Speedwell Weather

Topics: ***Setting up a weather desk (a shopping list)***

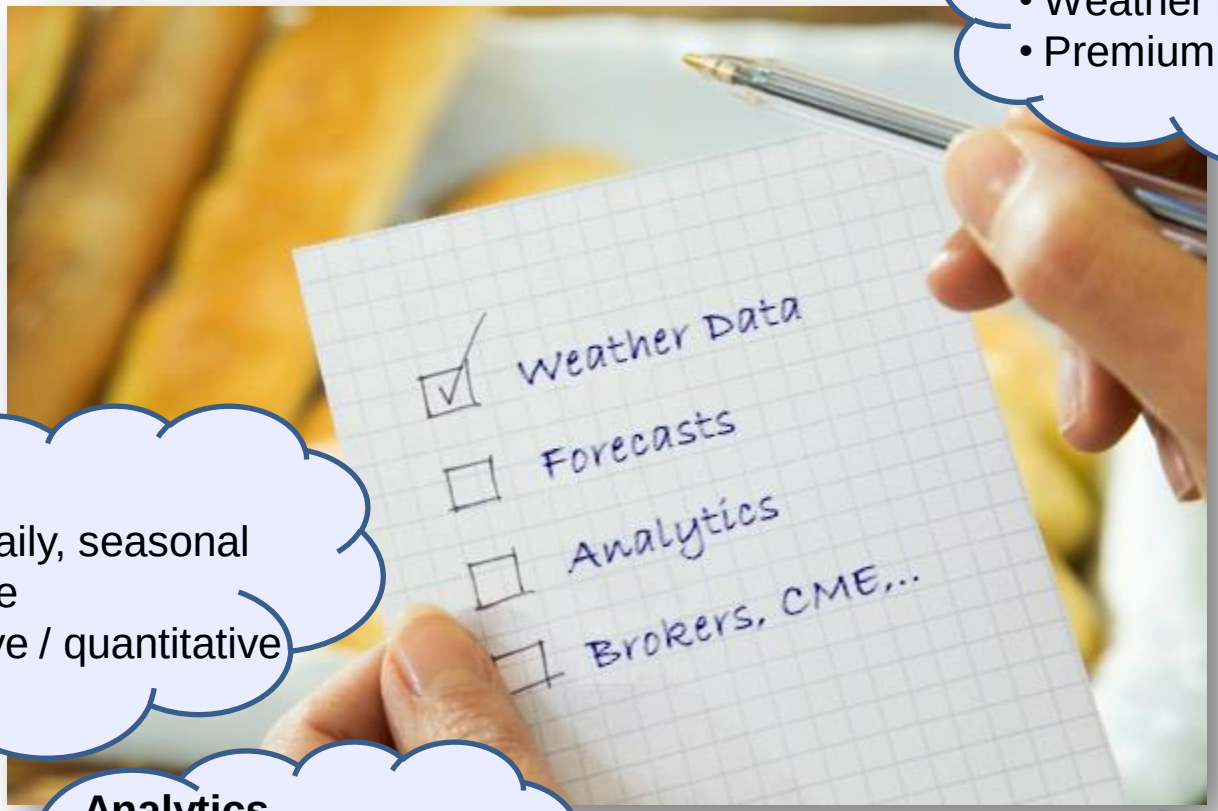
As Presented to the Weather Risk Management Association, Dusseldorf September 2011

RWE Trading Floor (Europe's largest energy trading floor), Essen Germany

Disclaimer: Speedwell Weather provides consulting services (data, forecasts, and software) for the weather risk management market. Yes, we sell these products…

Shopping list for a weather desk

Weather data
- Historical
- Weather Data Feeds
- Premium datasets



Forecasts
- Hourly, daily, seasonal
- Ensemble
- Qualitative / quantitative

Analytics
- Contract valuation
- Portfolio management
- Database

Brokers, CME, OTC hedge providers…

Weather Data

Weather Data

- **Without weather data you cannot understand value**

Why is data so important?

Historical Data	• Pricing based upon historical data (?50 yrs?) – simplest a burn analysis… • Understanding a location's climatology
Ongoing Feeds	• Marking your trade (how is your trade doing?) • Ongoing updates • Maintaining a database / looking for trading opportunities
Settlement Data	• Settling a transaction

Weather Data – Fundamentals

Things you should know…

1) How do you describe a location?
2) What type of data is it?
3) What is the observation convention?
4) Raw data, cleaned, un-edited, edited?

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) **How do you describe a location?**
2) **What type of data is it?**
3) **What is the observation convention?**
4) **Raw data, cleaned, un-edited, edited?**

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

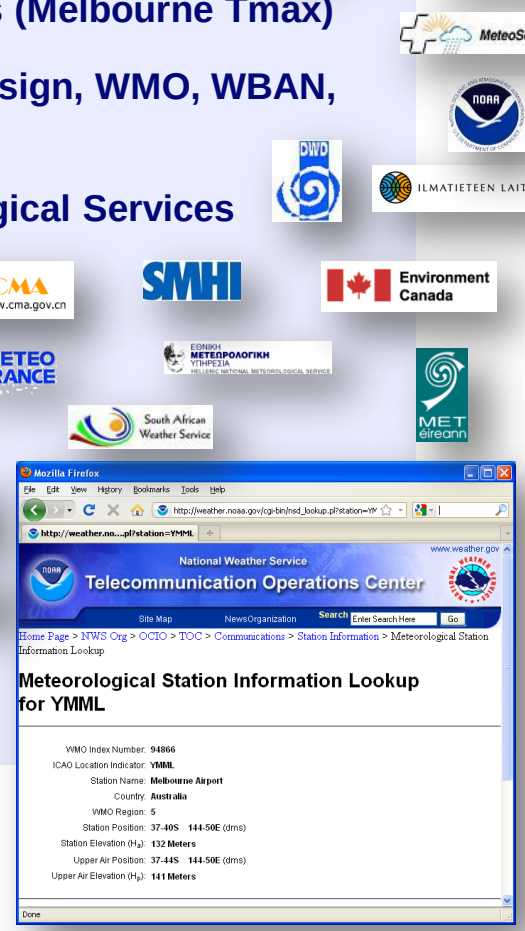
1) How do you describe a location?

   - Weather is observed at weather stations, not cities (Melbourne Tmax)
   - Weather stations are described by identifiers (call sign, WMO, WBAN, Coop ID, National Met Service ID,…)
   - In general data is observed by National Meteorological Services

2) What type of data is it?

3) What is the observation convention?

4) Raw data, cleaned, un-edited, edited?



Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe a location?
2) **What type of data is it?**
4) What is the observation convention?
5) Raw data, cleaned, un-edited, edited?

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe a location?

2) What type of data is it?

Climate data

- *generally* highest quality
- originates from a NMS
- additional quality control
- usually corresponds to a full day
- often preferred for weather risk transactions. BUT…

Synoptic data

- sometimes lower quality
- available where climate data is not available
- limited quality control at source
- partial day?

Derived Data

- derived from available data (20/24 hours)
- better than nothing

3) What is the observation convention?

4) Raw data, cleaned, un-edited, edited?

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe a location?
2) What type of data is it?
3) **What is the observation convention? (how the data is observed)**
4) Raw data, cleaned, un-edited, edited?

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe a location?

2) What type of data is it?

3) **What is the observation convention? (how the data is observed)**

   - **Midnight-midnight, 0000-0000 UTC, 7am to 7am LST,…**

4) Raw data, cleaned, un-edited, edited?

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe a location?
2) What type of data is it?
3) What is the observation convention? (how the data is observed)
4) **Raw data, cleaned, un-edited, edited?**

Weather Data – Understanding your data

Before using any data ask yourself the following questions…

1) How do you describe your location of interest?

2) What type of data is it?

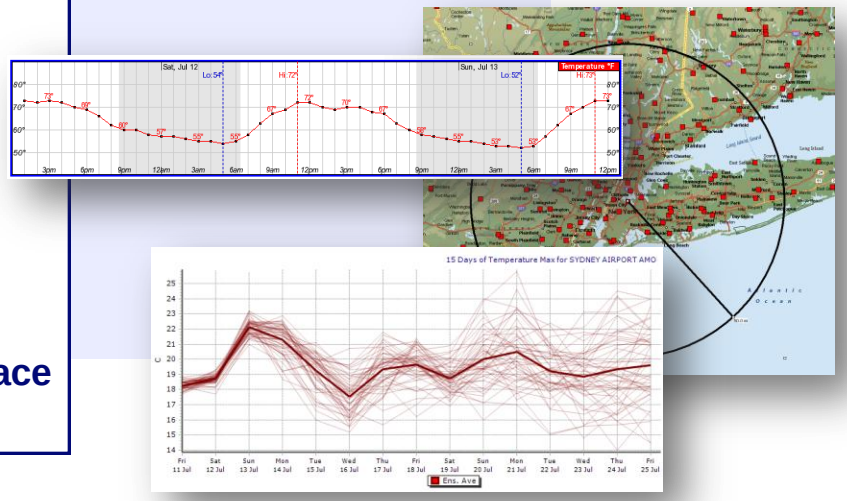
3) What is the observation convention? (how the data is observed)

4) **Raw data, cleaned, un-edited, edited**

   - **Understanding the QC level is important – certain levels have certain uses (i.e. in the U.S. edited data is used for OTC settlement)**

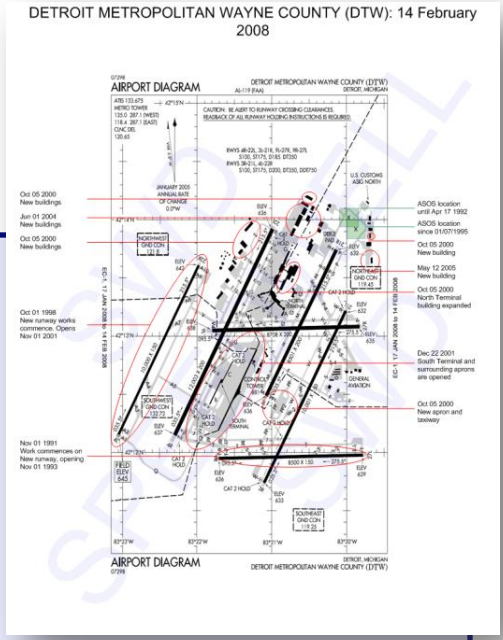
Cleaned Data

- **Weather data is not always of the highest quality**
- **Missing values and erroneous values are common**
- **Cleaned data is data that has undergone processing to fill missing values and replace erroneous observations**



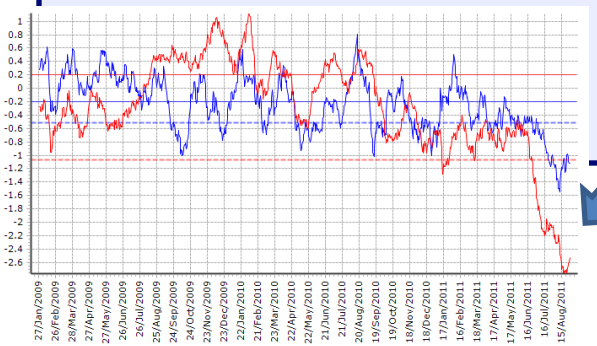
Weather Data – Premium Data Products

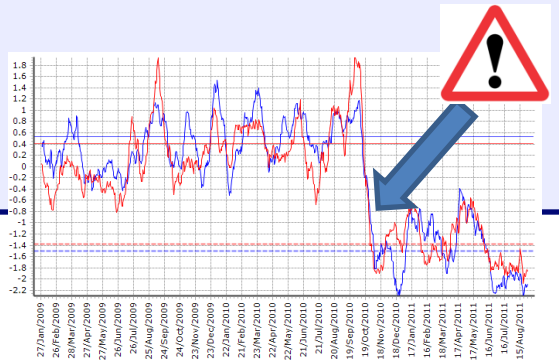
(competitive advantage / *how not to get picked-off*)



Recalibrated Data © (enhanced data, homogenized data,…)

- Changes to a weather station can impact observations
  - closer to the harbour? cooler max / warmer min
  - new runway? warmer max & min
  - replacement of thermometer?
- Market participants are aware of these changes / potential changes and are trading to their benefit
- Services exist (3rd party) that inform on and quantify the impact of these changes
- Analysis is useful in real-time for trading decisions as well as adjusted historical records for more accurate pricing





Forecasts

YOU CAN COUNT ON IT
PREDICT the UTURE!
LEFT FIELD
PREDICT EVERYTHING ABOUT THE FUTURE!

Forecasts– How forecasts are used in this market

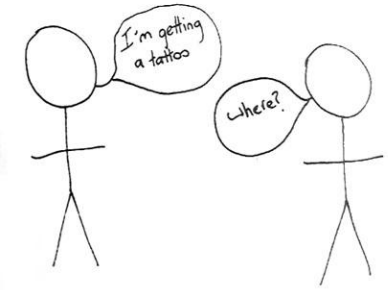
- Not at all..eg OTC hedging
  - trade long before the risk period
  - long range trends are viewed as more important
  - but…teleconnection may still be important (El Nino, La Nina,…)

- More accurate pricing
  - relevant when trading within the risk period or close enough that forecasts demonstrate skill

- Trading the forecast
  - some desks have meteorologists that feel their forecasting skills represent a competitive advantage

When using forecasts watch the volatility… using a forecast can artificially decrease the volatility as it attributes certainty that does not exist.

There are ways to address this…



Forecasts– Types of Forecasts

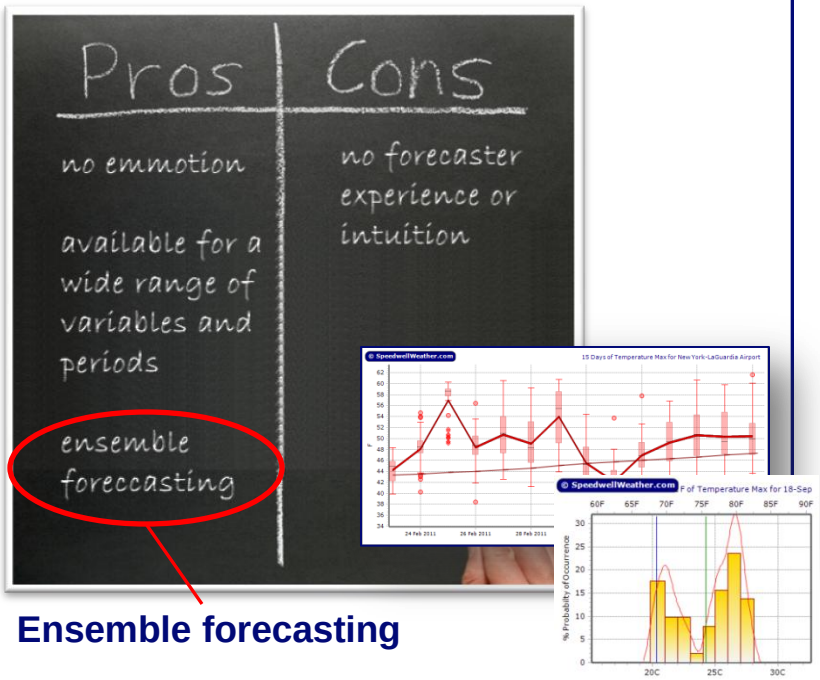
- **Hourly, daily, monthly, and seasonal**

Qualitative - human driven

- **Produced by a meteorologist / group of meteorologists**

Quantitative - statistical product

- **Based upon statistics / physics**



Ensemble forecasting

- **running the same forecast model multiple times with different initial conditions**
- **confidence in the forecast decreases if these small changes have a large impact on the outcome**
- **pricing with the average of the ensembles is not the same as pricing with the ensemble average**

Forecasts– Sources of Forecasts

- National Met Services
- Global models – ECMWF / GFS
- Private vendors

ECMWF – European Center for Medium Range Weather Forecasting

- 2 releases per day
- ensemble forecasts (51 members)

GFS (American model) – Global Forecast System

- 4 releases per day
- moves the US energy markets

Analytics

Analytics (software – useful tool or unnecessarily complicated?)

What are people using?

1) **nothing (no analytics)**
2) **spreadsheet**
3) **internally developed tools**
4) **3rd party applications**

Analytics (software – useful tool or unnecessarily complicated?)

Key functionality to consider

Functionality
- Burn
- Detrending
- Modeling
- Portfolio
- Database

Burn Analysis:

Using historical data to compute statistical averages and standard deviations

$$average = \frac{\sum_{k=1}^{n} x_k}{n}$$

Burn = average
Vol = standard deviation

$$S = \sqrt{\frac{\sum_{k=1}^{n} (x_k - \bar{x})^2}{n-1}}$$

Burn Summary

Atlanta-Hartsfield International Airport ; Temperature Ave; HDD; From 01/Mar/2011 To 31/Mar/2011; Call

Num. Of Years	Index Avg	Index StDev	Profit Avg	Non Det. Index Avg	Non Det. Index StDev	Non Det. Profit Avg
1	401.22	0.00	2,006,081.24	393.41	0.00	1,967,071.23
5	313.12	81.06	1,565,588.74	306.03	80.97	1,530,132.33
10	317.52	74.15	1,587,606.59	311.36	74.24	1,556,805.78
20	317.37	84.56	1,586,846.90	313.50	84.57	1,567,484.09
30	316.07	76.45	1,580,339.56	315.64	77.45	1,578,179.23
40	311.90	74.76	1,559,515.05	319.58	76.44	1,597,920.08
61	315.98	76.03	1,579,907.74	342.65	83.91	1,713,256.24

Problem: how do you price events that have never happened? Free options? …

	Burn Analysis
Nothing	
Excel	✓
Internal	*probably*
3rd party	✓

Analytics (software – useful tool or unnecessarily complicated?)

Functionality
- Burn
- Detrending
- Modeling
- Portfolio
- Database

Key functionality to consider

Data Detrending:

The statistical process of removing trends from a dataset.

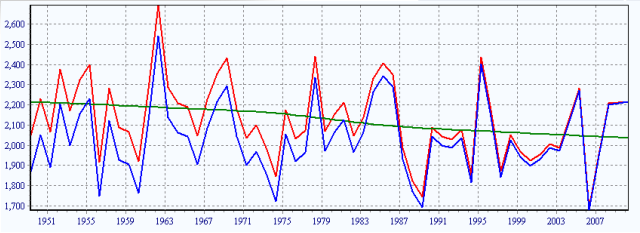
Causes? Urbanisation ?, global warming?,…

The goal is to make the historical data representative of the current state of the station.

Detrend what?
1) **The underlying data YES if critical-day**
2) **The index**
3) **… or both?**

	Data Detrending
Nothing	
Excel	✓
Internal	*probably*
3rd party	✓

Note: trends are not uniform across months



Essen HDD Trend

Analytics (software – useful tool or unnecessarily complicated?)

Key functionality to consider

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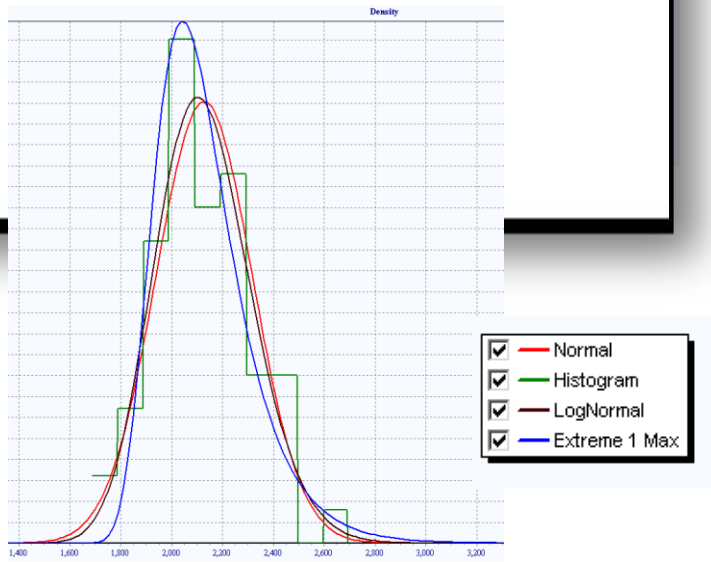
Modeling:

The process of fitting a distribution to the data.

Provides guidance on pricing events that have not occurred historically but are possible (tails)



	Modeling
Nothing	
Excel	?
Internal	*probably*
3rd party	✓

Analytics (software – useful tool or unnecessarily complicated?)

Key functionality to consider

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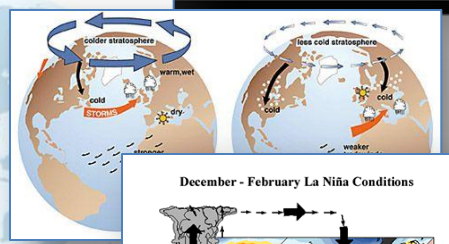
Portfolio Management:

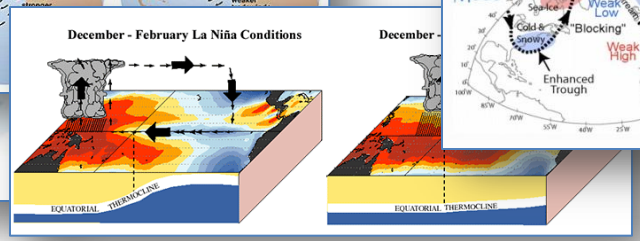
By running a large book of weather one can take advantage of the correlated / inversely correlated nature of weather

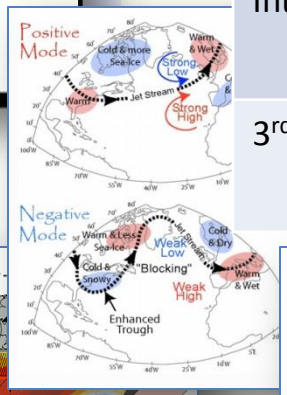
Adding or removing a contract from a portfolio can have significant impact on the overall risk

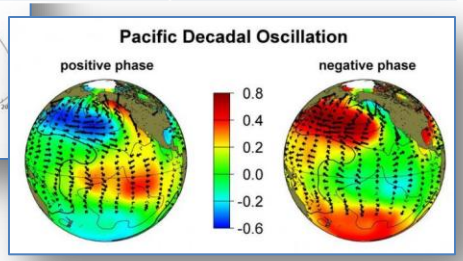
Software can allow for quick pricing against the portfolio to determine the marginal impact of a contract

	Portfolio Management
Nothing	
Excel	
Internal	*maybe*
3rd party	✓









Images from UCAR

Analytics (software – useful tool or unnecessarily complicated?)

Functionality
- Burn
- Detrending
- Modeling
- Portfolio
- Database

Key functionality to consider

Database Management:

- **Managing weather data**
  - **history and feeds, handle different data types, data revisions (!),..**
- **Portfolio**
  - **data, history, events,...**
- **Trade data**
  - **who, what, when, where,...**
- **Accounting**

	Database Management
Nothing	
Excel	
Internal	*maybe*
3rd party	✓

Analytics (software – useful tool or unnecessarily complicated?)

Key functionality summary:

Functionality
- Burn
- Detrending
- Modeling
- Portfolio
- Database

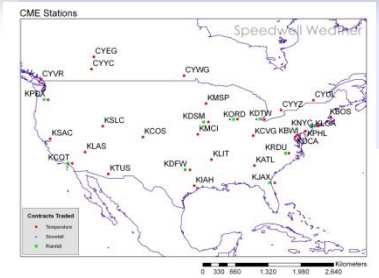
	Nothing	Excel	Internally developed tools	3rd party solutions
Burn analysis		✓	*probably*	✓
Data detrending		✓	*probably*	✓
Modeling			*probably*	✓
Portfolio management			*maybe*	✓
Database management			*maybe*	✓

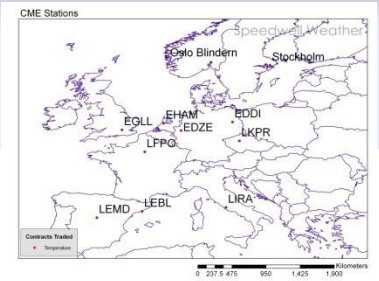
Brokers
CME
OTC Hedge Providers

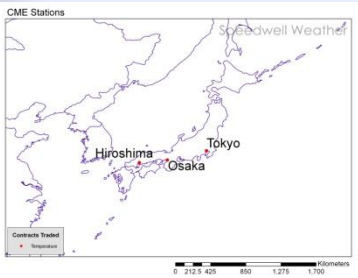
Chicago Mercantile Exchange

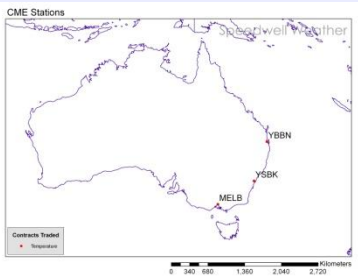
- **Exchange based weather futures and options**

- Temperature contracts
  24 U.S., 6 Canadian, 11 European, 3 Japan, 3 Australia (Bankstown, Brisbane Aero, Melbourne Regions)
- Precipitation contracts - 9 U.S.
- Snowfall contracts - 6 U.S.
- Hurricane contracts
- Frost Day contracts









Contact Us

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