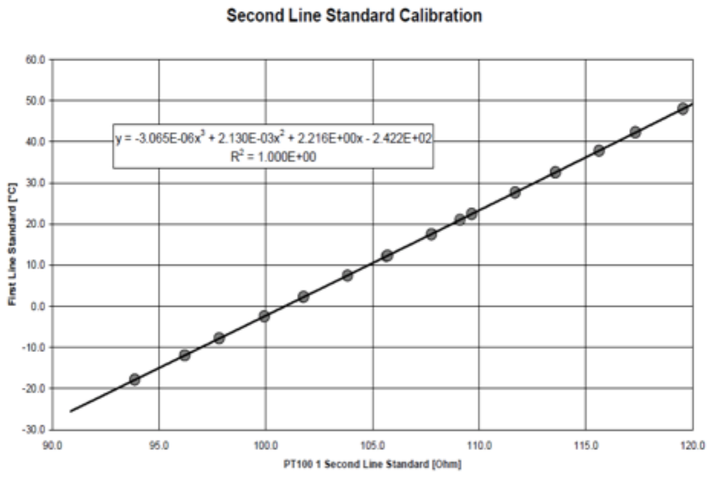
- **Use of homogeneous core instruments, data logger and station software,**
- **Redundant measurement of temperature at all nodes,**
- **Power supply independent of power mains allowing for easy relocation,**
- **Adoption of a standardized calibration procedure for critical measurements (e.g. temperature),**
- **Adoption of strict quality assurance practice:**
  - **Level-1 (station level) and level-2 (network level) human-operated validation, based on automatic level-0**

Calibration procedures

Based on the quality of instrumentation, a detailed quality control procedure has been designed and implemented (Curci et al, 2011). In synthesis, the data quality is assessed through:

- **Redundant sensors,**
- **Calibration of every single station using a climatic chamber,**
- **Field measure of stations at a testing site,**
- **First and second line standards (for temperature: PT 100 ohm Class A),**
- **3rd degree polynomial regression on a sequence of measuring points (for temperature: 20°, -20°C, +50°C, +30°C accounting for sensor hysteresis),**
- **Field testing of the calibration,**
- **Automatic control to detect anomalies.**

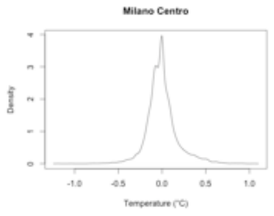
The detailed procedure ensures the highest quality and accuracy levels in meteorological and climatological measurements.



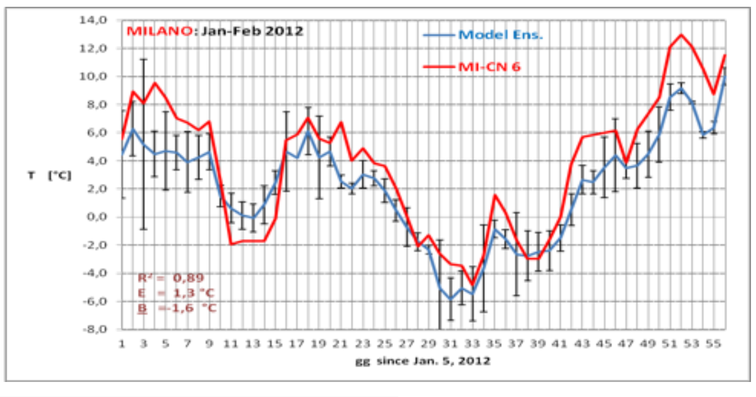
Time series analysis on data

Total and partial auto-correlation, cross-correlation and power spectra routinely computed on data as part of plausibility checking. Results support validation by defining what is "usual".

Correlation	Milano Centro	Milano I-N	Milano E-E	Milano E-W	Milano E-N
Milano Centro		0.9922	0.9935	0.9960	0.9809
Milano I-N	0.9922		0.9868	0.9912	0.9896
Milano E-E	0.9935	0.9868		0.9786	0.9803
Milano E-W	0.9960	0.9912	0.9786		0.9870
Milano E-E	0.9809	0.9896	0.9803	0.9870	



In a longer than a monthly verification time span, the correlation has been evaluated, for example, between mean daily temperatures: - measured (arithmetic mean of the 6 CN stations), and - forecast as a mean of the +27÷48 h model predicted 3-hourly values interpolated for the coordinates of Milan downtown:



Further work: Assimilation experiments of the CN high quality data into high resolution models will be eventually performed in order to set up an integrated efficient observational and forecasting tool to be used in densely populated areas, where pollution sources are numerous and air quality of outmost importance.

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References

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4) Curci Savino, and M. Virlan, C. Lavecchia: Traceability and reliability on Meteorological measures, "EESMS 2011 Proceedings", Milan 2011
5) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe