

PROCEDURE MANUAL

MDA Federal is the leading provider of quality-controlled weather data to the weather trading community. MDA Federal supports CME in the development and implementation of weather futures and options contracts by using the following methodology for quality control in the event of missing or erroneous observations.

The Approach for Real Time Quality Control of Observed Weather Elements

MDA Federal employs its meteorological and computer technology to produce an accurate set of weather data. This approach is a five-step systematic process.

Step 1. Decoding Data

Each morning MDA Federal decodes the respective data transmission feeds to determine what data exist for each station for which there is a corresponding futures/options contract, plus additional surrounding stations. Data are obtained from the following sources:

- United States: National Weather Service
- Canada: Environment Canada
- United Kingdom: U.K. Met Office
- France: Meteo France
- Netherlands: KNMI
- Germany: Deutscher Wetterdienst
- Sweden: SMHI
- Spain: Ministerio de Medio Ambiente
- Italy: Italian Air Force
- Norway: Meteorologisk Institutt
- Japan: Japan Meteorological Agency

Observation periods for the various sites are summarized below:

Data Observation Periods				
Station	Country	WMO	Maximum Temperature	Minimum Temperature
All US Sites	USA	n/a	0000 _d - 2359 _d Local Time	0000 _d - 2359 _d Local Time
Calgary International	Canada	71877	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC
Edmonton International	Canada	71123	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC
Montreal/Trudeau	Canada	71627	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC
Toronto Pearson Int'l	Canada	71624	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC
Vancouver International	Canada	71892	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC

Winnipeg International	Canada	71852	0600 _d - 0559 _{d+1} UTC	0600 _d - 0559 _{d+1} UTC
London Heathrow	United Kingdom	03772	0900 _d - 0859 _{d+1} UTC	0900 _{d-1} - 0859 _d UTC
Paris Orly	France	07149	0600 _d - 0559 _{d+1} UTC	1800 _{d-1} - 1759 _d UTC
Amsterdam Schiphol	Netherlands	06240	0000 _d - 2359 _d UTC	0000 _d - 2359 _d UTC
Berlin-Tempelhof	Germany	10384	2351 _{d-1} - 2350 _d UTC	2351 _{d-1} - 2350 _d UTC
Essen	Germany	10410	2351 _{d-1} - 2350 _d UTC	2351 _{d-1} - 2350 _d UTC
Stockholm	Sweden	02485	1800 _{d-1} - 1759 _d UTC	1800 _{d-1} - 1759 _d UTC
Barcelona	Spain	08181	0000 _d - 2359 _d UTC	0000 _d - 2359 _d UTC
Madrid	Spain	08221	0000 _d - 2359 _d UTC	0000 _d - 2359 _d UTC
Rome	Italy	16239	0000 _d - 2359 _d UTC	0000 _d - 2359 _d UTC
Oslo Blindern	Norway	01492	1800 _{d-1} - 1759 _d UTC	1800 _{d-1} - 1759 _d UTC
Osaka	Japan	47772	0000 _d - 2359 _d Local Time	0000 _d - 2359 _d Local Time
Tokyo	Japan	47662	0000 _d - 2359 _d Local Time	0000 _d - 2359 _d Local Time
Hiroshima	Japan	47765	0000 _d - 2359 _d Local Time	0000 _d - 2359 _d Local Time
d = calendar date for which the data is applicable				

Step 2. Data Recovery

Upon determining that data is missing for a station for which there is a corresponding futures/options contract, MDA Federal first attempts to recover this data from alternative data sources, such as Climate Summary Reports, contacting the local NWS office or local media reports, as appropriate. If the data cannot be recovered, the site is flagged and proprietary estimation techniques are used to estimate the missing data.

Step 3. Screening for Erroneous Values by Computer Algorithm

All observations shall be screened for inconsistencies and erroneous values. The validity of data is tested by comparing the data against itself and against alternative data sources, such as hourly data, Climate Summary Reports, surrounding stations, and additional observations, as appropriate. The tests include the following:

For data underlying HDD, CDD, CAT, and Weekly Average Temperature futures/options:

- $T_{max} < T_{min}$?
- Is $T_{max} >$ the maximum hourly temperature observation?
- Is $T_{min} <$ the minimum hourly temperature observation?
- Comparison of observation with Climate Summary Reports

For data underlying Cumulative Average Temperature futures/options:

- Does the hourly observation fall within a theoretical forecast envelope (regression based)?

- Are hourly temperature changes climatologically appropriate?
- Is the hourly temperature observation in line with surrounding stations?

For data underlying Snowfall futures/options:

- How does this observation compare with a station's climatology?
- Based upon additional observations (present weather, temperature observations, liquid precipitation, etc.) was snowfall possible?
- How does this observation compare with closely correlated stations?

For data underlying Frost futures/options:

- Is $T_{min} <$ the minimum hourly temperature observation?
- Is the hourly temperature observation in line with surrounding stations?

If the data is determined to be erroneous, it is flagged and will be replaced using proprietary estimation techniques.

Step 4. Screening for Erroneous Values by MDA Federal Meteorologists

All observations are screened a second time by MDA Federal Meteorologists to ensure that the data is meteorologically acceptable. This analysis involves many of the components of Step #3, organized into an online interactive environment for analysis. In addition to these tools, MDA Federal Meteorologists subjectively analyze situations based upon their own knowledge of weather systems and location meteorological patterns.

If the data is determined to be erroneous it is flagged and will be replaced using proprietary estimation techniques.

Step 5. Creation of Estimates by MDA Federal Meteorologists

MDA Federal meteorologists will replace observations that have been flagged as missing or erroneous. The methods used for filling of missing or erroneous observations are dependent upon the situation and may include the following:

- Surrounding station observations may be used as guidance
- Known biases between stations may be applied
- Alternative data, hourly data, 6-hourly reports, partial observations, or other methods may be used to piece together missing observations

At the time it is transmitted to CME, the information is the most current and accurate information available. Revisions, corrections, updates, and other modifications to the information that occur or become known after each day's transmission will be retained and included in the following day's transmission.