Research to Operations and Applications

PSL's research to operations and applications activities are summarized under the PSL Annual Operating Plan and are also presented here separately for convenience. They are guided by the NOAA Policy on Research and Development Transitions (NAO 216-105B) and span a wide variety of partnerships. Examples include working relationships with:

- NOAA national operational forecast offices and centers
- NOAA regional operational forecast offices and centers
- NOAA testbeds
- NOAA laboratories that provide experimental forecasts, predictions, and guidance
- local, regional, national, and international synthesis and assessment efforts
- other non-NOAA local, regional, national, and international agencies

The mechanisms for transitioning research advances into operations and applications are also varied and are motivated by the full spectrum of research-to-operations/applications (R2X) and operations/applications-to-research (X2R) collaborations.

Progress toward meeting PSL's R2X targets was monitored through an annual call for R2X activities distributed every August/September. The Performance Metric Manager of the NOAA Office of Atmospheric and Oceanic Research (OAR) initiated the OAR-wide annual call with updates requested quarterly. R2X advances were tracked in terms of the progression through four stages:

- Research (1,2)
- Development (3,4,5)
- Demonstration (6,7,8)
- Operation/Application (9)

where the parenthesized numbers represent the span of associated NOAA Readiness Levels (RLs):

- <u>RL 1</u>: Basic research, experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view. Basic research can be oriented or directed towards some broad fields of general interest, with the explicit goal of a range of future applications.
- <u>RL 2</u>: Applied research, original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective. Applied research is undertaken either to determine possible uses for the findings of basic research, or to determine new methods or ways of achieving specific and predetermined objectives.

- <u>RL 3</u>: Proof-of-concept for system, process, product, service, or tool; this can be considered an early phase of experimental development; feasibility studies may be included.
- <u>RL 4</u>: Successful evaluation of system, subsystem, process, product, service, or tool in a laboratory or other experimental environment; this can be considered an intermediate phase of development.
- <u>RL 5</u>: Successful evaluation of system, subsystem process, product, service, or tool in relevant environment through testing and prototyping; this can be considered the final stage of development before demonstration begins.
- <u>RL 6</u>: Demonstration of a prototype system, subsystem, process, product, service, or tool in relevant or test environment (potential demonstrated).
- RL 7: Prototype system, process, product, service or tool demonstrated in an operational or other relevant environment (functionality demonstrated in near-real world environment; subsystem components fully integrated into system).
- <u>RL 8</u>: Finalized system, process, product, service or tool tested, and shown to operate or function as expected within user's environment; user training and documentation completed; operator or user approval given.
- <u>RL 9</u>: System, process, product, service or tool deployed and used routinely.

The tables at the end of this document summarize 2015-2020 R2X targets.

				cycle F oving f			fecycle Movin		ie T	arget	Target	Target	Target						statement of	Type of R2A	all applicable)	(Choose	Cost of R2A Transition
Identifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research	Development	Demonstration Operations or Applications	Research	Development	Demonstration	Operations or Applications	15 Q1	15 Q2	15 Q3	15 Q4	Date Completed Fiscal year and quarter the project will transition to operations / applications	OAR Point of Contact	OAR Responsible SES	OAR Contributing Partners	Customer	what condition must be met for the product advancement to have been made. This should be sufficient to allow a	Operations	Commercial	Other	runging amount to move the project into operations/ applications (Only the profile shift and NOT the total funding
Reforecasts	Transition of global medium-range reforecast capacity	Dramatically improved weather and weather- climate forecast guidance supported by reforecast data sets												Expect funding for transition in 2015- 2017 timeframe	Hamill	Webb		NCEP/EMC		x			
Temperature Diurnal Warming Amplitude Estimates	Modeled global estimates of instantaneous SST diurnal amplitude based on NWP analyses for incorporation in operational Gobal SST analysis	Improved SST product accuracy enabled by correction for diurnal warming influences on individual satellite retrievals												NESDIS Algorithm Readiness Review scheduled for April 2015; product operationalization to follow	Wick	Webb		NESDIS		x			
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.	Improved accuracy of forecast initial conditions, which improves forecast skill												Implemented in NCEP operations May 2012, further improvements in subsequent upgrades.	Whitaker	Webb		NCEP/EMC		x			
ns 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.													Implemented in NCEP operations in 2015 for the EnKF analysis cycle, preparing for implementation in the medium range global ensemble system in 2016.	Whitaker	Webb		NCEP/EMC		x			
olgy Testbed observations	Research observations collected throughout U.S., but most notably in CA	Provides real-time access to NWS offices, including RFC's with SHEF-encoding												2013-2015	Gottas	Webb		NWS Western Region		x			
Streamflow forecasts	Distributed hydrologic model applied to Russian River basin, CA	Provides streamflow everywhere in the basin - not just forecast points												2014-2015	Johnson	Webb		NWS Western Region, CNRFC, and MTR WFO		x			

A the second and	Cridded Frent and /	Concepto allanonazione	 	- T T	- T	1	- T	1	2014 2015	Daviast	Markele	<u>т</u> .	1140	L			
Automated		Forecasts allow water							2014-2015	Reynolds	Webb		IWS	x	×	x	
Digital Frost	forecasts for Russian	agency to plan for											Vestern				
Forecast	River basin, CA	reservoir releases to										R	legion,				
System		accommodate crop										S	onoma				
		spraying to mitiage for										C	County				
		frost/heat. Growers											Vater				
		can augment storage											gency,				
		ponds prior to event to											onoma-				
		mitgate drawn-downs										N	/lendocino				
		in tributaries and										C	County				
		mainstem Russian on										g	rape				
		frost days. Goal is to											rowers,				
		elimi										-	Vestern				
		emm															
													Vx Group				
													nd Fox				
											1	v	Veather -	1	1	1	
												C	Commerica				
													wx		1	1	
													orecast				
												v	endors for				
C-LIM tropical	Empirical model yielding	CLIM will provide a nice							End of FY15Q4	Newman	Webb	Ň	IOAA/NW	×			
forecasts		complement and											/CPC	~			
TOTECASES		alternative for the										5	/CrC				
	forecasts of forecast																
		forecast of anomalous															
	running means) of	tropical convection to															
	tropical SSTs, OLR, and	that produced from															
	200/850 mb winds, for	purely physical models															
	forecast leads of 5-270	(i.e. CFS, etc.). CPC is															
		already using the C-LIM															
	uays.																
		to aid the NWS															
		operational Global															
		Tropics Hazards and															
		Benef															
											1			1	1	1	
Air quality	A set of codes to	Post-processing of							2014-2015	Djalalova	Webb	l N	WS/Natio	x	1	x	
PM2.5 post-		PM2.5 forecasts greatly							2010	e jaiaiova			al Center	^	1	Â	
											1			1	1	1	
processing	NOAA/NCEP CMAQ air	improves model									1		or	1	1	1	
algorithms.	quality model for ozone	forecast skill, and an									1		nvironme	1	1	1	
DjalalovaIrina	and particulate matter	automated analog post-									1	n	ital	1	1	1	
	forecasts through	processing scheme									1	Р	rediction,	1	1	1	
	application of analog	reduces the need for									1		PA, state	1	1	1	
		state and local air									1		nd local	1	1	1	
											1			1	1	1	
	processing schemes	quality forecasters to									1	-	ir	1	1	1	
		apply their own									1	n	nanageme	1	1	1	
1		subjective corrections									1	n	t disctricts	1	1	1	
		to the model forecasts									1			1	1	1	
											1			1	1	1	
	1								1		1			1	1	1	l

			Mov	Lifecy (definition)	cle Phase ed below) Mc	ving To	_	FY16 Target	t	Ou	it-Year Target		Expected							Type of R2X	t		
Transiton Project Name	Description	Purpose	R e s e l e a r c h	DDA eep vmp eol ini osc ota inra i	R e v e s e a r h e	D e m o n s t r a	A P I I C a t	02 03	04 8	FY17 FY1	18 FY19 FY20) FY21	Transiton Completion Date (FY/Q)	OAR Point of Contact (@noaa.gov)	OAR Responsible SES	OAR Contributing Partners	Customer(s)	A clear statement of what condition(s) must be met for the transition to be considered completed.	Operations	s Commerical	Other	Estimated Cost of R2X Transition (SK)	Comments
Atmosphere-Ocean P Annual Updates to Climate Change Web Portal	coesses - Alexander/Dias The climate Change Fortal is web based system (http://www.exit.neaa.gov/god/(pcc)) for visualiting model supplu used to simulate historical and future projections of the climate system. The portal was deployed in 1971 but is updated with enhancements annually.	The web portal provides scientists, resource managers, and stakeholders a framework to evaluate and interpret the models to comparing them to observations (landifivers portion) during the historic record and view how they project climate change in the future. To this end, Federal water and future managers have allered yued this loci in decision making processes.		x			x		x	x x	x x	×	FY16/04	Michael.Alexander	Webb		Federal water and fisheries managers (e.g. NMFS)		x		×		Need entry here - what update is being transitioned?
Attribution and Predi	ctability Assessments - Perlwitz/Barsugli																						
ENSO Situational Awareness	ENSO monitoring and impact assessment	To provide knowledge of the state of EBSO, give context to EBSO forecasts, and provde assessment of risks		x			x x	x x	×				FY16/Q4		Webb		CPC: NIDIS and their EWS; WWA; RCSDs; FEWSNET;				x		Ongoing knowledge transfer to a wide range of stakeholders and resource managers.
Direct covariance fluxes	vations and Processes - Fairall/Bianco Develop, test, and deploy a low-power direct covariance flux system for buoy operation. Transfer to a commercial entity the PSD air-sea	Improve accuracy of flux estimates from NOAA buoys for climate reference. NMP comparisons, and latellitic CAL/VMC areas of a mature technology To provide broader access of a mature technology to the public, private and academic sectors	,	k		x					x		FY19/Q4	Chris.Fairall	Webb	M. Cronin PMEL, J. Keene NDBC	CPO/COD, NDBC	Certification by NDBC	x				Proposal submitted to CPO/COD TPOS202, Item can recoved if proposal is not funded. PSD is currently working with the NOAA Technology
	flux system	to the public, private and academic sectors		x			x			x			?	Chris. Fairall	Webb		and other public, private and academic entities (e.g., Universities)	commercial entity		x			Partnerships Office (TPO) to explore the market potential of this technology, TPO will advise on necessary steps. Item can be removed if TPO determines transfer is not feasible.
Dynamics and Multisc Direct-TV Signals of Opportuntly	ale Interactions - Voronovich/Compo The amplitude/strength of Direct-IV signals is influenced by path-integrated liquid water (IW), which, in principle, provides a means of measurin this innortant strensoberic variable with either	This technology can potentially provide regional/national network-scale ILW water measurements to complement current GPS Integrated water waper measurements.																The technology is transitioned to an operational or commercial entity that provides regional/national network-scale IUM measuremeters)	r				PSD has initiated a collationation (pending finalization of contract) with The Ohio State University to have two Matters- level students construct two Direct-TV-spe Ku band receivers that will enable PSD contents to test the the proposed concept.
	this important atmospheric variable with either commercial or relatively inexpension reproductions of Direct-TV receiving antennas. This project involves the development of a Direct- TV type of receiver and a demonstration of its potential for measuring ILW.		×		*				×				FY20/Q4	alexander.voronovich	Webb					x			
Forecast and Modelin	g Development - Whitaker/Pegion																						
Referencests and Reanalyses Ensemble Kalman Filter Data Assimilation System	Transition of a capacity for generating global medium-range reanalyses and reforecasts Annual updates to an ensemble-based data	Grantacially improved weather and weather- climate forecast guidance supported by reforecast data sets and their use in statistical post- processing. Improved accuracy of forecast initial conditions, which improves forecast skill		x			x			×			FY17/Q2 initial	Tom.Hamili	Webb		NCEP/EMC		x				There is not yet complete hunding for the production of a next- generation reanalysis, only for the preliminary steps of setting up an observation database, performing experiments on the configuration, and setting methods for defining with absorbing system to augure one time. We accurate the absorbing of the system of the system of the system project that will allow us a bushally perform the next- generation reanalysis/effortacast (in conjunction with NWS pathers), unplemented in KEP operations KAY 2023, further improvements in ubstrayeuting adds.
Data Assimilation System Stochastic Parameterizations of Model Uncertainty	Annual updates to an ensemble-based data assimilation technique that incorporates flow- dependent estimates for forecast uncertainty. Became operational at NCEP in 2012. Improves the representation of model uncertainty in ansamble forecast, improving forecast reliability and analysia accurage. Became operational in the and analysia accurage. Became operational in the med GEPS.	Improved reliability of forecast ensembles, improved analysis accuracy.		x			x		×	x x	× ×	×	implementation in Q3FY12, with annual upgrades. FY14/Q4 (implement in the DA cycle) FY17/Q4 (implement in the GEFS)	Jeffrey.S.Whitaker	Webb		NCEP/EMC NCEP/EMC		x				In subsequent upgrades. Implemented in NCIP operations in 2014 for the EntP analysis cycle, preparing for implementation in the medium range global ensemble system in 2017.
4D Incremental Analysis Update for global data assimilation 4D Ensemble-Variational Data assimilation	improve the retention of analysis increments in the forecast system by smoothly introducing them into the forecast model during the assimilation window. With NCEP collaborations, test and implement a 40 upgrade to the operational 30 Ensemble- Variation DA system Under the NWS Mational Blend of Models, will	Improved use of observations in the analysis system, improved forecasts.		x			x x	x		×			FY17/Q1 FY16/Q3	Jeffrey.S.Whitaker	Webb		NCEP/EMC NCEP/EMC		x				
Post-Processed Precipitation Guidance Hydrometeorology an Streamflow Forecasts	transfer improved methods for post-processing of precipitation variables to NWS d Modeling Applications - Cifelli/Hughes	of precipitation-related variables		x			x			*			Ongoing, with next transition ~ Q2 FY2017	Tom.Hamill	Webb		NCEP/MDL	The distributed forecast model must be	x				Using USWIP Funding, the model performance is surveying
owner in the second sec	Distributed hydrologic model applied to Russian River basin, CA	Provides streamflow everywhere in the basin - not just forecast points		x			×			×			FY18/02	Lynn.Johnson	Webb		CNRFC, and MTR WFO	Ine distribution rorecast model must be running in the CMFF/EWS operational environment at either the CNRFC or the Monterey, CA WFO	x			\$200k	Using USIMP funding, the model performance is currently being evaluated by stakeholders (VPC, ONRYC, CA Dept of Water Resources) and a concept of operations to run the model in parallel with the BFC-Transport model is being developed. Visualization tools are also being developed to developed. Visualization tools are also being developed to developed t

Automated Digital Frost	Gridded frost and heat forecasts for Russian River	Forecasts allow water agency to plan for reservoir	1 1		1 1		1 1	1		1					ŀ	WS Western Region,	Frost/Heat forecast system runnning in				Funding required to move this beyond the demo
Forecast System	basin, CA	releases to accommodate crop spraying to mitiage for frosthet. Crowers can augment storage ponds prior to event to mitgate drawn-downs in tributaries and mainstem Rays and on the drawn-downs in tributaries and mainstem Rays. Coal is to eliminate any fish strandings to restore endangered salmon species in Russian.		×			x	x			F	FY16/04	David. Reynolds	Webb	5 7 8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	onoma County Wate gency, Sonoma- tendocino County rape growers, Vestern Wx Group nd Fox Weather - ommerical wx precast vendors for ounties.	AWIPS II environment which the NWS Weather Forecast Office in Monterey, CA or Western Region.	x	x	x	phase. The transition to NWS will require endor NWS HQ.
Evaporative Demand Drought Index (EDDI)	index for drought monitoring and early warning as well as fire risk	Improved early warning for drought and "flash drought" as well as quantitative assessment for fire risk		x			x		×		F	FY19/Q3	Mike Hobbins	Webb	1	WS/National Wate Center	EDDI running fully autmoated at NWC producing forecasts	x			Funding required to move this beyond demonstr \$900k Funding may come through RTAP, if proposal a (submitted Dec. 2015)
(-													
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(-												
	bservations and Processes - White/Jackso																				
Sea Surface Temperature Diurnal Warming Amplitude Estimates Improved Wind Profiler	Modeled global estimates of instantaneous SST diurnal amplitude based on NWP analyses for incorporation in operational Gobal SST analysis	Improved SST product accuracy enabled by correction for diurnal warming influences on individual satellite retrievals		×			×	×				FY16/Q4	Gary.Wick	Webb		NESDIS		×			NESDIS Algorithm Readiness Review scheduled for la product operationalization to follow
Improved Wind Profiler Signal Processing	Improved wind profiler singal processing is needed to remove increasingly evident contaminating signals caused by radio frequency interference, ground clutter, and migrating birds			x		×		×				FY16/Q4	Daniel.Gottas	Webb		NWS, DOE, other	Improved signal processing algorithm is deployed on wind profillers	x	x	x	
AWIPS-2	In transition from XWIPS-1 to XWIPS-2, the capability to display wind profiler data was lost. PSD is developing a standalone version of XWIPS-2 to enhance the RZX process and will deomonstrate the capability to display wind profiler data on this modernized NWS platform.	wind profilers		x		x		×			F	FY16/Q4	Daniel.Gottas	Webb	GSD	NWS	Wind profiler data display capability is implemented on PSD standalone AWIPS-II platform	x			
í																					
I					_		_	 _	_												
(-												
 																					
Polar Observations ar	nd Process - Uttal/Shupe	1																			
Sea Ice Forecasting	The RASM-ESBL model produces regional 5-day to forecasts and hindcasts for the Alaka and Arctic region to understand physical processes impacting sea-ice forecast. Validation, skill metrics, and comparisons with other NOAA and Navy forecast models will be completed in 2016.	Improve understanding and model representation of coupled ice-ocean-atmosphere processes to better predict sea ice on the 0-10 day time scale		x			x	x			F	FY16/Q4	Janet.Intrieri	Webb		NWS Alaska Region		x			
An Arctic Data Pontal	The IASOA data portal uses a metadata harvesting technique to link users to over 900 data sets from 10 observatories related to properties of the Arctic Atmosphere. The data set will be expanded to include additional international data and a faceted	observation-based Arctic research and initialization/assimulation/validation of models that further process understanding of the Arctic		x		×		×			F	FY16/04	Taneli.Uttal Sandy.Starkweather	Webb	GMD	International Research	An Arctic Data portal that will provide comprehensive metadata and access to atmospheric data sets collected at a pan- Arctic system of observatories.			x	New Report Describes Progress and Promise of Approach to Archite Research (https://www.whitehouse.gov/biog/2015/12/14/n describes-progress-and-promise-interagency-ap research) Cyberinfrastructure and Collaboratory Support Interation of Arctis Amoscheins Research
	include additional international data and a faceted search tool will be implemented.												1								(http://dx.doi.org/10.1175/BAMS-D-14-00144.1)
	inclue aotional international data and a raceted search tool will be implemented.																				(http://dx.doi.org/10.1175/BAMS-D-14-00144.1)
	incluse additional international data and a faceted search tool will be implemented.																				(http://dx.doi.org/10.1175/BAMS-D-14-00144.1)
	include additional international casa and a taceted search tool will be implemented.																				Integration or Ancion Anticophetic Research (http://dx.doi.org/10.1179/EPAMS-D-14-00144.1)
	include additional international capa and a taceted search tool will be implemented.																				Integration or Arctic Antrodynetic Research (http://dx.doi.org/10.1175/BAMS-0-14-00144.1)
	include additional international data and a faceteed search bod will be implemented.																				International Control of Control Contr

Mission Function	NOAA Readiness Level (RL)	Readiness Levels Defined
	1	Basic research and/or development principles observed and reported
Research	2	Formulation of concept for operations, application, commercialization or other uses for societal benefits
	3	Proof-of-concept (viability established)
Development	4	Validation of system, process, product, service, or tool in laboratory or other experimental environment
	5	Validation of system, process, product, service, or tool in relevant environment
	6	Validation of system, process, product, service, or tool in relevant environment (potential demonstrated)
Demonstration	7	Prototype demonstrated in an operational or other relevant environment (functionality demonstrated in pseudo real world environment)
	8	System, process, product, service, or tool completed and "mission qualified" through test and demonstration in operational or other relevant end- to-end environment (functionality demonstrated)
Application	9	System, process, product, service, or tool approved for deploymen/application and use in decision making (transition complete)

			Mov	ving from	n 1	Moving to	Tar	get Actu	al Targe	t Actual	Target	Actual T	arget A	ctual			Targ	ets							condition must be	Type of R2 (Chi	A pose all applica	ible)	Cost of R2A Transition	
Identifier (Name of Parent Project) Atmosphere-Ocean	Brief Description Processes - Alexander/Dias	Statement of intended purpose	Re vé se oj arc m h ni	e De el mo p nst re rat t ion	Op era tio ns Re or se Ap arc h cat ion s	De De vel mo op nst me rat nt ion	Op era tio ns or 1 Ap Q pli cat ion s	7 17 11 Q1	17 Q2	17 Q2	17 Q3	17 Q3	17 Q4	17 Q4	Why was the target missed? When will the target be completed? What is the risk of missing the target?	18	19 20) 21	22	Date Completed Fiscal year and quarter the project will splications	OAR Point of Contact	OAR Responsible SES	OAR Contributin g Partners	Customer	met for the product advanceme nt to have been made. This should be sufficient to allow a knowledgea ble observer to evaluate whether the	Operations	Commercial	Other	Funding amount to move the project into operations/ applications (Only the profile shift and NOT the total funding amount.)	Comments
Climate Change Web Portal	The Climate Change Portal is web-based system (http: //workdi/wcb/ for visualizing model output used to simulate historical and future projections of the (imate system. The portal was deployed in PY13 but is updated with enhancements annually.	scientists, resource managers, and stakeholders a framework to evaluate and interpret the models by comparing thent to observations (and/rivers portion) during the historic record and view how they project climate change in the future. To this end, Federal water and fisheries managers have already used this tool in decision making processes.		x			x						x			×	xx	x	×	FY16/Q4	Michael. Alexander	Webb		Federal water and fisheries managers (e.g. NMFS)		x		x		
	dictability Assessments - Perl																			PHC (04		Webb								Opening languisting transfer to a with more of
Awareness	ENSO monitoring and impact assessment servations and Processes - Fai	the state of ENSO, give context to ENSO forecasts, and provde assesment of risks		×			×		×		x		×							FY16/Q4		Webb		CPC; NIDIS and their EWS; WWA; RCSDs; FEWSNET;				x		Ongoing knowledge transfer to a wide range of stakeholders and resource managers.
Direct covariance fluxes from NOAA NDBC Tropical	Develop, test, and deploy a low-power direct covariance flux system for buoy operation.	Improve accuracy of flux estimates from NOAA buoys for climate reference, NWP comparions, and satellite CAL/VAL	×	¢		×											×			FY19/Q4	Chris.Fairall	Webb	M. Cronin PMEL, J. Keene NDBC	CPO/COD, NDBC	Certification by NDBC	x				Proposal submitted to CPO/COD TPOS202. Item can removed if proposal is not funded.
PSD Air-Sea Flux System	Transfer to a commercial entity the PSD air-sea flux system	To provide broader access of a mature technology to the public, private and academic sectors		x			x									x				\$	Chris.Fairall	Webb		Various operational and other public, private and academic entities (e. g., Universities)	Documente d transfer of technology to a commercial entity		x			PSD is currently working with the NOAA Technology Partnerships Office (TPO) to explore the market potential of this technology. TPO will advise on necessary steps. Item can be removed if TPO determines transfer is not feasible.
	iscale Interactions - Voronovi																													
of Opportuntiy	The amplitude/strength of Unrect.7V signals is influenced by path- integrated liquid water (LUM, which, in principle, provides a means of measuring this important atmospheric variable with either commercial or reactively integensive reproductions of Direct.7V type of receiver and a development of a Direct.7V type of receiver and a demonstration of Its UN.	This technology can potentially provide regional/national network- cale LIW water measurements to complement current CPS integrated water vapor measurements.	x			x							x							FY20/Q4	Alexander. Voronovich	Webb			The technology is transitioned to an operational or commercial entity that provides regional/nat ional network- scale ILW measuremte nts.		x			
Reanalyses	Transition of a capacity for generating global medium- range reanalyses and reforecasts	Dramatically improved weather and weather- climate forecast guidance supported by reforecast data sets and their use in statistical post-processing.		x			×									x				FY17/Q2	Tom.Hamill	Webb		NCEP/EMC		x				here is not yet complete funding for the production of a next generation reambylis, doi/ here and the preliminary steps: of earling up an observation database, performing experiments on the configuration, and testing methods for dealing with bioenvalues system changes over time. We anticipate matching funds in the future from the subsessional prediction project that wall allow us to reambylic/inforceast (in conjunction with NWS
Ensemble Kalman Filter Data Assimilation System	Annual updates to an ensemble-based data assimilation technique that incorporates flow-dependent estimates for forecast uncertainty. Became operational at NCEP in 2012.			×			×						x			×	x x	x	×	initial implementation in Q3FY12, with annual upgrades.	Jeffrey.S. Whitaker	Webb		NCEP/EMC		x				Implemented in NCEP operations May 2012, further improvements in subsequent upgrades.
	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. Implement in the GEFS.	Improved reliability of forecast ensembles, improved analysis accuracy.														x				FY14/Q4 (implement in the DA cycle) FY17/Q4 (implement in the GEFS)	Jeffrey.S. Whitaker	Webb		NCEP/EMC		x				Implemented in NCEP operations in 2014 for the EnKF analysis, che, orpsparing for implementation in the medium range global ensemble system in 2017.
4D Incremental Analysis Update for global data assimilation	Improve the retention of analysis increments in the forecast system by smoothly introducing them into the forecast model during the assimilation window.	Improved use of observations in the analysis system, improved forecasts.		×			x									×				FY17/Q1	Jeffrey.S. Whitaker	Webb		NCEP/EMC		x				
4D Ensemble- Variational Data assimilation	With NCEP collaborations, test and implement a 4D upgrade to the operational 3D Ensemble-Variation DA system	Improved use of observations in the analysis system, improved forecasts.		×			×				x									FY16/Q3	Jeffrey. Whitaker	Webb		NCEP/EMC		×				

Post-Processed	Under the NWS National	Improved deterministic and	×	1 1 1	×				×		Ongoing, with next transition ~ Q	2 FY2017 Tom.Hami	I Webb	N	CEP/MDL		x				1
Precipitation Guidance	Blend of Models, will transfer improved methods for post-processing of precipitation variables to	Improved deterministic and probabilistic forecasts of precipitation-related variables													. ,						
Hydrometeorology	NWS and Modeling Applications - C	ifelli/Hughes																			
Streamflow Forecasts	Distributed hydrologic model applied to Russian River basin, CA	Provides streamflow everywhere in the basin - not just forecast points	×		x				x		FY18/Q2	Lynn. Johnson	Webb	Re	estern gion, IRFC, and IR WFO	The distributed forecast model must be running in the CHPS/FEWS operational environmen t at either the CNRFC or the Monterey, CA WFO	x			\$200k	Using USW8P funding, the model performance is currently being evaluated by stakeholders (WPG), OKM7, CO Bept Ovaler Resources and a concept of operations to run the model in parallel with the KPG's "humper" model is being developed to help freecasters integret the streamflow forecasts, especially for uncertainty estimation.
Automated Digital Frost Forecast System	Gridded frost and heat forecasts for Russian River basin, CA	Foresats allow water agency to plan for reservic releases to accommodate crop spraying to mitige for frost/heat. Growers can agement storage ponds prior to even it to mitigate drawn-downs in tributaties frost drawn-downs in tributaties frost drawn drawn drawn drawn- frost drawn drawn drawn drawn frost drawn drawn drawn drawn frost drawn drawn drawn drawn frost drawn drawn drawn drawn frost drawn drawn frost drawn drawn frost drawn drawn frost drawn fro	x		x		×				FY16/Q4	David. Reynolds	Webb	WW Re Re Co Co WW Ag So MM Co gra gra gra gra Gra Gra Gra Gra Gra Gra Gra Gra Gra G	VS estern gion, noma unty ater ency, noma- endocino unty ape estern Wx oup and	Frost/Heat forecast system runnning in AWIPS II environmen t within the NWS Weather Forecast Office in Monterey, CA or Western Region.	x	x	x	\$100k	Funding required to move this beyond the demonstration phase. The transition to NWS will require endorsement from NWS HQ.
Evaporative Demand Drought Index (EDDI)	Index for drought monitoring and early warning as well as fire risk	drought and "flash drought" as well as quantitative assessment for fire risk	×		x					x	FY19/Q3	Mike Hobbins	Webb	NV	VS/Nation I Water Center	EDDI running fully autmoated at NWC producing forecasts	х			\$900k	Funding required to move this beyond demonstration phase. Funding may come through RTAP, if proposal awarded (submitted Dec. 2015)
Hydrometeorology Sea Surface	Observations and Processes - Modeled global estimates of						x				FY16/04	Gary.Wick	Webb		NESDIS		x				NESDIS Algorithm Readiness Review scheduled for
Temperature Diurnal Warming Amplitude Estimates	instantaneous SST diurnal amplitude based on NWP analyses for incorporation in operational Gobal SST analysis	accuracy enabled by correction for diurnal warming influences on individual satellite retrievals	×		x		×										x				NESDS Algorithm Readness Review Scheduled for late in FY 2015; product operationalization to follow
Improved wind profiler signal processing	Improved wind profiler singal	To provide the highest quality real-time wind profile data to end users	x		×		×				FY16/Q4	Daniel. Gottas	Webb			Improved signal processing algorithm is deployed on wind profiilers	x	x	x		
	display wind profiler data was lost. PSD is developing a standalone version of AWIPS-2 to enhance the R2X process and will deomonstrate the capability to display wind profiler data on this modernized NWS platform.	profiler data, including data	x		x		×				FY16/Q4	Daniel. Gottas	Webb	GSD		Wind profiler data display capabiltiy is implemente d on PSD standalone AWIPS-II platform	x				
	and Process - Uttal/Shupe The RASM-ESRL model	I many and a strend in a set									FY16/Q4	lanat late's	- 10.44		MC Alaska						
Sea Ice Forecasting	produces regional 5-day ice forecasts and hindcasts for the Alaska and Arctic region to understand physical proccesses impacting sea-ice forecast. Validation, skill metrics, and comparisons with other NOAA and Navy forecast models will be completed in 2016.	Improve understanding and model representation of coupled ice-ocean- atmosphere processes to better predict sea ice on the 0-10 day time scale	×		X		x					Janet.Intrie			VS Alaska Region		x				
An Arctic Data Porrial	The HSOA data portal uses a metadata harvesting technique to link users to over 90 data sets from 10 observatories related to properties of the Arctic Atmosphere. The data aet will be expanded to include ta and a facetted search tool will be implemented.	sets allows for both observation-based Arctic research and initialization/assimulation/v alidation of models that further process understanding of the Arctic environment and linkages					x				FY17/Q4	Taneii Utt Sandy. Starkweath r	e Vebb	GMD Int	Research	An Arctic Data portal that will provide comprehens ive metadata and access to atmospheric data sets collected at a pan-Arctic system of observatorie 5.			x		New Report Describes Progress and Promise of Interagency Approach to ArcLit Research (https: //www.whitehouse.gov/bag/2015/12/14/new- report-describes-gorgess-and-promise-interagency- approach-arcLit-coregores.ind-promise-interagency- approach-arcLit-chamoplere (https:// https://dx.doi.org/10.1175/RMMS-D-14-00144.1)

			Lifecy		Lifecyc	le Ti	arget	Actual	Target	Actual	Target	Actual	Target	Actual		Targe	is							A clear statement of what	(Cho	Type of R2A ose all applicat	ble)	Cost of R2A Transition		
ldentifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development	Demonstration Operations or Applications	Development	Applications	18 Q1	18 Q1	18 Q2	18 Q2	18 Q3	18 Q3	18 Q4	18 Q4	19 2	0 21	22	23	Date Completed Fiscal year and quarter the project will transition to operations	OAR Point of Contact	OAR Responsi ble SES	Contributing Partners	Customer	A clear statement or what condition must be met for the product advancement to have been made. This should be sufficient to allow a knowledgeable observer to evaluate whether the advancement has been achieved.	Operations	Commercial	Other	Funding amount to move the project into operations/ applications (Only the profile shift and NOT the total funding amount.)	Comments	Weather Act
	Finalize a CRADA with Radiometrics, Inc., to commercialize PSD's snow-level radar technology	Transfer of federally developed technology into commercial sector		x		x							x						FY18, Q4	White	Webb	CIRES	Radiometrics	Signed CRADA		x			There is currently some concern about getting the CRADA signed by the end of the fiscal year due to a lack of available labor force to execute manufacture process at commercial partner (80 % probabitly of completion)	
	Develop experimental HRRR data to use to inform Probable Maximum Probable estimation in CO-NM Dam Safety Study	Develop model-based precipitation products to inform dam safety risk minimization and prototype future improvements to Probable Maximum Precipitation generation methods	x			с —					x								FY18, Q3	Mahoney	Webb	ESRL GSD	Colorado, New Mexico Divisions of Dam Safety	High-resolution Rapid Refresh (HRRR) and other dynamical model produced grids of maximum precipitation, precipitation type, and historical extreme events diseeminated to project sponsors and incorporated into user software utilities	x	x			The "Lifecycle Phase Moving to" is likely somewhere between "Development" and "Demonstration." Products do exist and have already been demonstrated. They are a prototype though, and in that sense are an "experimental tool"	
	Transition to NCEP an updated Kalman-Filter Analog (KFAN) bias correction method for ozone and PM.25 forecasts from the operational CMAQ air quality model.	Improve NWS air quality forecasts		x		x							x						FY18, Q4	Wilczək	Webb		NWS, State and local forecasters, public	Bias -corrected gridded ozone fields created for each forecast cycle tested and evalauted by NCEP and incorporated into oeprational NCEP air quality forecasts	x				Forecast grids have already been transitioned to and tested and evaluated by NCEP but still are waiting on higher level sign-off to opertionalize.	
	Transition the Evaporative Demand Drought Index (EDDI) to an operational status at the National Water Center.	Provide a service for drought early warning, and ongoing drought monitoring to stakeholders affected by agricultural, hydrologic, and ecological drought, and at wildfire risk		x		x									×				FY19, Q3	Hobbins	Webb	Desert Research Institute & NOAA- National Water Center	NOAA-	EDDI running at National Water Center and providing user-queryable drought monitoring andf ancillary information to stakeholders	x				Target date for complete transition to NWC is May 2019.	
	Develop and transition to operations improved methods for postprocessing of precipitation related variables using multi- model ensembles under the National Blend of Models project.	Develop statistically postprocessed, high- resolution multimodel ensemble guidance to provide National Weather Service forecasters with a calibrated, downscaled starting point for producing digital forecasts.		x		x			x										FY18, Q2	Hamill	Webb		NWS/NCEP	Algorithms tested and delivered for implementation in initial version of NBM QPF product	x					
	The first-generation stochastic physics package from the NOAA Environmental Modeling System/Global Spectral Model (NEMS/GSM) will be ported to new NEMS dynamical core (FV3) to better represent model uncertainty in ensemble forecasts.	Improved representation of model uncertainty in the NOAA Global Ensemble Forecast System (GEFS)		x		×			x										FY18, Q2	Whitaker	Webb			Stochastic physics parameterizations implemented in time for use in beta implementation of FV3GFS data assimilation system and FV3GEFS reforecasts	x					
	ESRL/PSD is a co- developer of the NOAA operational ensemble- variational data assimilation system. This project supports ongoing development and maintenance of the code, and testing of new algorithms, in collaboration with NCEP/EMC.	Improved analyses and forecasts in the operational NCEP Global Forecast System (GFS)		x		x			x										FY18, Q2	Whitaker	Webb		NWS/NCEP	Code developed, tested and integrated into the master repository for the NCEP Global Statistical Interpolation System. Experiments performed and analyzed to quantify the impact of the code changes.	x					
	Demonstrate and provide forecast guidance products (daily during fall freeze up period - 01,04) of sea ice, atmosphere, ocean conditions for the Arctic Basin on 0-10 day scales.	sea ice and Arctic conditions during Arctic fall freeze-up period		x		x	x	x					x	x	×				FY19, Q3	Intrieri	Webb	NWS Arctic Testbed	NWS	Adoption by NWS of current experimental sea ice forecasting capability.	×					
	Develop, produce, and release a new modern-era high-resolution atmospheric global reanalysis and reforecast to facilitate the generation of high-quality operational post- processed model guidance by the National Weather Service	Improve NWS operational forecasts		x		x									x				FY19, Q3	Hamill	Webb	NCEP OAR/CPO	NCEP CPC and EMC, as well as NWS forecast offices	Provide datasets needed to post-process operational global ensemble forecasts to provide calibrated probabilities to the public.	x					

				ecycle ing fro	m N	ifecycl Ioving		Target	Actual	Target	Actual	Target	Actual	Target	Actual		Targe	ets							A clear statement of what	(Choc	Type of R2A ose all applicat	ole)	Cost of R2A Transition		
Identifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research	Demonstration	Operations or Applications Research	Development Demonstration	Operations or Applications	18 Q1	18 Q1	18 Q2	18 Q2	18 Q3	18 Q3	18 Q4	18 Q4	19 2	0 21	22		Date Completed Fiscal year and quarter the project will transition to operations	OAR Point of Contact	OAR Responsi ble SES	Contributing Partners	Customer	condition must be met for the product advancement to have been made. This should be sufficient to allow a knowledgeable observer to evaluate whether the advancement has been achieved.	Operations	Commercial	Other	Funding amount to move the project into operations/ applications (Only the profile shift and NOT the total funding amount.)	Comments	Weather Act
	Develop, produce, and release a new version of the 20th Century reanalysis (version 3) to better represent extreme events and characterize their uncertainty back to 1850.	See column B		x			×									x				FY19, Q3	Compo	Webb	CIRES, NCEI, PMEL	climate researchers, federal, private sector and academic	A dataset is made available to climate researchers that includes 3-hourly gridded fields back from 1850-present.			x			
	Provide quarterly services to better inform regional decision makers on evolving climate conditions and extreme events (NIDIS)	See column B	x				x	x	x	x	x	×	x	x	x					Ongoing	Hoell	Webb	NIDIS	NIDIS Federal Partners	Understand characteristics and predictability of Northern Plains Drought and apply to seasonal forecasts used by NIDIS partners			x		This is an FY18-19 project in which we use the case of the 2017 Northern Plains drought to motivate examination of the causes and predictability of all droughts over the region (FY19, Q1 end date)	
	Provide quarterly services to better inform regional decision makers on evolving climate conditions and extreme events (FEWSNET)	See column B	x				x	x	x	x	x	x	x	x	x					Ongoing	Hoell	Webb	USGS NASA USAID	USAID Famine Early Warning System Network	Understand predictability of African and Asian drought and apply to seasonal forecasts used by food security analysts			x		This is an ongoing collaboration in which we examine predictability of drought and use that information to advise food security analysts famine outlooks that are then used by the U.S. government to mobilize aid	
	Develop a new version of the Climate Change Web Portal	Provide accessible climate variability and change information to fisheries and water resource managers								x	x									FY18, Q2	Alexander	Webb		NMFS, fishery and water managers		x	x	x			
	Improve stratospheric ozone in GFS	Upgraded Naval Research Laboratory's CHEM2D-OPP stratospheric ozone parameterization in NCEP GFS system		x			x								x	x			F	FY19, Q2	Compo	Webb	EMC, NRL, CPC, SUNY- Albany	NCEP/NOA A	The parameterization is currently in parallel testing in the new FV3GFS and will be included in the operational implementation FV3 GFS	x					
	Improve stratospheric water vapor in GFS	Included Naval Research Laboratory's CHEM2D-OPP stratospheric water vapor parameterization in																					EMC, NRL, CPC, SUNY-	NCEP/NOA	The parameterization is currently in parallel testing in the new FV3GFS and will be included in the operational implementation FV3						
	Testing channel loss parameterization in the National Water Model	NCEP GFS system This is NOAA Joint Technology Tranfer grant funded research that seeks to improve National Water Model performance in arid climate regimes by simulating water losses in river channels.		x			x								x	x				FY19, Q2	Zamora	Webb	Albany University of Arizona, OWP	OWP	GFS The parameterization will be included in the 2021 National Water Model Operational NCEP Update after parallel tesing in 2020.						

				cycle	Life	cycle	Targe t	Actual	Target Act	ual Tarj	get Actual	Target	Actual	Out-Y	ear Tai	rgets							(Choo	Type of R2A ose all applica	ble)	Cost of R2A Transition		
Identifier (Name of Parent Project)	Brief Description	Statement of Intended purpose	Research	Demonstration	Operations of Applications Research Develomment	Demonstration Option	suonpriddy io suonprado	FY19 Q1	FY19 FY19 Q2 Q3	PY: Q	19 FY19 3 Q3	FY 19 Q4	FY19 Q4	20 21	22	23 24	Date Completed Fiscal year and quarter the project will transition to operations	PSD Point of Contact	OAR Responsible SES	Contributing Partners	Customer	A clear statement of what condition must be met for the product advancement to have been made. This should be sufficient to allow a knowledgeable observer to evaluate whether the advancement has been achieved.	Operations	Commercial	Other	Funding amount to move the project into operations/ applications (Only the profile shift and NOT the total funding amount.)	Comments	Weather Act
EDDI	Transition the Evaporative Demand Drought Index (EDDI) to an operational status at the National Water Center.	Provide a service for drought early warning, and ongoing drought monitoring to stakeholders affected by agricultural, hydrologic, and ecological drought, and at wildfire risk		x		x	r						x				FY19, Q4	Hobbins	Webb	Desert Research Institute & NOAA- National Water Center	NOAA- National Water Center	EDDI running at National Water Center and providing user- queryable drought monitoring andf ancillary information to stakeholders	x				Target date for complete transition to NWC is May 2019.	
NGGPS Improvements	ESKU-PSO has developed parameterizations of model uncertainty in the NCEP operational global ensemble forceast system. These parameterizations are crucial for producing accurate sat representations with the data assimilation cycle both the data sassimilation cycle and the ensemble prediction system. This project supports ongoing development aimed at improving these parameterizations, in collaboration with KCEP/KMC.	Improved representation of model uncertainty in the NOAA Global Ensemble Forecast System (GEFS)		x		x	ſ					x					FY19, Q4	Whitaker	Webb		NWS/NCEP	Stochastic physics parameterizations for use in beta implemented in time for use in beta implementation of FV3GF5 data assimilation system and FV3GEFS reforecasts	x					
NGGPS Improvements	ESKU/SPO has developed the Escuel/SPO has developed the Encemble Xiama Titler (EnK7) component for the operational global data assimilation system. The EnK7 is used to update an ensemble of forecasts in the data assimilation cycle, and that ensemble is used to estimate background error covariances needed by the data assimilation update. This project assimilation update. This pr	Improved representation of background errors in the operational data assimilation system, leading to improved use of observations, improved analyses and forecasts.	x			x						x					FY19, Q4	Whitaker	Webb		NWS/NCEP	Improvements to the operational data assimilation system tested and merged in time for the code frezea ahead of the next operational FV3GFS upgrade.						
NGGPS Improvements		Improve NWS operational forecasts		x		x								x			FY19, Q3	Hamill	Webb	NCEP OAR/CPO	NCEP CPC and EMC, as well as NWS forecast offices	Provide datasets needed to post-process operational global ensemble forecasts to provide calibrated probabilities to the public.	x				Due to EMC problems with their diurnal sea-surface temperature forecast algorithm, reanalysis and reforecast production is somewhat delayed and final delivery may slip to Q2FY2020.	
Arctic Sea Ice Forecasting	Produce experimental forecast guidance products (daily during fall	Improve forecasts of sea ice and Arctic conditions during Arctic fall freeze-up period	x			×				×							FY19, Q3	Intrieri	Webb	NWS Arctic Testbed	NWS/NCEP	Use by NCEP as a demonstration baseline of potential NGGPS Arctic sea ice forecast performance Adoption by NWS of current experimental sea ice forecasting capability.	x					
NGGPS Improvements	modern-era high-resolution atmospheric global reanalysis and reforecast data set to facilitate the generation of high-quality operational post-processed model guidance by the National Weather Service	Improve NWS operational forecasts		x		x	r.			×	:						FY19, Q3	Hamill	Webb	NWS/NCEP OAR/CPO	NCEP, CPC and EMC, as well as NWS forecast offices	Use of reanalysis and reforecast datasets by customers to post- process operational global ensemble forecasts to provide calibrated probabilities to the public.	x					
Soil Moisture Drought Monitoring	Prototype NOAA's National Water Model soil moisture products for drought monitoring in select NIDIS watersheds	Develop experimental soil moisture drought monitoring capability based on hourly, best available, quality-controlled NWM output.	:									x					FY19, Q4	Cifelli	Robert Webb	NWS/NWC	NIDIS	A demonstration of possible adoption of watershed-scale NWM-derived soil mositure anamoly maps by NIDIS			×			
20C Reanalysis	Develop, produce, and release a new version of the 20th Century reanalysis (version 3) to better represent extreme events and characterize their uncertainty back to 1850.	See column B		x		×	r							x			FY19, Q3	Compo	Webb	CIRES, NCEI, PMEL	climate researchers, federal, private sector and academic	A dataset is made available to climate researchers that includes 3-hourly gridded fields back from 1850-present.			x			
NIDIS	inform regional decision makers on evolving climate conditions and extreme events (NIDIS)	See column B	×			×	x		×	×	:	x					Ongoing	Hoell	Webb	NIDIS	NIDIS Federal Partners	Understand characteristics and predictability of Northern Plains Drought and apply to seasonal forecasts used by NIDIS partners			×		This is an FY18-19 project in which we use the case of the 2017 Northern Plains drought to motivate examination of the causes and predictability of all droughts over the region (FY19, Q1 end date)	
FEWSNET	Provide quarterly services to better inform regional decision makers on evolving climate conditions and extreme events (FEWSNET)	See column B	×			×	x		×	×		×					Ongoing	Hoell	Webb	USGS NASA USAID	USAID Famine Early Warning System Network	Understand predictability of African and Asian drought and apply to seasonal forecasts used by food security analysts			×		This is an ongoing collaboration in which we examine predictability of drought and use that information to advise food security analysts famine outlooks that are then used by the U.S. government to mobilize aid	
Climate Chnage Web Portal	Continue the development of the Climate Change Web Portal	Provide accessible climate variability and change information to fisheries and water resource managers		x		×			×								Ongoing	Alexander	Webb		NMFS, fishery and water managers	Interactive web-portal for displaying a suite of climate variables	x	×	x			
ENSO Stratospheric	Develop prediction systems for ocean conditions including ENSO Improve stratospheric ozone in GFS	Explore new methods for prediction of important ocean varaibles and indices Upgraded Naval Research Laboratory's CHEM2D-OPP stratospheric ozone	×		×				ž			x					FY19,Q4	Alexander	Webb	EMC, NRL, CPC, SUNY-	NWS, NMFS	Skill shown based on retrospective forecasts. The parameterization is currently in parallel testing in the new FV3GFS and will be	x		x			
Ozone	Improve stratospheric water vapor in GFS	stratospheric ozone parameterization in NCEP GFS system Included Naval Research Laboratory's CHEM2D-OPP			$\left \right $									+			1113,42	Compo	**EDD	Albany EMC, NRL,		included in the operational implementation FV3 GFS. The parameterization is currently in parallel testing in	*					$\left \right $
Stratospheric Water Vapor		stratospheric water vapor parameterization in NCEP GFS system		x		×			x								FY19, Q2	Compo	Webb	CPC, SUNY- Albany	NCEP/NOAA	the new FV3GFS and will be included in the operational implementation FV3 GFS	x					

			Lifecycle Moving from	Lifeo	ing to	Targe A	ctual Ta	irget Actu	al Target	t Actua	l Target	Actual	Out-Y	Year T	argets							(Choo	Type of R2A ose all applica	ble)	Cost of R2A Transition		
Identifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development Demonstration	tions	tions	FY19 F Q1	Y19 F Q1	Y19 FY19 Q2 Q2	FY19 Q3	FY19 Q3	FY 19 Q4	FY19 Q4	20 21	22	23 24	Date Completed Fiscal year and quarter the project will transition to operations	PSD Point of Contact	OAR Responsible SES	Contributing Partners	Customer	A clear statement of what condition must be met for the product advancement to have been made. This should be sufficient to allow a knowledgeable observer to evaluate whether the advancement has been achieved.	Operations	Commercial	Other	Funding amount to move the project into operations/ applications (Only the profile shift and NOT the total funding amount.)	Comments	Weather Act
Tes in t			x		x								x			FY20,Q2	Zamora	Webb	University of Arizona, OWP	OWP	The parameterization may be included in the 2021 National Water Model Operational NCEP Update after parallel tesing in 2020.	x			amount.)		
stri D-ICE	etermine best practice ice mitigation Trategies for broad-band radiometers	Improve monitoring of tronsdama fradiation which is a critical component of global surface energy budsets by (1) assessing current technology during cling conditions, (2) quantifying the impact of icing quantifying the impact of icing quantifying														FY19, Q4	Uttal	Webb	Industry: Delta-T, Kipp & Zonen, Hukseflux, Eppley, EKO. Insitutes: NOAA-GMD, US. Dept. of Energy-ARM, NCCAR, MeteoSwiss (Switzerland), AWI (Germany), PMOD-WRC (global standard, Switzerland), BSRN	Operators (e. g., BSRN, NOAA-GMD), engineering/ development (federal, private sector, academic), end-users (e. g., climate researchers)	Dissemination of results to end, user (via publication), operations community (via Baseline surface Radiation Network) and industry (via report to partners), as well as incorporation of results by NOA-APS for devision-making in flux systems deployed to hyph institude Attrube environments.						
wir	mall UAS sensor package to measure vinds, temps, RH, and P to derive tmospheric fluxes	Characterization of atmospheric properties needed for model validation and process studies														FY20, Q2	Intrieri	Webb	NOAA UAS	NOAA UAS	Completion and sign-off of UASPO Transition Plan						

			Lifec			ecycle		t Target	Target	Target	Fu	uture	Targe	ts									rpe of R2A	
ldentifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development	uo	Applications arch	Development Demonstration	perations or Applications 10 05A4	FY20 Q2	FY20 Q3	FY 20 Q4	21	22 2	23 24	1 25	Date Completed	PSD Point of Contact	PSD Research Team	OAR Responsible SES	OAR Contributing Partners	Customer	A clear statement of what condition must be met for the product advancement to have been made.	Operations	Commercial Other	Comments
EDDI	Complete transition the Evaporative Demand Drought Index (EDDI) to an operational status at the National Water Center.	Provide a service for drought early warning, and ongoing drought monitoring to stakeholders affected by agricultural, hydrologic, and ecological drought, and at wildfire risk		x			x x								FY20, Q2	Hobbins	нма	Webb	Desert Research Institute & Notional Water Center	NOAA-National Water Center	Reference ET and EDDI implemented at NWC.	×		Reference ET and EDDI are now being estimated at NWC using PSD-originated software, with their data to be shared with PSD (either pushed or pulled) in a raw format not usable by stakeholders; PSD will add any value for stakeholders and host the EDDI products exactly as we do currently; the NWC and PSD IT groups are finalizing the data transfer details, leaving PSD's remaining tasks to check their EDDI against ours and set up the data transfer at our end, which we anticipate being completed in Q1 of Y20.Target date for complete transition to NWC is December 2019. Completed in Q2.
NGGPS/UFS Improvements (GEFS)	ESRL/PSD has developed parameterizations of model uncertainty in the NCEP operational global ensemble forecast system. These parameterizations are crucial for producing accurate representations of forecast uncertainty for both the data assimilation cycle and the ensemble prediction system. This project supports ongoing development aimed at improving these parameterizations, in collaboration with NCEP/EMC.	Improved representation of model uncertainty in the NOAA Global Ensemble Forecast System (GEFS)		x			x			x					FY20, Q4	Whitaker	FMD	Webb		NW5/NCEP	Stochastic physics parameterizations implemented in time for use in beta implementation of FV3GFS data assimilation system and FV3GEFS reforecasts	x		
NGGPS/UFS Improvements (GSI/EnKF)		Improved representation of background errors in the operational data assimilation system, leading to improved use of observations, improved analyses and forecasts.	×			x				x					FY20, Q4	Whitaker	FMD	Webb		NWS/NCEP	Improvements to the operational data assimilation system tested and merged in time for the code freeze ahead of the next operational FV3GFS upgrade.	x		
Arctic Sea Ice Forecasting	Produce daily experimental forecast guidance products of sea ice, atmosphere, ocean conditions for the Arctic Basin on 0-10 day scales.	sea ice and Arctic conditions		x			x x	x	x	x					FY20, Ongoing	Intrieri	POP	Webb		NWS/NCEP, NIC, NWS-Alaska Region Forecast Office, Alfred Wegner Institute (MOSAiC)	Daily forecasts are posted online for use by NOAA NWS, outside partners (https://www.esrl.noaa. gov/psd/forecasts/seaice/)	x		Completed
NGGPS/UFS Improvements (Arctic)	Deliver Arctic-focused diagnostics toolkit for assessing UFS performance wrt high quality observations and provide SME analysis	Assess and improve UFS Arctic region forecast skill	x			x	x								FY20, Q1	Intrieri	POP	Webb		NCEP/EMC	Transition toolkit and analysis information to EMC UFS Development Team (POC: Avichal Mehra)	x		Completed

			Lifecyc	le	Lifecy																	Туре		
			Moving	from	Movin		rget Ta	irget Targ	et Targ	et	Futu	ire Ta	rgets									R2/	A	
ldentifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development	Uemonstration Operations or Applications	Research Development	Demonstration Deperations or Applications	Y20 FY Q1 (Y20 FY2/ Q2 Q3			1 22	23	24	25	Date Completed	PSD Point of Contact	PSD Research Team	OAR Responsible SES	OAR Contributing Partners	Customer	A clear statement of what condition must be met for the product advancement to have been made.	Operations Commercial	Other	Comments
CMAQ Improvements	Over the past several years PSD has been working Improve NCEP codes for air quality forecasts via the Community Multiscale Air Quality (CMAQ) Modeling System.	Develop post processing code for PNQ.5 and ozone for a new coupled FV3-CMAQ air quality forecast system.	x		x				×							Wilczak	BLO	Webb		NOAA NCEP	Skill shown relative to the raw FV3- CMAQ simulations.	x		Delayed because FV3-CMAQ model simulations have not yet been provided by NCEP due to problems in implementing the GFS FV3 model. Instead, promising new post-processing algorithms have been developed using the older NAM-CMAQ model, and these will be applied to the FV3- CMAQ simulations when they become available.
Temperature and Precipitation Forecast Improvements	Deployment of experimental cool-season temperature and precipitation forecasts based on a combined, lagged sea-surface temperature regression model	Provide cool-season probabilistic forecasts of temperature and precipitation based on method developed internally at PSD	,	<		x			x						FY20, Q4	Hamill	ΑΡΑ	Webb		Weather/climate community	Experimental web graphics page completed and following submitted for publication: Switanek, M. B., J. J. Barsugli, M. Scheurer, and T. M. Hamill, 2020: Present and Past Sea Surface Temperatures: A Recipe for Better Seasonal Climate Forecasts. Wea. Forecasting, 35, 1221–1234, https: //doi.org/10.1175/WAF-D-19- 0241.1.		x	
Sensor Improvements	Develop and demonstrate miniflux and microbuoy observing technologies	Advance air-sea-ice observational capability, in particular, as related to the measurement of ocean and atmosphere boundary layer fluxes to help improve our predictive understanding of these processes and their representation in climate models.	x			x		x								Intrieri	POP	Webb			Flight testing of miniFlux onboard the L3 Harris vehicle (in AZ) and from a moving ship platform (The Becker ship in FL).		x	Testing has been postponed due to COVID- 19 so the final demonstration for NOAA UASPO is still TBD
Attribution Assessments	Produce two or more attribution assessments of climate extreme events, anomalies and trends	Investigate and communicate our understanding of the causes of climate extreme events, anomalies and trends.	x			x		x	x						FV20 Q2,Q4	Hamill	АРА	Webb		Weather/climate community Decision/policy makers	Possible contributions may include: (1) BAMS paper submitted on FACTs web site maintained by PSD. (2) BAMS Explaining Extremes Events publication (coordination and editing by Hoell, Hoerling) ("Dec 2019) (2) Reattribution / reforecasting of Colorador ain of 2013: Hoerling will paresent at AGU in special session extreme events. Possible written assessment depending on interest and feedback. (a) Andy Hoell will present at the CDPW on understanding record winter/spring 2019 precipitation in the US Great Plains. Possible AMS Annual presentation as well. A Journal article is likely too, perhaps in 2020. (5) An internal document on PSD attribution / predictability data set evolution, including counter-factual submitted on "Confirmation for and Predictability of Distinct impacts of El Niño Flavors' (Tao Zhang, Hoell, Hoerling, Pewitz)		x	

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ldentifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development	lications	Development Development	plications	FY20 F Q1		/20 FY 23 C	20 21	22 2	3 24 2	Date Completed	PSD Point of Contact	PSD Research Team	OAR Responsibl SES	OAR e Contribu Partne	iting	Customer	A clear statement of what condition must be met for the product advancement to have been made.	Operations Commercial	Other	Comments
Predictability Assessments	Produce two or more predictability assessments for subseasonal to decadal time scales in order to quantify the prospects and gaps for skillful predictions, including droughts.	Investigate and communicate our understanding of the limits of predictability of subseasonal to decadal weather-climate phenomenon.	x	0		x			x	<			FY20 Q3,Q4	Hamill	АРА	Webb			Veather/climate community Decision/policy makers	Possible contributions may include: 1. Submit a proposal for an AGU Chapman Conference on "Colorado River Flow and its Climate Drivers", for the 15 March 2020 AGU call for proposals. 2. Complete analysis and prepare a manuscript on the topic The Millenium Drought on the Colorado River." 3. Preliminary results of the diagnoses of GFS reforecasts for stratospheric and precipitation. A. Some or all of GLACE protocol data for FV3 GFS system created. Possible		x	
larine Heat Waves	Examine marine heat waves, including the processes that cause them and their predictability	Survey of the processes that cause marine heat waves to improve the predictive understanding of these events. Examine the heat wave developing off the US west coast in 2019.							x				FY20, Q3	Alexander	AOP	Webb		w		Draft and submit for publication a journal paper describing the result of this study.		x	
Water Vapor Flux Tool	Add the GFS (FV3 core) to PSD's water vapor flux tool	PSD's water vapor flux tool is available at sites where PSD operates Doppler wind profilers, and more specifically, the picket fence of semi- permanent atmospheric river observatories deployed along the U.S. West Coast. The tool combines observations and numerical weather prediction output in a unique display that allows forecasters to evaluate model predictions of the the incoming flux of water vapor, the snow level, and the precipitation that result from landfalling atmospheric rivers. This effort will allow NWS forecasters to evaluate how well the GFS is predicting atmospheric river conditions several days in advance. This complements the current tool, which does the same for the HRRR and ARP models on								< .			Fγ20, Q4	Gottas	нор	Webb			Veather/climate community NWS Western Region	Implementation of of advanced capability on current website	x		Update to the tool to include the GFS was completed early in 0.2. Forecasters can now choose from the HRRR, HRRR, RAP, and GFS to compare with observations. An example can be viewed at https://www. esrl.noaa. gov/psd/data/obs/datadisplay/ViewDataTy pe.php? DataTypeID=67&SiteID=bby&DataSourceID = 1 by choosing one of the model buttons in the upper left of the display.
ATOMIC Field Program	Lead the ATOMIC field program to study shallow cumulus and air-sea interaction in the North Atlantic	shorter time scales. ATOMC is a the U.S. contribution to an international field program being conducted in Jan-Feb 2020 off Barbados. NOAA is providing a research vessel and a P-3 aircraft. https://www. esrl.noaa.gov/psd/atomic/. The purpose of the field program is to improve our predictive understanding of the phenomena and their representation in climate models.								<			FY20, Q2	Fairall	BLO	Webb	PMEL, AG		Veather/climate community	Successful completion of field study			The project was sucessfully completed in Jan 5-Feb 15, 2020. In processes of creating data archive.

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			Moving fr	om Mov		Target	Target	Target	Fut	ure T	argets								R2A	
Identifier (Name of Parent Project)	Brief Description	Statement of intended purpose	Research Development Demonstration	Operations or Applications Research Development	Demonstration Operations or Applications DOTA	FY20 Q2	FY20 Q3	FY 20 Q4	21 2	2 23	24 2	Date Complete 5	PSD Point o Contac		OAR Responsible SES	OAR Contributing Partners	Customer	A clear statement of what condition must be met for the product advancement to have been made.	Operations Commercial Other	Comments
GEFSv12 reforecast usage to improve National Blend of Models Precipitation Forecasts	Adapt code in the National Blend of Models so that it utilizes the longer training data sets available with the GEFSv12 reforecasts, and thereby produces improved precipitation forecasts	Adapt the National Blend of Models (NBM) so its precipitation postprocessing leverages Global Ensemble Forecast System version 12 (GEFSv12) reforecasts, improving precipitation product quality that anchor NWS forecast products. Starting fail 2020, the GEFSv12 will provide reforecasts that are statistically consistent with the real-time forecasts. Currently, the NBM uses only the past 60 days of forecasts for training data; this approach is especially problematic in transition seasons, warm-to-cool and cool-to-warm, when the character of precipitation forecasts shifts from convective to large scale, and back. With modest adjustments, the NBM code can be reconfigured to leverage the GEFSv12 reforecasts.	×		x				x			FY21 Q4 delivered MDL	o Hamill	APA	Webb	None	NWS MDL	Ultimate condition is the operational implementation in the NBM, but the time of this depends on MDL's implementation schedule. The ultimate delivery for PSL will be code and documentation and data suitable to MDL that provides what they need to support the operational implementation.		This was funded by OAR WPO under its precipitation grand challenge project