Research to Operations/ Applications

ESRL Physical Sciences Division
Science Review
May 12-14, 2015

PSD Research to Operations

PSD works closely with NOAA operational entities to transition selected research advances into NOAA operations. These transitions are often funded and progress carefully monitored. A representative sample is shown below.

Product	Description	Target Organization	Benefits/Impacts	TRL*	Transition Date	PSD Contact
Air Quality PM2.5 Post-Processing Algorithms	A set of codes to improve the skill of the NOAA/ NCEP CMAQ air quality model for ozone and particulate matter forecasts through application of analog and Kalman filter post-processing schemes	NWS/NCEP Environmental Modeling Center	Post-processing of PM2.5 forecasts greatly improves model forecast skill, and an automated analog post-processing scheme reduces the need for state and local air quality forecasters to apply their own subjective corrections to the model forecasts	9	2014-2015	Irina Djalalova
Automated Digital Frost Forecast System	Gridded frost and heat forecasts for Russian River basin, CA	NWS Western Region	Forecasts allow water agency to plan for reservoir releases to accommodate crop spraying to mitigate for frost/ heat. Growers can augment storage ponds prior to event to mitigate drawn-downs in tributaries and mainstem Russian on frost days. Goal is to eliminate any fish strandings to restore endangered salmon species in Russian.	8	2014-2015	David Reynolds
C-LIM Tropical forecasts	Empirical model yielding forecasts (and a priori forecasts of forecast skill) for pentads (5-day running means) of tropical SSTs, OLR, and 200/850 mb winds, for forecast leads of 5-270 days.	NWS/NCEP Climate Prediction Center	CLIM will provide a nice complement and alternative for the forecast of anomalous tropical convection to that produced from purely physical models (i.e. CFS, etc.). CPC is already using the C-LIM to aid the NWS operational Global Tropics Hazards and Benefits Outlook prepared weekly at CPC, but also plans to use it as part of the upcoming experimental probabilistic Week 3-4 U.S. temperature and precipitation outlooks in the context of assessing the potential tropical - extratropical teleconnection.	6 -7	2015	Matthew Newman

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Ensemble Kalman Filter Data Assimilation System	An ensemble-based data assimilation technique that incorporates flow-dependent estimates for forecast uncertainty. Became operational at NCEP in 2012.	NWS/NCEP Environmental Modeling Center	Improved accuracy of forecast initial conditions, which improves forecast skill	10	Implemented in NCEP operations May 2012, further improvements in subsequent upgrades.	Jeffrey Whitaker
Hydrometeorolgy Testbed Observations	Research observations collected throughout U.S., but most notably in CA	NWS Western Region	Provides real-time access to NWS offices, including RFC's with SHEF-encoding for situational awareness	7	2013-2015	Daniel Gottas
Reforecasts	Transition of global medium-range reforecast capacity	NWS/NCEP Environmental Modeling Center	Dramatically improved weather and weather-climate forecast guidance supported by reforecast data sets and their use in statistical post-processing.	7-9	Expect funding for transition in 2015-2017 timeframe	Thomas Hamill
Sea Surface Temperature Diurnal Warming Amplitude Estimates	Modeled global estimates of instantaneous SST diurnal amplitude based on NWP analyses for incorporation in operational Global SST analysis	NESDIS	Improved SST product accuracy enabled by correction for diurnal warming influences on individual satellite retrievals	7	NESDIS Algorithm Readiness Review scheduled for April 2015; product operationalization to follow	Gary Wick
Stochastic Parameterizations of Model Uncertainty	Improves the representation of model uncertainty in ensemble forecast, improving forecast reliability and analysis accuracy. Became operational in the EnKF DA system at NCEP in 2014.	NWS/NCEP Environmental Modeling Center	Improved reliability of forecast ensembles, improved analysis accuracy.	9	Implemented in NCEP operations in 2015 for the EnKF analysis cycle, preparing for implementation in the medium range global ensemble system in 2016.	Jeffrey Whitaker

*Technology Readiness Levels

TRL 1: SCIENTIFIC RESEARCH

- Basic principles have been observed and reported
- Essential characteristics and behaviors of systems and architectures have been described
- Descriptive tools are mathematical formulations or algorithms

TRL 2: APPLIED RESEARCH

- Technology concept and/or application formulated
- Theory and scientific principles are focused on specific application area to define the concept
- Characteristics of the application are described
- Analytical tools are developed for simulation or analysis of the application

TRL 3: PROOF OF CONCEPT

- Analytical and experimental critical function and/or characteristic proof-of- concept
- Active research and development is initiated with analytical and laboratory studies
- Demonstration of technical feasibility using breadboard or brassboard implementations that are exercised with representative data

TRL 4: COMPONENT VALIDATION

- Component/subsystem validation in laboratory environment
- Standalone prototyping implementation and test
- Integration of technology elements
- Experiments with full-scale problems or data sets

TRL 5: PROTOTYPE TESTING

- System/subsystem/component validation in relevant environment
- Thorough testing of prototyping in representative environment
- Basic technology elements integrated with reasonably realistic supporting elements
- Prototyping implementations conform to target environment and interfaces

TRL 6: TESTING IN AN END-TO-END ENVIRONMENT

- System/subsystem model or prototyping demonstration in a relevant end-to-end environment
- Prototyping implementations on full-scale realistic problems
- Partially integrated with existing systems
- Limited documentation available
- Engineering feasibility fully demonstrated in actual system application

TRL 7: DEMONSTRATION IN AN OPERATIONAL ENVIRONMENT

- System prototyping demonstration in an operational environment

- System prototyping demonstration in operational environment
- System is at or near scale of the operational system, with most functions available for demonstration and test
- Well integrated with collateral and ancillary systems. Limited documentation available.

TRL 8: SYSTEM DEVELOPMENT COMPLETED

- Actual system completed and “mission qualified” through test and demonstration in an operational environment
- End of system development
- Fully integrated with operational hardware and software systems
- Most user documentation, training documentation, and maintenance documentation completed
- All functionality tested in simulated and operational scenarios
- Verification and validation completed
- TRL 9: System Fully Operationally Integrated
- Actual system “mission proven” through successful mission operation
- Fully integrated with operational hardware/software systems
- Actual system has been thoroughly demonstrated and tested in its operational environment
- All documentation completed
- Successful operational experience
- Sustaining engineering support in place