Atmospheric System Research (ASR) **Funding Opportunity Number: DE-FOA-0001845**				
Title	**PI**	**Institution**	**Location**	**Synopsis**
High concentrations of ice: investigations using polarimetric radar observations combined with in situ measurements and cloud modeling	Alexander Ryzhkov	Board of Regents of the University of Oklahoma	Norman, OK	Applicants propose a new method to retrieve ice crystal size distributions, concentrations, and amounts using differential phase measurements in dual-polarized radar data. These retrievals would be performed on selected ARM campaign data and validated with concurrent in situ aircraft and other measurements. The retrieved crystal data would be used to constrain model results using specified ice process parameterizations.
Multiscale Aerosol Modeling Across Space and Composition	Matthew West	Board of Trustees of the University of Illinois	Champaign, IL	Applicants propose to expand their current particle resolved model PartMC-MOSAIC to incorporate aerosol structure/morphology, then propose to apply this framework to predictive relationships involving the aerosol structure on CCN and ice nucleation. They will then use the expanded PartMC-MOSAIC and data from DOE field studies (CARES and HI-SCALE) to validate larger scale models such as MAM4. Finally they propose machine learning algorithms for global uncertainty analysis of the PART-MC predictions.
Ice Nucleating Particles, Aerosols and Clouds over the Higher Latitude Southern Ocean	Paul DeMott	Colorado State University	Fort Collins, CO	Applicants propose analyses of filter samples from ARM MARCUS and MICRE campaigns in the Southern Ocean (SO) region to investigate hypotheses regarding the role of sea spray formation and microbial activity in primary ice nucleation (IN) processes in this important region. IN potential analyses from collected

				samples and local measurements will be supplemented by chemical and biological analyses of the samples and other complementary meteorological data to assess formation and source characteristics, and the results used to inform parameterizations relevant to the region.
Assessing Secondary Ice Production in Continental Clouds Based on AMF Synergistic Remote Sensing Observations	Jui-Yuan (Christine) Chiu	Colorado State University	Fort Collins, CO	The application is focused on using polarimetric radar observations of mixed-phase clouds during the BAECC ARM campaign to characterize secondary ice production events.
Organisation of Diverse Mechanisms of Secondary Ice Production among Basic Convective and Stratiform Cloud-types	Vaughan Phillips	Lunds Universitet	Lund, Sweden	Applicants propose to evaluate four candidate mechanisms for secondary ice production in cases characteristic of four dominant cloud types, using PI's Aerosol-Cloud model simulations compared to ARM campaign data. Parameterizations for one mechanism (ice-ice collision breakup) will be informed by laboratory experiments in Manchester chamber.
Exploring natural aerosol formation from DMS oxidation and implications for aerosol forcing	Jesse Kroll	Massachusetts Institute of Technology	Cambridge, MA	This proposal aims to explore secondary aerosol formation by oxidation of dimethyl sulfide (DMS) by laboratory experiments and its implication will be investigated by global modeling. They plan to investigate and characterize particle formation by DMS oxidation under conditions relevant to pristine- and present-day atmospheres (high and low NOx, a range of oxidants, and aqueous as well as gas-phase reactions) and incorporate results into global models to investigate impacts on estimates of aerosol radiative forcing.

Laboratory Measurements of Cloud Scavenging of Interstitial Aerosol in a Turbulent Environment	Will Cantrell	Michigan Technological University	Houghton, MI	Applicants propose studies in the MTU "Pi" cloud chamber to investigate particle scavenging in a simulated turbulent cloud environment, specifically focusing on activation, diffusional capture, and phoretic processes.
Spectro-Microscopy Studies of Atmospheric Particles	Alexander Laskin	Purdue University	West Lafayette, IN	Applicants propose to use several complementary spectromicroscopy techniques including SEM, TEM, and STXM for analyses of composition (mixing state) and morphology of particles sampled during ACE-ENA (primarily) and secondarily HISCALE and GoAmazon, to develop detailed particle mixing state/structure statistics to compare population and particle specific optical, hygroscopic and IN properties as well as phase state. CCN and ice nucleation measurements will be applied to relate the particle data to indirect or direct cloud effects.
Dissipation of Mixed-Phase Arctic Clouds and Its Relationship to Aerosol Properties	Adele Igel	Regents of the University of California, Davis	Davis, CA	The application is focused on using high-spectral resolution lidar and radar data from the North Slope of Alaska ARM Site, along with large-eddy simulation-scale modeling, to look at the role of aerosol-cloud interactions in the dissipation of high-latitude low-level mixed-phase clouds.

Vertical distribution of boundary layer new particle formation and implications on nanoparticle growth mechanisms	James Smith	Regents of the University of California, Irvine	Irvine, CA	Applicants propose to Investigate New Particle Formation processes aloft from DOE field campaigns vs ground based conditions where bulk of data exist to probe elevated regional events and altered relationship with clouds; to use process and 3D regional models to investigate particle growth mechanisms, and refine process understanding with targeted lab experiments and model development.
Biological particles and aerosol-cloud interactions in the Southern Great Plains	Allison Steiner	Regents of the University of Michigan	Ann Arbor, MI	This application is focused on determining the role of pollen-derived particles on cloud properties, deep convection, and precipitation in the US Great Plains. The PI will use data from the SGP ARM site along with HISCALE and other aircraft campaign data and the WRF-Chem model to look at the impacts of these biologically-sourced particle on aerosol-cloud interactions.
Improving parameterization of ice microphysical processes in Arctic clouds using a synergistic modeling and observational approach	Matthew Kumjian	The Pennsylvania State University	University Park, PA	The goal of this proposal is to improve understanding and model representation of ice crystal growth processes in Arctic clouds. The team will use current and prior laboratory measurements to constrain ice particle growth parameters as well as NSA radar data to better utilize ice particle property model output in developing and testing parameterizations in bulk microphysics schemes.

How Snow Drives the Seasonal Evolution of Land and Sea Surface Albedos in the Alaskan High Arctic	Matthew Sturm	University of Alaska Fairbanks	Fairbanks, AK	The proposed work will characterize spatial variability and temporal evolution of surface albedo during proposed ARM field campaign at NSA site over 3 melt seasons, model optical properties to explore how the measured snow properties produce the observed spectral albedo; then assess the impact of temporal and spatial variations of the surface albedo on the NSA radiation budget using radiative transfer models and satellite remote sensing.
Investigation of the surface coupling of marine clouds and its interactions with aerosols over the Southern Ocean	Zhanqing Li	University of Maryland	College Park, MD	The focus of the application is to use ARM data from the MARCUS campaign along with large eddy simulation modeling to look at the dynamic coupling of clouds, aerosols, and the surface in the Southern Ocean marine boundary layer.
Detection and Characteristics of Blowing Snow at ARM Sites	Aaron Kennedy	University of North Dakota	Grand Forks, ND	The high-latitude processes application is focused on using ARM data from Barrow, Oliktok, and AWARE to determine frequency in microphysics of blowing snow events and determine their impact on surface radiation budget; evaluate a proposed parameterization, and develop a blowing snow product for the ARM community.
Processes Associated with Boundary Layer Cloud Ice Phase Precipitation in the High Southern Latitudes	Gerald Mace	University of Utah	Salt Lake City, UT	The application is focused on improving understanding of the processes determining cloud thermodynamic phase partitioning in super-cooled boundary-layer clouds in the Southern Ocean. The proposal will make use of recently collect ARM data from the Southern Ocean MICRE and MARCUS field campaigns, as well as from other field campaigns in the

				region and involves extensive algorithm and data product development.
Mixed-phase Convective Clouds in the Polar Marine Boundary Layer	Bart Geerts	University of Wyoming	Laramie, WY	This application is focused on improving the understanding of the cold-air outbreak cloud regime in the high latitudes. The team will use ARM observations from the NSA site and from two AMF deployments, the recent MARCUS campaign in the southern ocean and the upcoming COMBLE campaign off the coast of Norway to describe the cold-air outbreak cloud regime, especially in the context of mesoscale organization. They will then use high-resolution modeling to study the feedbacks between microphysical processes and dynamics.
Improving GCM Predictability of Mixed-Phase Clouds and Aerosol Interactions at High Latitudes with ARM Observations	Xiaohong Liu	University of Wyoming	Laramie, WY	Applicants propose to develop improvements in the ability of the CAM6 atmospheric model to simulate mixed-phase clouds by candidate treatments evaluated against ARM multi-instrument retrievals using the CAPT "weather-forecasting mode" and single column representations. Applicants will: 1) add ice nucleation by marine organic aerosol to CESM/CAM6; 2) parameterize sub-grid heterogeneity in mixed phase clouds; 3) add schemes for vertical transport, scavenging, and the CLUBB higher order turbulence closure treatment.

Environmental System Science **Funding Opportunity Number: DE-FOA-0001855**				
Title	**PI**	**Institution**	**Location**	**Synopsis**
Coastal Wetland Carbon Cycling Processes in a Warmer Climate	J. Patrick Megonigal	Smithsonian Institution	Washington, DC	The application seeks to quantify how warming affects the stability and storage of soil carbon in coastal wetlands located on the Chesapeake Bay. The application leverages a previous DOE award made in 2015. Since coastal wetlands are largely ignored in Earth system models, the applicant seeks to conduct a warming manipulation study to examine how plants and soil biogeochemistry respond to manipulative warming and potential sea level rise. The proposed research will be used to refine the Costal Carbon Ecosystem Model (CCEM) and the Energy Exascale Earth System Model (E3SM-ELM).
Sticky Roots -- Implications of Widespread, Cryptic, Viral Infection of Plants in Natural and Managed Ecosystems for Soil Carbon Processing in the Rhizosphere	Zoe Cardon	Marine Biological Laboratory	Woods Hole, MA	This exploratory application seeks to improve mechanistic understanding of linkages among release of organic compounds by plant roots, microbial growth and activity, and the strength of organic matter-mineral associations in soil. A central feature of the effort is the use of viral infections as a natural tool to examine to stimulate plant to release more organic compounds in the soil that will stimulate the microbial community. The application is

				high risk, but could have a very large scientific return on investment and transform our perception of the potential importance and influence of prevalent virus infections on terrestrial carbon cycling. This effort is collaborative with William Riley at Lawrence Berkeley National Laboratory.
Using Root and Soil Traits to Forecast Woody Encroachment Dynamics in Mesic Grassland	Jesse Nippert	Kansas State University	Manhattan, KS	This application seeks to explore how the encroachment or woody plants (e.g., shrubs) in the US Great Plains grasslands alters the whole ecosystem biogeochemical cycling, including root and soil carbon at various depths. This application will be one of the first studies to examine the interactive effects of drought and woody plant encroachment on ecosystem traits such as roots growth, microbial activity and soil biogeochemistry at depths up to 1 meter. The results from this study will be used to parametrize trait enabled land surface models (e.g., CLM-FATES).
Effects of Hurricane Disturbance and Increased Temperature on Carbon Cycling and Storage of a Puerto Rican Forest: A Mechanistic Investigation of Above- and Belowground Processes	Tana Wood	USDA Forest Service	San Juan, PR	The application seeks to mechanistically understand how increasing temperatures and recent hurricane disturbance impact carbon cycling and biogeochemistry for both plants and soils in a Puerto Rico tropical forest. The proposed work is a continuation of a prior DOE award made in 2015 and is the first and only study to integrate both tropical canopy (aboveground) and soil warming (belowground) warming manipulation anywhere in the tropics. The study was hit by both hurricanes Irma and Maria in 2017.
	Molly Cavaleri	Michigan Technological University	Houghton, MI	

	Sasha Reed	US Geological Survey	Moab, UT	While the experimental infrastructure survived the extreme storms, the forest and associated vegetation was severely impacted. This creates a once in a century opportunity to examine coupled impacts of large ecosystem disturbances on biogeochemical cycles and forest recovery under projected future warming conditions. This effort is collaborative with Jennifer Pett-Ridge at Lawrence Livermore National Laboratory.
Peatland Hydrology Across Scale: A Probabilistic Framework for Confronting Variability, Heterogeneity, and Uncertainty	Xue Feng	Regents of the University of Minnesota	Minneapolis, MN	This exploratory application seeks to integrate small-scale spatial variability in peatland water-table interactions into larger-scale models of peatland hydrology. The study will examine variations and differences in peatland hydrology over time and space as well as the inherent water connectivity of peatlands nearby. The study will be conducted in northern Minnesota at the USDA Forest Service's Marcell Experimental Forest and will collaborate with the DOE SPRUCE team.
Effects of Rapid Permafrost Thaw on CO_2 and CH_4 Fluxes in a Warmer and Wetter Future	Rebecca Neumann	University of Washington	Seattle, WA	The application seeks to clarify how the impact of advection of heat (via rain) might influence changes in carbon dioxide and methane fluxes in old versus new thermokarsts in the Arctic (Alaska). Additionally the study will address how nitrogen availability may be a pivotal driver in how plants and microbes in old and new thermokarsts differentially respond in terms of carbon cycling. The proposed work will collaborate with the DOE supported NGEE-

				Arctic study and Qing Zhu at Lawrence Berkeley National Laboratory.
Catastrophic Forest Disturbance and Regrowth in Puerto Rico Following Hurricane Maria: Benchmarks for Earth System Models from Forest Inventory and Remote Sensing Measurements	Michael Keller	USDA Forest Service, International Programs	Washington, DC	This application seeks to leverage extensive forest inventory and airborne remote sensing data acquired before and after Hurricanes Irma and Maria in Puerto Rico to quantify variability in tree mortality and canopy damage. The applicant will study canopy damage, mortality, and post-disturbance forest recovery across landscape gradients in climate, geology, topography, forest age, past land use and species composition. The resulting time series of field and airborne remote sensing data will enable the team to contrast hurricane damage with estimates of background forest mortality and canopy dynamics in the absence of storms across the entire island. New landscape-level knowledge of damage, mortality, and post-disturbance recovery will provide benchmark data sets for modeling to advance our mechanistic understanding of tropical forest resilience to catastrophic disturbance. This effort will collaborate with the DOE supported NGEE-Tropics effort.
	Douglas Morton	NASA - Goddard	Greenbelt, MD	