Weather Patterns and Natural Gas Price Movement Linked, Trading Strategies Identified

Quantifying the Relationship between Changes in Government Weather Forecasts and Natural Gas Futures Prices

By Aaron Studwell, Meteorologist
Senior Manager, Research & Analytics
Weather Insight, L.P.

As traders well know, changes in weather affect natural gas demand. What has been unclear, however, is the magnitude of movement in natural gas futures prices that results from changes in U.S. government weather forecasts.

To quantify the relationship between changes in government weather forecast models and the prompt NYMEX natural gas contract price, we conducted a study using two years of historical forecast data. Our objectives were to measure how significant changes in forecasts move the markets and to identify tradable patterns that may exist. Our studies focused on New York City-LaGuardia during the winters of 2006-2007 and 2007-2008, and on Chicago during the summers of 2006 and 2007. Analysis tools used were Weather Insight's historical weather forecast database and Logical Information Machines' XMIM software application.

The study compared the U.S. government forecast model, the Global Forecast System (GFS) model, released at 10:30 a.m. Central Daylight Time in the summer (9:30 Central Standard Time in the winter) with the GFS model issued 12 hours earlier at 10:30 p.m. CDT. The government forecast models released at 10:30 a.m. and 10:30 p.m. CDT are considered to have the most market-moving potential.

In our data analysis, we used two meteorological criteria to define a significant change:

1. The difference between the two weather forecasts must be above average. (These values are shown on Figure 1.)
2. The new weather forecast must predict temperatures either much above or below the 30-year norm (by +/- 8 degrees).

Using the LIM software system and Weather Insight's historical weather forecast database, we were able to correlate these significant changes in forecast models with movements in natural gas futures prices.

The findings were dramatic, identifying specific criteria for actionable trades in the financial natural gas market.

The Winter Study – New York, LaGuardia

The winter study yielded several examples of strong market price movements in response to significantly colder temperatures in the 9:30 AM CST government forecast models. However, when temperatures were significantly warmer during the winter study, the impact on the market was not statistically significant.

With colder temperatures, the most impact from significant forecast changes was observed in the latter forecasts days, specifically Forecast Day 7 to Forecast Day 15. Longer-term weather forecasts tend to have greater market influence than those for near-term periods, due to their higher forecast volatility.

The winter study found that when the longer-term weather forecast changed, with temperatures at least 8 degrees colder than the 30-year norm, along with an above-average difference from the previous forecast, strong movement in the natural gas futures price occurred ***89 percent of the time***.

In one of the actionable trade periods studied (Forecast Day 9), colder temperature criteria were seen on 20 days (e.g. "FD 9" as seen on the x-axis in Figure 1). On 16 of those 20 days (80 percent rate of occurrence), natural gas futures prices rallied an average of 8.1 cents per contract.

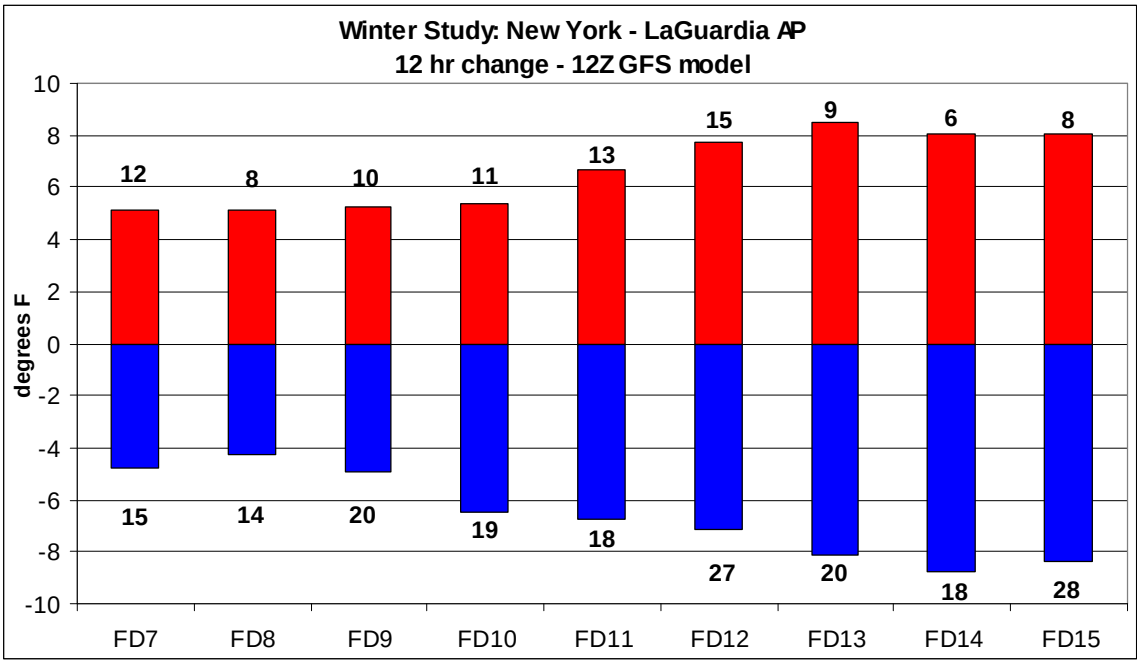

Figure 1. Red and Blue bars represent the 'average positive' and 'average negative' 12-hour forecast temperature changes for the 12Z GFS. Bold numbers next to each bar represent the number of days that temperature criteria were met for Forecast Days 7 through 15.

Interestingly, the winter study results showed that, when both temperature criteria were met, prices generally moved an hour later. This indicates that traders would be able to use the government weather forecast release at 9:30 a.m. CST to identify and place a trade and then take the trade off an hour later. We believe that the one-hour delay occurs because the market confirms the forecast change with another government weather forecast, which is released about 1 hour later.

The Winter Study – Actionable Trades

- Colder forecasts resulted in actionable trades, but trader patience is required. (Warmer forecasts in the winter study did not produce tradable patterns.)
- Natural gas futures *buy signals* were generated after colder temperature criteria were met on Forecast Day 7 or later.
- No strong price action was observed in the first hour. *One hour after the forecast was released, strong positive price trends were noted in 8 of 9 forecast days (89%).*

The Summer Study – Chicago

The summer study also yielded actionable trades when government forecast models showed a deviation (warmer or cooler) of 8 degrees or more from the 30-year norm and an above-average difference from the previous weather forecast (Figure 2). As with the winter study, government forecast models released at 10:30 a.m. CDT were compared with the forecast released 12 hours earlier at 10:30 p.m. CDT. Timing and magnitude of the market movements varied, depending upon the specific forecast changes, as will be discussed in detail.

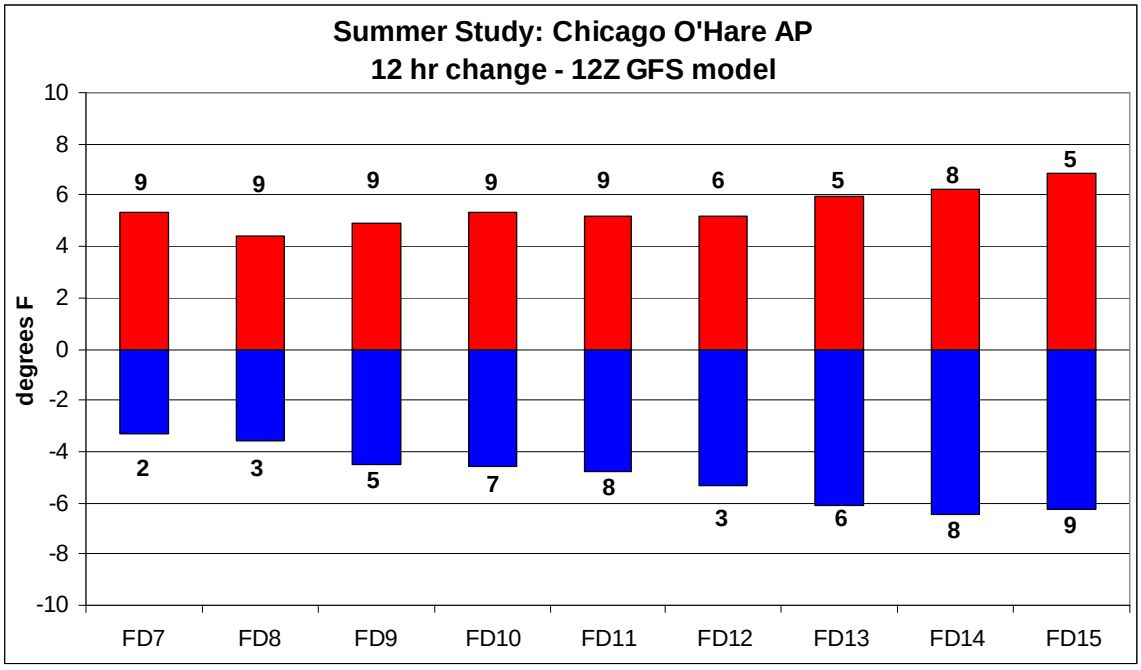

Figure 2. Red and Blue bars represent the 'average positive' and 'average negative' 12-hour forecast temperature changes for the 12Z GFS. Bold numbers next to each bar represent the number of days that temperature criteria were met for Forecast Days 7 through 15.

Summer Study – Warmer Forecast

When changes in government forecast models called for significantly warmer temperatures, two price movement patterns and trading strategies were identified. Both strategies yield actionable *buy signals.*

- Option 1 – Act Quickly

  Focusing on Forecast Day 7 through Forecast Day 15, a total of 9 days, there were 7 out of the 9 forecast days (78 percent) that demonstrated strong positive price trends within 15 minutes of the forecast day being released. On Forecast Day 7, there were 9 occurrences when temperature criteria were met (Figure 2). On every occurrence, natural gas futures prices rallied an average of 3.4 cents per contract.

- Option 2 – Be Patient

  For the last three forecast days (Forecast Days 13-15), one hour after these forecast days were released, strong, positive price trends were observed. For example, on Forecast Day 14, there were 8 occurrences when both temperature criteria were met. On every occurrence, natural gas futures prices rallied an average of 6.3 cents per contract.

Summer Study – Cooler Forecast

Also in the summer study, when the government forecast models showed cooler temperatures (8 degrees or more compared to the 30-year norm) and an above average difference from the previous forecast (Figure 2) on Forecast Day 7 or later, there was a strong downward price movement after 30 minutes, resulting in an actionable *sell signal*. (In the first 30 minutes, no strong price action was detected.)

For example, on Forecast Day 11, there were 8 occurrences when the temperature criteria were met (e.g. "FD 11" as seen on the x-axis in Figure 2). After 30 minutes, for 6 of 8 occurrences, natural gas futures prices declined *an average of 6.9 cents per contract.* After one hour, for 6 of 8 occurrences, natural gas futures prices dropped *an average of 14.3 cents per contract.*

Conclusions

Analysis of significant changes in government weather forecast models demonstrated a strong impact on the NYMEX's prompt month natural gas futures prices and identified tradable patterns. The analysis also illustrated that there is no single way to approach the natural gas futures market as a trader; rather a variety of strategies should be

employed in response to changes in government weather forecasts. For example, based on these results, traders would want to act quickly during the summer months to capitalize on the market's sensitivity to heat in the Midwest and warmer forecasts. However, there are times—such as during the winter months—when the market may be looking for confirmation from the next model released for additional evidence of forecast changes.

To further investigate the impact of forecast model changes, Weather Insight will conduct additional research on price changes in the physical natural gas markets and how these specific physical hubs relate to changing weather forecasts from various cities in the U.S.

In response to the trading community's higher level of interest in actionable data from government weather forecasts, Weather Insight is also increasing the speed of its FirstInsight service, and expanding the range of geographic areas covered.

For more information about Weather Insight and its suite of FirstInsight services, as well as its Premium Tropical Weather Service and other cutting-edge products, please see our web site at http://www.weatherinsight.com or call 713-361-4950.

Spring 2008