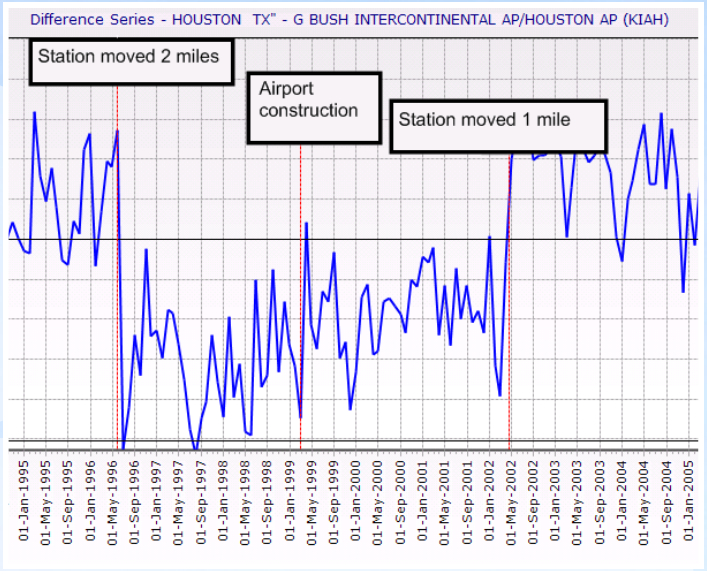
Speedwell Recalibrated Data

Speedwell Weather
Recalibrated Data

Recalibrated Data is an adjusted historical temperature time series which has been re-based to remove discontinuities such as those arising from site moves or instrument changes.

Recalibrated data is the best possible baseline for risk analysis and risk pricing.



Product Highlights

- Cleaned Data - Data that has been processed to fill missing values and replace erroneous observations.
- Recalibrated Data - The cleaned time series that has been adjusted to correct for discontinuities.
- Recalibrated Data Alerts - Recalibrated data subscribers receive e-mailed alerts of potential discontinuities as conditions warrant.
- Real-Time Monitor - The monitor is an online tool that allows a user to track / detect potential discontinuities in near real-time.

Valuation Impact

The table below demonstrates the impact of using Recalibrated Data vs. Cleaned Data for basic pricing on a seasonal HDD contract. For each station we have computed the mean and standard deviation using all years of historical data with detrending.

	Station 1	Station 2	Station 3	Station 4
Index Type	**HDD**	**HDD**	**HDD**	**HDD**
Period Start	**Nov 1, 2020**	**Nov 1, 2020**	**Nov 1, 2020**	**Nov 1, 2020**
Period End	**Mar 31, 2021**	**Mar 31, 2021**	**Mar 31, 2021**	**Mar 31, 2021**
RECALIBRATED DATA				
MEAN	**3,588**	**4,464**	**2,753**	**4,784**
VOL (Std Dev)	**312**	**295**	**272**	**402**
CLEANED DATA				
MEAN	**3,721**	**4,278**	**2,616**	**4,974**
Difference Mean (Recalibrated - Cleaned)	**-133**	**186**	**137**	**-190**
Z-score	**-0.43**	**0.63**	**0.50**	**-0.47**
Dollar error for a $5k tick contract	**-$665,000**	**$930,000**	**$685,000**	**-$950,000**

Station #1 - traded U.S. Mid-Atlantic location

Station #2 - traded U.S. Northeast location

Station #3 - traded U.S. Southern Midwest location

Station #4 - traded U.S. Northern Midwest location

Product Background

Weather stations are constantly changing. Changes to the station location, the technology used, and the local environment may all result in consistent changes to long term observations (i.e. discontinuities).

Station moves

Historical weather data is archived by National Meteorological Services (NMS) in the form of station data. The term "station" often refers to a general location such as an airport, farm, or town where the meteorological instruments are located. For example, although archived as a single time series, the location of the measuring instruments at Atlanta (KATL) are documented as having been at four locations since 1950, as shown right. Observations are highly influenced by local micro-climates giving each position its own characteristics.

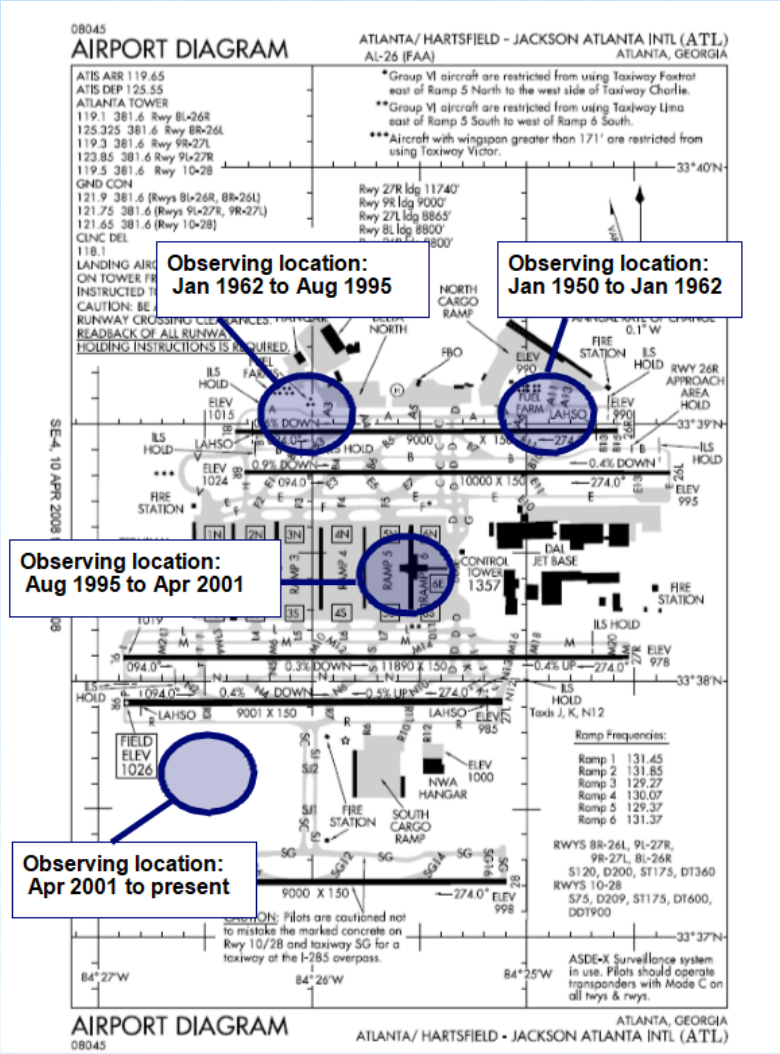
In general, a single weather station dataset can be regarded as the concatenated data of a number of stations distributed throughout history.

New technology / changes to environment

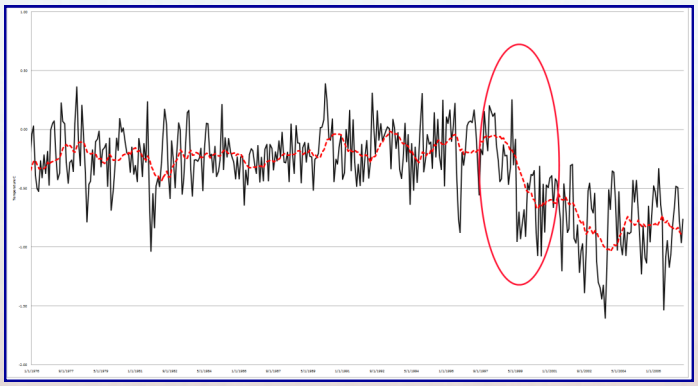
Changes to thermometer types and changes in the immediate local environment (e.g. construction of new runways, parking lots, adjacent buildings) often impact the long term observations.

Each of these changes (moves, technology, and local environment) all have the potential to create a discontinuity.

The Speedwell Recalibrated Dataset has been adjusted, through the correction of discontinuities, to create a historical record that reflects the current observations at a given station. Using this information for pricing provides a more accurate assessment of what the future may hold.



Atlanta International Airport - Since 1950 the observation location has been documented as having been at four locations.



A discontinuity is a sudden, distinct, and lasting change in the long term observations for a site. A discontinuity represents an end of one continuous regime and the beginning of another. A discontinuity is not a trend.

Methodology (high level summary)

The recalibration methodology consist of two key components:

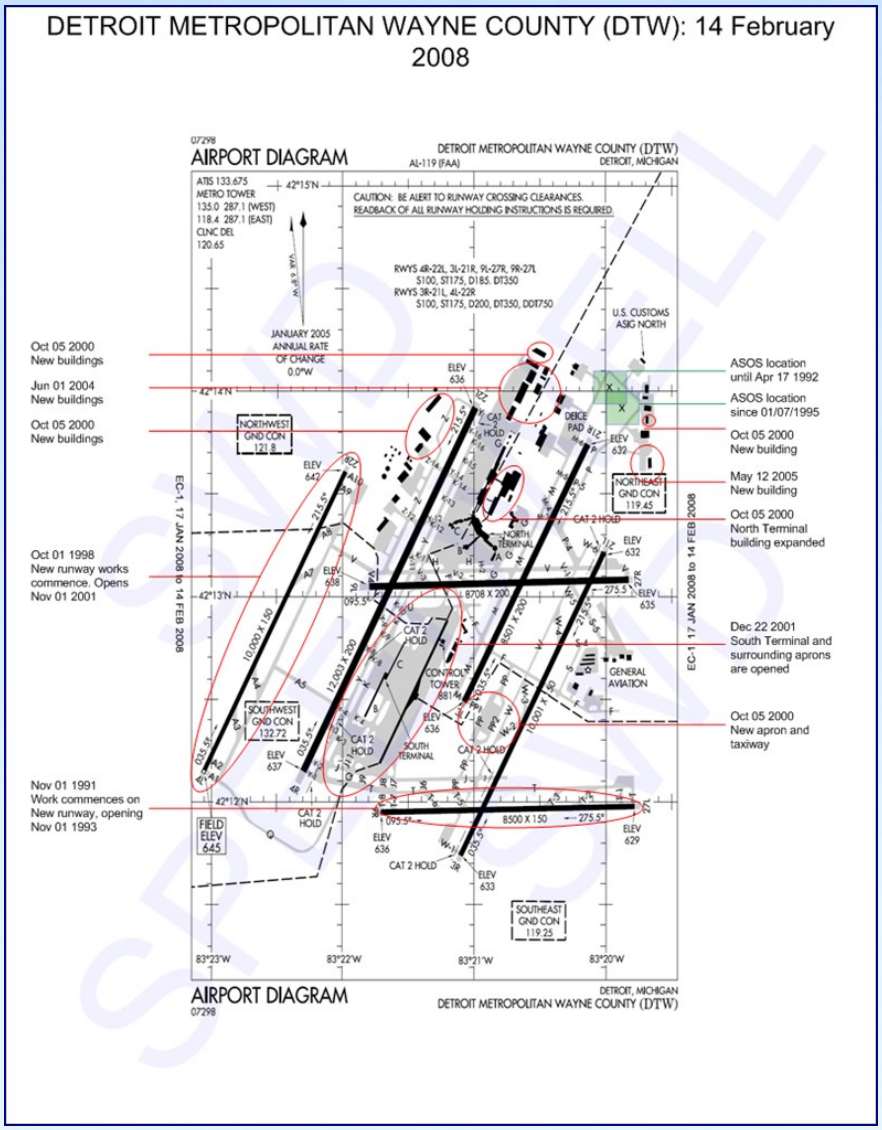
Statistical Analysis

The crux of the recalibration methodology is the creation of a synthetic station that is designed to represent the station you are analysing. This synthetic station is ideal in that it has no discontinuities. When comparing the data from the analysed station with the synthetic station discontinuities become apparent. The result of this processing is a list of potential discontinuities and information concerning the confidence in each event.

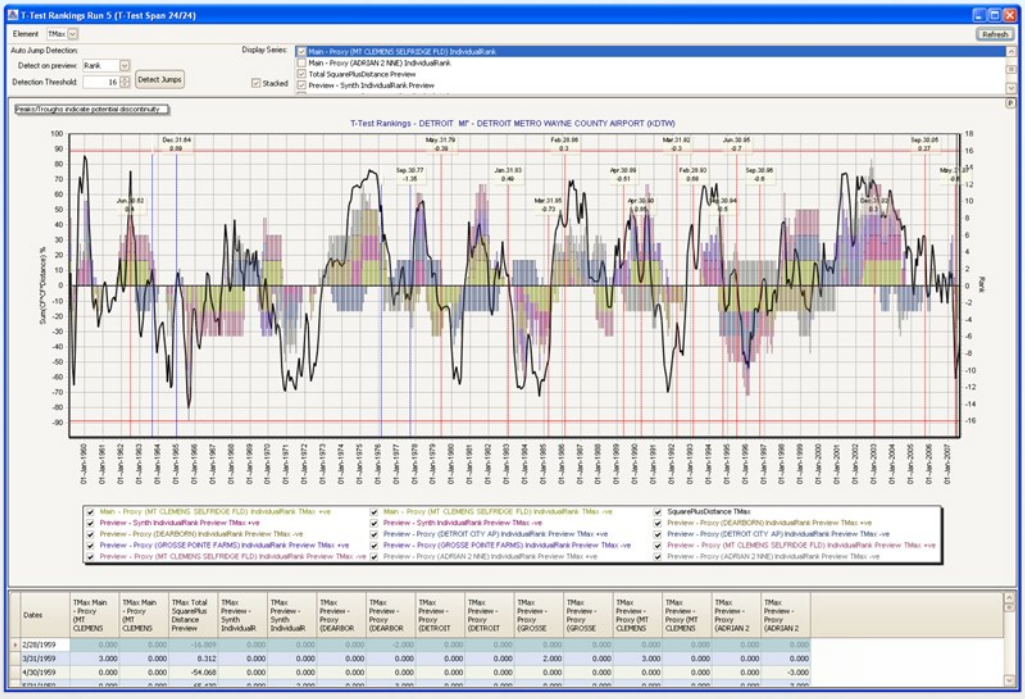
Metadata Review

Metadata is the historical record of events at a weather station. Metadata includes the station's location, the equipment used, the station attributes, description of the local environment, administrative changes, maintenance logs,… The statistical analysis (described above) produces a list of suspect discontinuities. Speedwell analysts use metadata to verify the results produced by the statistical analysis.

With the importance of metadata, significant effort goes into the creation and maintenance of our metadatabase. Sources of information include interviews with observing staff, discussions with airport managers, media, work logs, recreational observers, satellite imagery, and the Speedwell airport change analysis.



Speedwell airport change analysis



Proprietary software used for the statistical analysis of discontinuity events

Recalibrated Stations

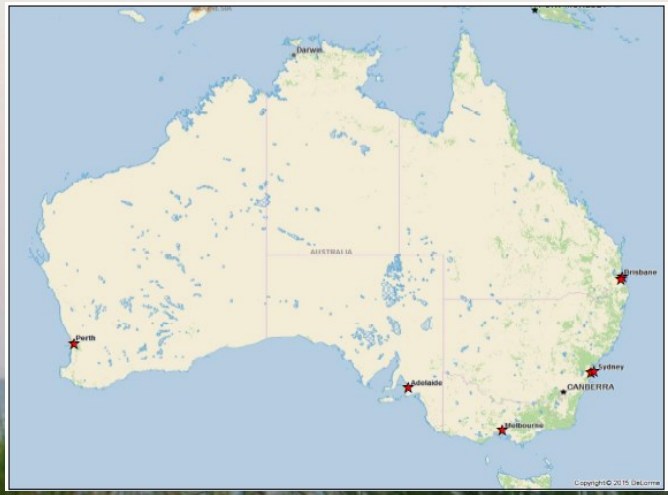
Speedwell Weather
Recalibrated Data

Asia-Pacific
Australia, Adelaide (West Terrace)
Australia, Archerfield Airport
Australia, Bankstown Airport AWS
Australia, Brisbane Airport
Australia, Melbourne (Olympic Park)
Australia, Perth Airport
Australia, Sydney (Observatory Hill)

Europe
Austria, Innsbruck Airport
Austria, Vienna Schwechat-Airport
Czech Republic, Brno Turany
Czech Republic, Prague Ruzyne
Denmark, Copenhagen Kastrup
France, Lyon Bron
France, Marseille Marignane
France, Paris Orly
France, Strasbourg Entzheim
France, Toulouse Blagnac
Germany, Berlin Dahlem
Germany, Bremen
Germany, Dresden Klotzsche
Germany, Duesseldorf
Germany, Essen
Germany, Frankfurt Airport
Germany, Hamburg Fuhlsbuettel
Germany, Hannover
Germany, Munich Airport
Netherlands, Amsterdam Schiphol
Norway, Oslo Blindern
Spain, Barcelona Airport
Spain, Bilbao Sondica
Spain, Madrid Barajas
Sweden, Stockholm
Switzerland, Geneva Cointrin
Switzerland, Zurich Ville
United Kingdom, Birmingham
United Kingdom, Glasgow
United Kingdom, London Heathrow

North America
United States, Atlanta-Hartsfield Airport
United States, Baltimore-BWI Airport
United States, Boston-Logan Airport
United States, Chicago O'Hare Airport
United States, Cincinnati Kentucky Airport
United States, Colorado Springs Airport
United States, Dallas-Fort Worth Airport
United States, Des Moines Airport
United States, Detroit Metro Airport
United States, Houston-George Bush Airport
United States, Kansas City Airport
United States, Las Vegas McCarran Airport
United States, Little Rock Adams Field Airport
United States, Los Angeles Airport
United States, Miami Airport
United States, Minneapolis-Saint Paul Airport
United States, New Orleans Airport
United States, New York-LaGuardia Airport
United States, Philadelphia Airport
United States, Portland Airport
United States, Raleigh-Durham Airport
United States, Sacramento Executive Airport
United States, Salt Lake City Airport
United States, Tucson Airport
United States, Washington National Airport

Canada, Edmonton Airport
Canada, Montreal Airport
Canada, Vancouver Airport



For additional information

Speedwell Weather
Europe: +44 (0) 1582 465 551
USA: +1 (843) 737-4843
info@speedwellweather.com