CASE STUDY 9

PROJECTING NATURAL GAS DEMAND (NORTH-EASTERN UNITED STATES)

SUMMARY

Title
Natural gas production and pricing using Madden-Julian Oscillation (MJO) satellite analyses

Service
2–6 week forecast of natural gas demand in the north-eastern United States of America

End users
Home owners and businesses using natural gas

Intermediate users
Consulting meteorologists

Application(s)
Short-term statistical climate forecasting and climate monitoring

Models used
Statistical model of satellite-derived Madden-Julian Oscillation state and surface temperatures

Climate data records used
Outgoing longwave radiation

Satellite observations used
HIRS (1978–present)

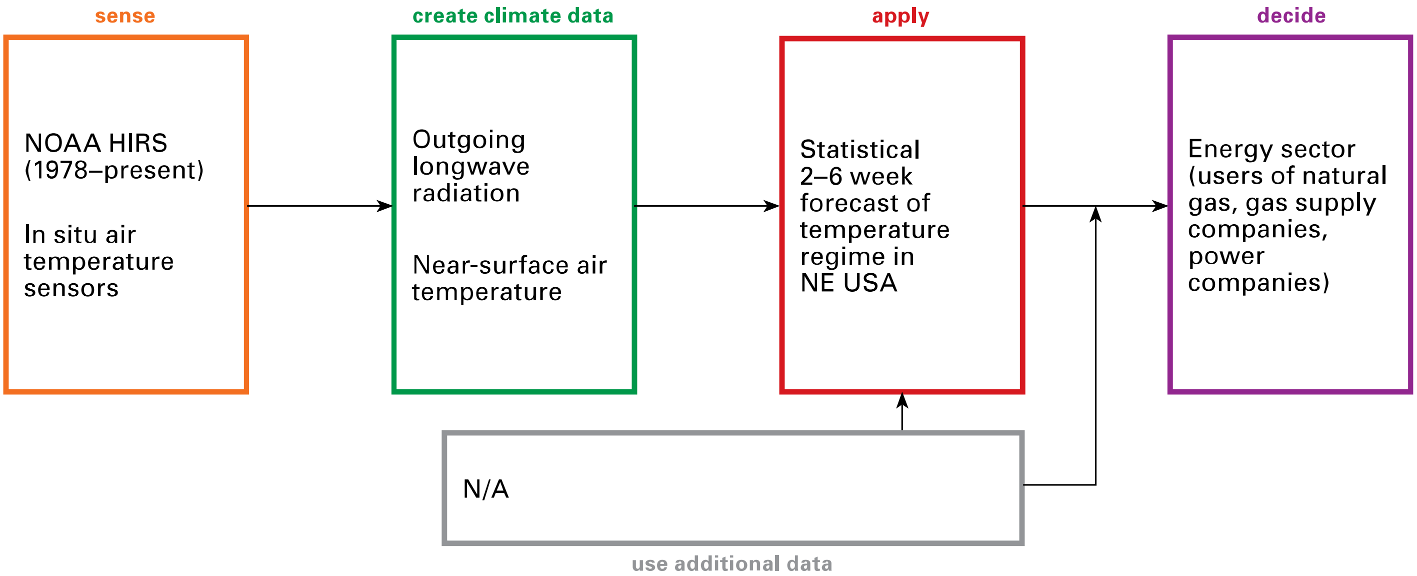
Agencies that produce records
NOAA and Cooperative Institute for Climate and Satellites North Carolina (CICS-NC)

Sustainability of service (demonstration or ongoing)
Ongoing (http://monitor.cicsnc.org/mjo/current)

FLICKR

Natural gas stove

INFORMATION FLOW



DESCRIPTION

It is no surprise that energy demand in the United States of America is driven by changes in temperatures. Forecasting those temperatures as far in advance as possible is a top priority for energy companies. Numerical models are useful for predictions of up to about a week, but their accuracy drops off after that. For longer-term predictions, forecasters in the energy sector often rely on statistical techniques and historical analogues.

Climate data records are ideal inputs into those statistical models. As climate data records have been homogenized, forecasters can be sure that the model will not be affected by data changes through time. Satellite proxies for tropical rainfall, like outgoing longwave radiation, are particularly valuable. They can identify patterns in the tropics that drive a significant part of the global circulation. These patterns also evolve slowly enough to provide higher levels of accuracy for the longer-term predictions that the energy sector needs.

Figure 1 shows an example of how outgoing longwave radiation can be used to anticipate weather patterns over the United States. The Madden–Julian Oscillation is a large area of tropical rainfall that takes about 30 days to move eastward around the globe. In both panels, the rainfall is enhanced near Indonesia and Australia (green shading), although there is a noticeable difference near Hawaii. The lower panel has a large area of enhanced rainfall that is not in the upper panel.

The contours identify changes in the global circulation. The red contours generally correspond to areas that are warmer than usual, while the blue contours are cooler than normal. The patterns in the two panels are practically reversed over North America.

As those differences can be persistent, they have been identified with a newly developed index, the Multivariate Pacific–North American index (MVP) (Schreck et al., 2013), in order to infer temperature anomalies in the continental United States. Satellite observations of outgoing longwave radiation play a key role in this index. By using the MVP and other Madden–Julian Oscillation diagnostics on the website monitor.cicsnc.org/mjo, forecasters in the energy industry will be better prepared to meet the demands of future temperature extremes.

Reference

Schreck, C.J., J.M. Cordeira and D. Margolin, 2013: Which MJO events affect North American temperatures? *Mon. Wea. Rev.*, 141:3840–3850, doi:10.1175/MWR-D-13-00118.1.

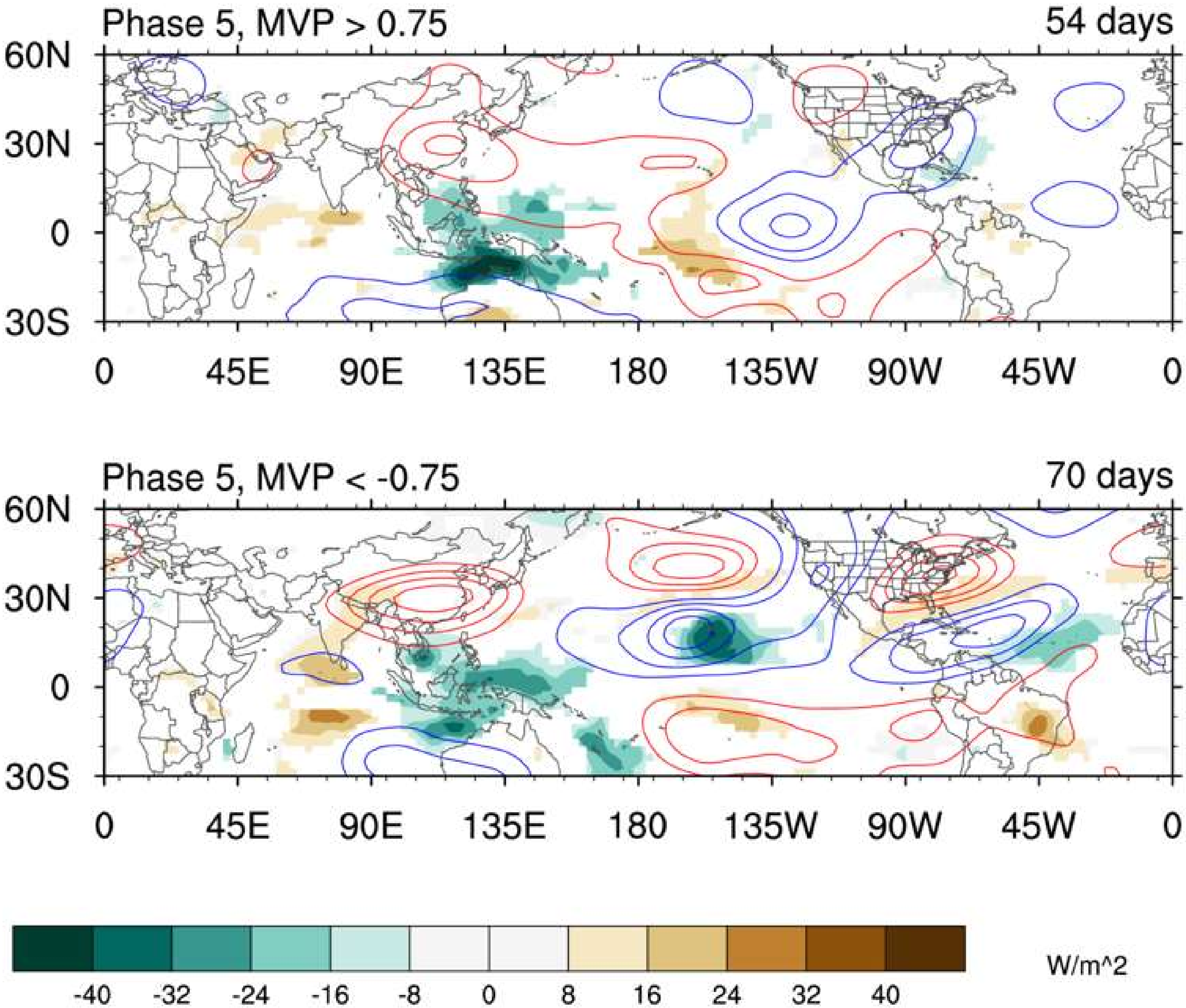


Figure 1. Composite outgoing longwave radiation anomalies (shading) and 200-hPa streamfunction anomalies (red and blue contours every 5x106 m^2s^{-1}) for real-time multivariate Madden–Julian Oscillation phase 5 when MVP >0.75 (top) and MVP <0.75 (bottom). Only outgoing longwave radiation anomalies that are 95% significant are shaded. Red contours (for example, in lower panel over the North-eastern United States) are generally associated with warm surface temperature anomalies. The numbers in the top right denote how many events were used in each composite.