Medium- and Extended-Range Weather and Climate Forecasts Scaled and Tested for IPM Decision Support in US States

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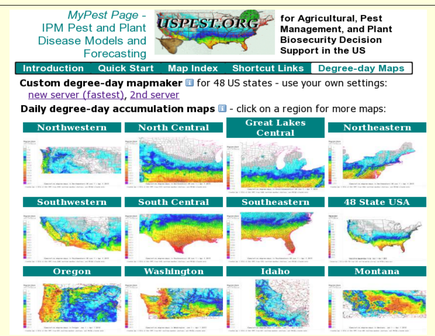


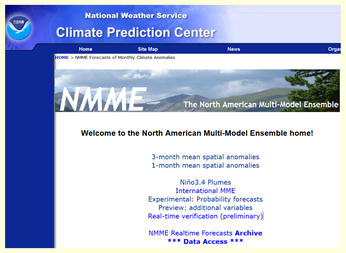
http://uspest.org/wea – DD Maps

ABSTRACT The website at http://uspest.org/wea was first created in 1996 and has served numerous phenology or degree-day (DD) models and maps, and plant disease risk and other hourly-data driven models to the USA and particularly Western states since around 2007. Decision support systems (DSSs) depend on having weather data and forecasts of known provenance and quality assurance. Also, real-time decision support must rely on always changing, continuously updated methods and data types with multiple options in particular with regard to weather and climate forecasts.

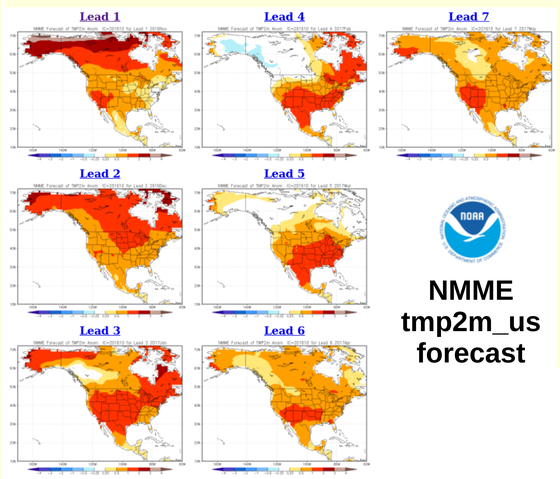
As climate change is becoming an ever-more prominent part of the weather, we are working to add new options to end-users (Extension agents, crop advisors, growers, and members of the public) so that they have a suite of science-based forecasts to drive models with. With this IPM-focused grant, we have expanded these options beyond 30-year NORMALS that were used in the past. New selections include 1) NMME "smooth" interpolated from monthly to daily data, (7-month forecast), 2) NMME "patterned" data interpolated from monthly to daily (90-day forecast), 3) Last years data used as an extended forecast, 4) Year-before-last data used as an extended forecast, and 5) A monthly-updated average of the previous 10 years. We are gradually integrating these choices into numerous DSS products and models, and are developing the Extension programming to introduce these new tools to end-users. It is expected that it will take several years to determine adoption rates and gather feedback.

CREDITS IPPC works closely with and gives thanks and appreciation to: funding agencies USDA NIFA CPPM ARDP (Applied Research and Development Program), W. IPM Center, NOAA NWS, MESOWEST UTAH, USDA APHIS PPQ, the Western Weather Systems Workgroup, The OSU PRISM Group. And numerous sources of weather data including WSU AgWeatherNet, AGRIMET, ADCON, CIMIS, and numerous other public and agricultural networks. The system has evolved over 20 years using open source software tools such as GNU/LINUX, GRASS GIS, and the Perl and R programming languages.

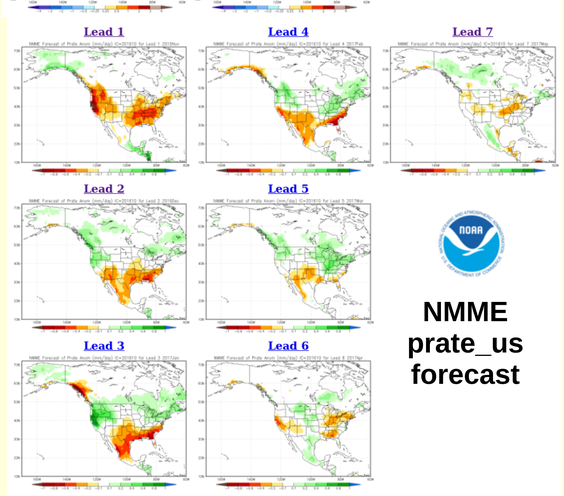
Source of Extended Forecast: NOAA NMME



NMME is updated monthly at:
<www.cpc.ncep.noaa.gov/products/NMME/>
Monthly surface temperature and daily precipitation anomalies are available at 4KM resolution globally and for N. America. Recent forecast images shown below for 7 months (beginning with Nov. 2016) for temperature and precipitation.



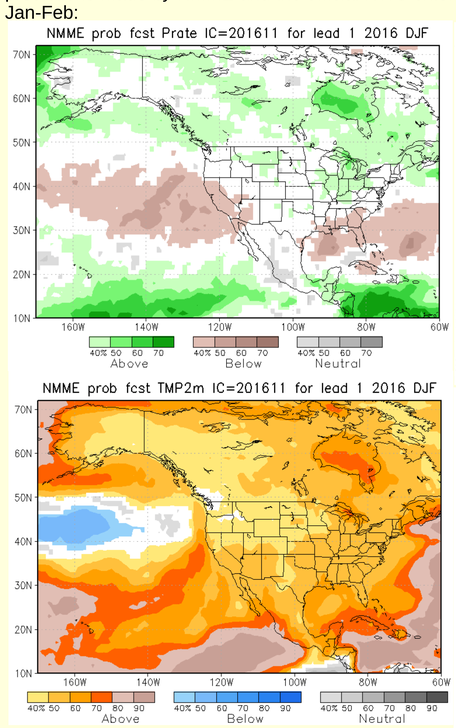
NMME tmp2m_us forecast

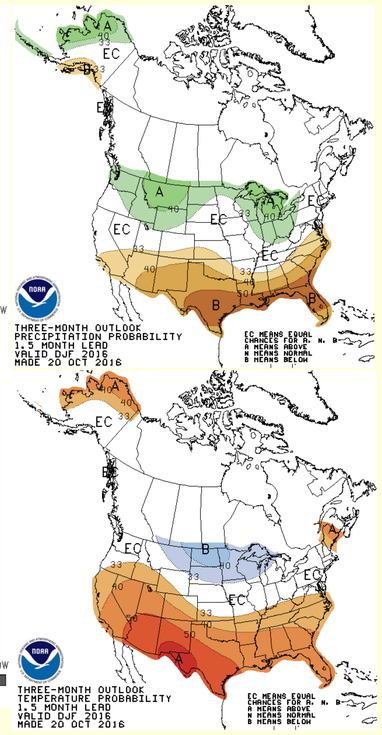


NMME prate_us forecast

What is NMME anyway?

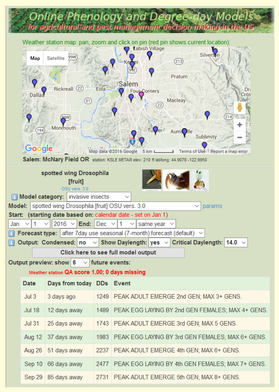
NMME: North American Multi-Model Ensemble – is an ensemble of 7 leading US and Canadian seasonal climate models from climate science centers such as NCEP, NCAR, NASA, CMC, and GFDL. NMME is the only system with a strict protocol that openly provides real-time climate forecasts and hindcasts for research and applications. OSU IPPC found a good similarity of predictions made by NMME and the official NWS extended outlook products. Examples for Dec-Jan-Feb:





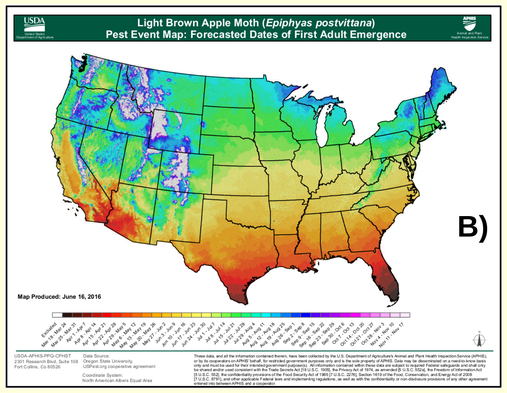
Comparison of Dec-Jan-Feb forecast probabilities for NMME (left) and NWS official outlook (right). Differences of note include:
- NMME is also available as GIS grid files and as anomalies (difference from Normal in actual units such as deg. C and mm precipitation (examples on left)
- NWS Outlooks use multiple resources and are ultimately subjective (drawn by hand by experts), and are not a usable digital forecast product
- In this example none of the 7 models used by NMME suggest below average temps in the upper Midwest; NWS has no explanation for this prediction
- All extended forecasts are primarily driven by SSTs (sea surface temperatures) and researched teleconnections

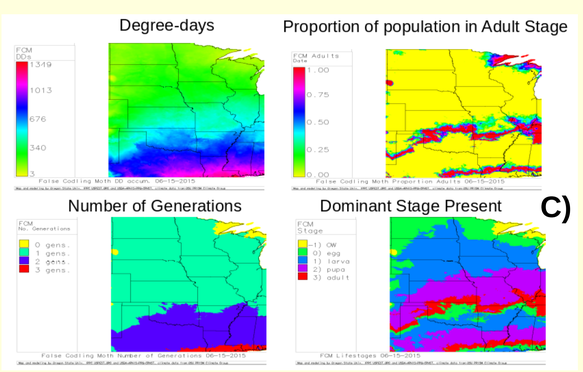
Using Extended Forecasts 1. Vegetable Crop Scheduling

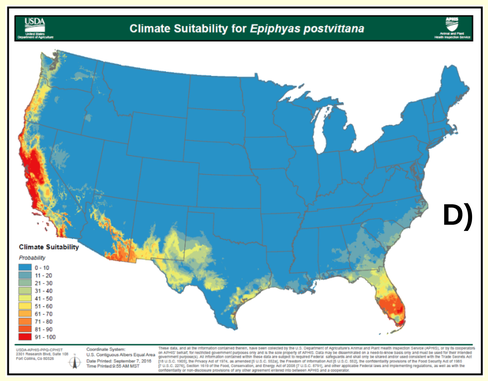


An example where an extended forecast can improve options for a degree-day modeling system: New Googlemap interface to USDA SARE funded CROPTIME project, focused on improved scheduling of vegetable crops and integration with pest, weed, and fertilizer timing models. Over 100 phenology/degree-day models are hosted and can use the new forecast options at uspest.org

Using Extended Forecasts 2. Degree-Day Maps including APHIS PPQ models for Invasive Species Trapping

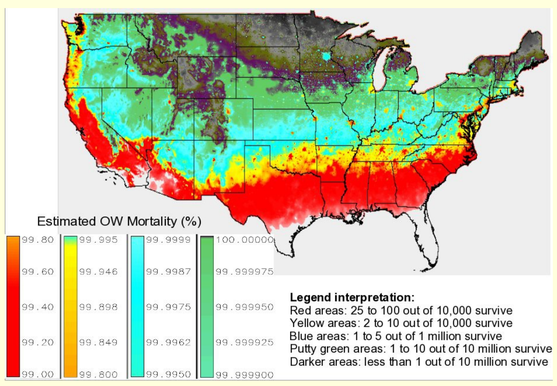






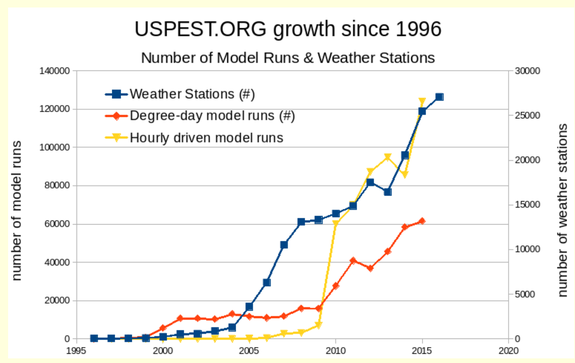
Examples: Online interface (A), APHIS PPQ prototype products (B & D), and IPPC intermediate products (C), all making use of PRISM 4K climate data for past data <www.prism.oregonstate.edu> and up to 7-month climate forecast generated from NMME anomalies combined with PRISM normals.

Using Extended Forecasts 3. Spotted Wing Drosophila



Spotted wing Drosophila has a complex life cycle. Spring activity forecast models can help growers prepare for early arrival and high over-wintering survival. These models will benefit by using extended forecasts such as with NMME.

Growth of USPEST.ORG since 1996



USPEST.ORG has had steady increases in number of models, weather stations, and networks over the past 20 years, while the number of phenology (DD) and disease risk model runs has increased significantly especially over the past 8 years with full US coverage (27,000+ weather stations).