

# INTERAGENCY ARCTIC RESEARCH POLICY COMMITTEE

## 2016 SUMMARY OF ACCOMPLISHMENTS AND 2017 PRIORITIES

The accomplishments described here represent highlights for each IARPC collaboration team during FY 2016, presented in order of appearance in the 5-Year Plan. Each team also has contributed an update on priorities for the coming year. The latest milestone updates can be obtained from the secretariat and are available online on the member side of the IARPC Collaborations [website](#).

### IARPC Collaboration Teams

Sea Ice Collaboration Team	Atmosphere Collaboration Team
Distributed Biological Observatory Collaboration Team	Arctic Observing Systems Collaboration Team
Chukchi & Beaufort Seas Ecosystem Collaboration Team	Arctic Data Collaboration Team
Glaciers & Fjords Collaboration Team	Modeling Collaboration Team
Terrestrial Ecosystems Collaboration Team	Arctic Communities Collaboration Team
Wildfires Collaboration Team	Human Health Collaboration Team

These Federal agencies comprise IARPC: Department of Commerce (DOC), Department of Defense (DOD), Department of Energy (DOE), Department of Health and Human Services (HHS), Department of Homeland Security (DHS), Department of Interior (DOI), Department of State (DOS), Department of Transportation (DOT), Environmental Protection Agency (EPA), Marine Mammal Commission (MMC), National Aeronautics and Space Administration (NASA), National Science Foundation (NSF, Chair), Office of Management and Budget (OMB), Office of Science and Technology Policy (OSTP), Smithsonian Institution (SI), and United States Department of Agriculture (USDA).

## Sea Ice Collaboration Team (SICT)

### Accomplishments

The annual minimum Arctic sea ice extent in 2016—4.1 million square kilometers (km<sup>2</sup>)—tied with 2007 for the second-lowest ice extent in the satellite record of 1979-present. The ten lowest minimum ice extent values have occurred during the last ten summers, 2007-2016. The dramatic change in the annual minimum sea ice extent is the focus of the Sea Ice Outlook, an activity of the Sea Ice Prediction Network (SIPN). Co-funded by the Department of Energy, the National Science Foundation (NSF), and the Office of Naval Research (ONR), with in-kind support from National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration, SIPN uses the Sea Ice Outlook to assess the predictability of sea ice as part of its broader effort to inform improvements in seasonal sea ice prediction. In August 2016, the Sea Ice Outlook received 39 contributions, also known as outlooks, for the September, pan-Arctic minimum ice extent. The outlook values ranged from 3.7 to 5.2 million km<sup>2</sup>, with a median value of 4.4 million (km<sup>2</sup>). Five (13%) of the outlooks correctly anticipated the actual minimum extent of 4.1 million square km<sup>2</sup>. Of those five outlooks, one was the outcome of an heuristic approach, three were from statistical models, and one was from a dynamical model.

Models are essential for sea ice prediction and they depend on observations for initialization, calibration, improving the representation of processes, and evaluating model skill. In another approach to improving sea ice prediction, NSF supported a summer camp in late May 2016 in Barrow, Alaska, to promote integration between the sea ice observational and modeling communities. The 25 participants were a diverse group of early-, mid- and later-career observationalists and modelers who engaged in indoor classroom activities to learn about modeling and remote sensing, and outdoor classroom activities to learn about essential sea ice variables such as albedo, snow depth, ice thickness and morphology, and ice salinity and temperature.

Arctic sea ice thickness and the depth of snow on the ice are the subject of the annual NASA Operation IceBridge campaigns that have taken place since 2010. Operation IceBridge is an airborne remote sensing project that measures snow depth and ice thickness to aid the development of algorithms to derive ice thickness from ICESat-2 ice surface elevation measurements; ICESat-2 is a satellite scheduled for launch in late 2017. There were two Operation IceBridge sea ice campaigns in 2016, both over the western Arctic Ocean adjacent to Canada and the United States (Alaska). The first mission, in April-May, focused on snow depth and ice thickness before the onset of melting, and the second mission, in July, focused on the extent, frequency and depth of melt ponds, the pools of melt water that form on sea ice during spring and summer.

Operation IceBridge is literally bridging a gap between the shutdown of ICESat-1 in 2010 and the launch of ICESat-2 in 2017, and providing data that are useful for testing the skill of predictive models as part of the continuing effort to improve sea ice predictions. A complementary approach is to conduct process studies to increase scientific understanding that contributes to improved explicit representation or parameterization of processes in models. To that end, the ONR "Sea State and Boundary Layer Physics of the Emerging Arctic ocean" project is, among other things, investigating the interactions and feedbacks between ocean surface waves and the sea ice cover in order to improve wave and sea ice models and forecasting in the Arctic. In 2016, the highlight of the 5-year project was a 33-day field experiment

involving 25 scientists aboard the research vessel “Sikuliaq” as the ice cover advanced during freeze-up in the Chukchi and Beaufort seas.

### **Priorities for 2017**

NASA will continue Operation IceBridge sea ice measurement campaigns, and continue preparing for the launch of the ICESat-2 satellite in 2018. ONR will conduct pilot projects to test equipment and procedures in advance of the main field experiment in 2018 of the 5-year “Stratified Ocean Dynamics in the Arctic (SODA)” project. The SICT will begin implementing the sea ice goal in *Arctic Research Plan 2017-2021*.

## **Distributed Biological Observatory Collaboration Team (DBOCT)**

### **Accomplishments**

A major accomplishment in 2016 was the completion of a decadal DBO Implementation Plan. The Plan focuses on the period 2015-2024 and provides a framework for the preparation of Periodic Assessments of the State of Pacific Arctic Marine Environment (PARMA), at 3-year intervals starting in 2018. The PARMA will be based upon analyses and modeling using DBO-generated data and data from projects supported by the National Oceanic and Atmospheric Administration, National Science Foundation, Bureau of Oceanic Energy Management, National Aeronautics and Space Administration, North Pacific Research Board and other sources.

Regionally, the DBO Implementation Plan identifies specific strategies to foster connections with existing community-based observation programs in an effort to link offshore observations of biological change to local observations and indigenous knowledge. Internationally, linkages to pan-Arctic DBO-type sampling programs will be fostered, including transects identified by the Arctic Council Conservation of Arctic Flora and Fauna/Circumpolar Biodiversity Monitoring Program and the Protection of the Arctic Marine Environment (PAME)/Implementation of Ecosystem Approach (EA) to Management Program.

The completion of the DBO Implementation Plan was the last DBO CT milestone in the 2013-2017 IARPC Plan and was publicly vetted at the 3<sup>rd</sup> DBO Data Workshop, the 2016 Arctic Observing Summit, and the PAME EA International Conference, as well as at various other national and international venues. Other significant achievements include the completion of year-7 of sampling in DBO/Chukchi regions 1-5, and opportunistic sampling in DBO/Beaufort regions 6-8. Field-sampling was contributed by colleagues from 11 projects representing 5 countries.

The DBO continues to benefit from organizational support from the international Pacific Arctic Group, including integrated collaborations with the Pacific Arctic Climate Ecosystem Observatory. These achievements in international cooperation lay the groundwork for a truly pan-arctic biological observatory, as envisioned at the PAME EA International Conference.

### **Priorities for 2017**

The DBO CT will focus efforts over the next five years on Performance Element 4.3.1, 4.3.2, 4.3.3 in IARPC *Arctic Research Plan 2017-2021*, which contribute to the objectives of Research Goal 4 (Marine Ecosystems). We anticipate a DBO-core group will continue as a sub-unit of the Marine Ecosystem (Goal 4) Team to retain team integrity and to focus on the long-term goals as agreed in the decadal DBO Implementation Plan. Work towards establishing linkages between the DBO and community based modeling will be continued, including partnership with the nascent University of Alaska Fairbanks Arctic Observatory & Knowledge Hub community observing program. Internationally, the DBO will contribute to the development of a pan-Arctic Ocean Observing Network, including participation on the Norwegian Strategic Initiative-Arctic where the Institute of Marine Research is adding shelf-basin transect lines to track northward migration of commercial fish species.

## **Chukchi & Beaufort Seas Ecosystem Collaboration Team (CBCT)**

### **Accomplishments**

CBCT activities in 2016 focused on facilitating communication among participants from federal agencies and non-federal entities to raise awareness of ongoing and planned activities and to encourage collaboration. Consistent participation by agency representatives and academic scientists based in Alaska, Washington, D.C., and elsewhere was achieved. Monthly webinars included an opportunity for project updates to be communicated and the Team Leaders actively invited Principal Investigators to share information each month. Several presentations on a wide variety of ongoing and recently completed relevant research projects in the Chukchi and Beaufort Seas were hosted.

New interagency marine research programs were initiated in FY16 thanks in part to the collaborative relationships developed through the CBCT. In May 2016, the North Pacific Research Board (NPRB) launched an Arctic Integrated Ecosystem Research Program (Arctic IERP) in partnership with Bureau of Ocean Energy Management and the North Slope Borough/Shell Baseline Studies Program. This new program secured commitments to collaborate from 22 existing Federally-funded research projects. The Office of Naval Research funded a new Departmental Research Initiative “Stratified Ocean Dynamics of the Arctic” that will collaborate with the NPRB program and others. These new research programs will collaborate with interagency projects that were initiated in FY15 such as the Arctic Marine Biodiversity Observing Network and Marine Ecosystem Study (MARES). A science integration conference also emerged from the joint efforts of the CBCT and the Sea Ice Collaboration Team.

Invited presentations to CBCT meetings demonstrated progress on outstanding milestones defined in *Arctic Research Plan 2013-2017*. For example, several presentations were given on the milestones related to oil spill risk assessment and potential impacts of oil spills on the ecosystem, and one of the two related milestones was completed in FY16. The Oil Spill Recovery Institute based in Alaska was invited to participate and announced plans to fund new research in FY17.

### **Priorities for 2017**

The CBCT will begin implementing the marine ecosystems objectives 4.1-4.3 in the *Arctic Research Plan 2017-2021*. Specifically, the CBCT will implement efforts aimed to increase the knowledge on the distribution and abundance of Arctic marine species across all trophic levels and scales, e.g., the AMBON study; improve understanding of basic life history of Arctic marine species to support multi-agency decision-making. In this respect, the CBCT will particularly focus on supporting efforts that integrate current knowledge through pan-Arctic perspectives and conceptualizations; The CBCT will prioritize the advancement of the understanding of how climate-related changes, biophysical interactions, and feedbacks at different scales in the marine ecosystems impact Arctic marine resources and human communities that depend on them. The MARES program and the Beaufort Sea upwelling study are key elements that the CBCT will track over the next 5 years.

## Glaciers and Fjords Collaboration Team (GFCT)

### Accomplishments

Organized to enhance interagency collaborations on land ice loss process studies targeting specific dynamic regimes, the GFCT continued to encourage discussion on a variety of glaciological processes and parameterizations in models.

The Community Earth System Model (CESM) Land Ice Working Group continues to facilitate collaboration between agencies and academic scientists to develop a community ice sheet model, which incorporates the results of recent process studies, for use in Earth system models. The Ice Sheet Model Project (ISMIP6) has been formally endorsed by the Coupled Model Intercomparison Project (CMIP) Phase 6, and allows for ice sheets to be, for the first time, included in the CMIP definition of Earth System modeling. ISMIP6 experiments and data request protocols have been submitted for a publication. The suite of experiments designed to investigate the uncertainty in sea level due to ice sheet model initialization in standalone mode (i.e.: uncoupled to climate models) has been completed for the Greenland ice sheet by 15 international groups.

The International Greenland Ice Sheet-Ocean Interactions (GRISO) Network, a self-organized, international, open network of scientists, grew out of the U.S. Climate Variability and Predictability (CLIVAR) working group. GRISO maintains close coordination with of the Study of Environmental Arctic Change (SEARCH) Land-Ice Action Team, whose goals are often commensurate. A 2013 U.S. CLIVAR workshop recommended a planning strategy for obtaining long-term time series of critical in situ glaciological, oceanographic, and atmospheric parameters to provide information on the time-evolving relationships between different climate forcings and the glacier flow, called the Greenland Ice-Ocean Observing System (GrIOOS). The SEARCH Land-Ice Action Team met in December 2015 to continue planning for GrIOOS and a report will be released shortly. The GRISO Network has been funded to develop a virtual data portal, leveraging existing infrastructure, to make interdisciplinary data submission and data availability easier and to promote uniform and appropriate data management practices.

### Priorities for 2017

The activities of the GFCT will be subsumed under those of the team addressing Research to Understand and Project the Mass Budget of Glaciers, Ice Caps, and the Greenland Ice Sheet, and Their Consequences for Sea Level Rise in *Arctic Research Plan 2017-2021*. Long-term monitoring of the Greenland ice sheet and its glaciers will continue through NASA's Operation IceBridge. International linkages, both directly and through synergies with the newly formed SEARCH Land Ice/Sea Level Rise Action Team and the expanding activities of the International GRISO Network, will be enhanced.

## Terrestrial Ecosystems Collaboration Team (TECT)

### Accomplishments

TECT accomplishments included a) closeout of all milestones from the *Arctic Research Plan 2013-2017*, b) transitioning leadership from the former co-chairs to new ones, c) adapting monthly meeting formats to reflect recent changes in focus and needs of Arctic terrestrial ecosystem science, and d) contributing to scoping, authorship and vetting of the new *Arctic Research Plan: 2017-2021*. Of the eleven TECT milestones, six were outstanding at the beginning of the year, and all milestones were completed or deactivated as of September 30, 2016.

The new co-chairs reviewed the TECT monthly meeting format in preparation for 2016. In recognition of emerging challenges in a) scaling of systems-based science, and b) scoping, coordinating, and funding more sophisticated, collaborative interagency research, a dual-speaker format was adopted to increase attendance and audience engagement while better addressing these needs. Paired speakers provided dynamics such as competing viewpoints, and complementary spatial scales. Our IARPC-wide seminar in June paired an integrative science talk with Program Manager commentary to frame proposing, coordinating, and executing collaborative research in context of larger agency funding priorities and congressional mandates. To date, feedback on the new format has been very positive.

Much of our TECT content was directly applied to the new *Arctic Research Plan: 2017-2021*, for which TECT co-chairs and TECT members were authors. In so doing, Permafrost emerged as a topic meriting its own chapter in the new Plan, and perhaps its own collaboration team in the future. It should be noted that much of this recognition came as a result of activities answerable to TECT Milestone 3.2.3.f.

### Priorities for 2017

TECT will open a new chapter of interagency coordination through the new *Arctic Research Plan: 2017-2021*. The plan's Terrestrial and Freshwater Ecosystems Research Goal updates the vision to include three primary Research Objectives, each of which defines a focus, and then presents specific, measurable, Performance Elements to ensure progress and promote coordination.

The new research objectives for FY2017 – 2021 emphasize a strongly coordinated, systems-cognizant, scalable approach which will better address changes to terrestrial and freshwater ecosystems at multiple scales, and provide needed support to IARPC policy drivers, as these changes: a) are key components of the Arctic environment (*Stewardship and Security*), b) provide important feedbacks to the climate (*Arctic-Global System*), and c) provide key ecosystem services that contribute to the health and well-being of Arctic residents (*Well-being*). A full accounting of these Research Objectives and Performance Elements is presented in *Arctic Research Plan: 2017-2021*. Performance elements supporting the three objectives are led by agencies within Department of the Interior, Department of Energy and the National Aeronautic and Space Administration, and include participants from many other agencies with diverse, complementary missions within Arctic research.

## Wildfires Collaboration Team (WCT)

### Accomplishments

During 2016, the Wildfires Collaboration Team built upon previously collected research summaries and gaps analysis and focused on opportunities to promote research on identified gaps in Arctic fire science. Eight monthly meetings were held. February's meeting featured a webinar by Dave McGuire of the University of Alaska Fairbanks on the status of the Land Carbon Project, an ambitious effort led by the Alaska Climate Science Center to estimate the entire carbon balance in Alaska and chart its future in a warmer climate using an integrated ecosystem model. May's meeting was a double feature with presentations by two graduate students on their work regarding Air Pollution from Wildfires and Human Health Implications in Alaskan Communities (Lucia Woo, Yale) and Spatial Temporal Dynamics of Wildfire Activities in the Arctic Tundra Biome Using MODIS data (Arif Masrur, UNI)

The WCT guided development of a proposal for Milestone: 3.2.4.g *Convene an international, interdisciplinary workshop with remote sensing scientists, ecologists, hydrologists, agency fire managers and decision-makers on new opportunities to use remote sensing in boreal/arctic wildfire management and science*. Subgroups held additional meetings with collaborators from US and Canada to hammer out a proposal. That effort came to fruition in September when the workshop proposal was funded by NASA's Applied Sciences office and calls for abstracts are now out for the April, 2017 workshop in Fairbanks. With the Arctic Science Summit and Arctic Observing Summit meeting in Fairbanks in March, 2016, the WCT prepared a poster summarizing human impacts of increased fire disturbance in arctic/subarctic environments. Team products and presentation recordings are hosted on the IARPC website. We continued to make progress on other milestones: Milestone 3.2.4.b was completed with BLM-Alaska Fire Service funding master's student Alyssa Shanks to study wildfire impacts to indigenous Arctic communities under UAF's Resilience and Adaptation Program. The report is posted on the website. Eric Miller summarized data needs for high latitude fire management and gave a presentation to the Arctic Data Collaboration team September 15<sup>th</sup>, 2016.

### Priorities for 2017

The Wildfires Team will continue with monthly teleconferences through 2016, with continued emphasis on webinars which foster scientist/stakeholder communication and lead to actionable science. The "Opportunities to Apply Remote Sensing in Boreal/Arctic Wildfire Management and Science Workshop" (Milestone 3.2.4.g, above) will be April 4-6, 2017. Under *Arctic Research Plan 2017-2021*, the WCT will continue discussions with other teams, including the TECT and Arctic Data for future direction and collaboration efforts.



## **Atmosphere Collaboration Team (ACT)**

### **Accomplishments**

The IARPC Atmosphere Collaboration Team goals encompass a better understanding of short-lived climate forcers in the Arctic as well as Arctic cloud and aerosol properties and processes. For all atmospheric constituents, support and enhancement of ground-based measurements, support for manned and unmanned aircraft campaigns, source identification and transport to the Arctic, linking ground-based and satellite observations, and support of modeling through process studies and syntheses were all objectives.

Over the 5-year plan period, US agencies have maintained and enhanced ground-based monitoring of gases, aerosols, clouds, and radiation budgets across the Arctic. During FY2016, data streams from previously established ground-based sites have continued and augmented as some of the sites were upgraded in 2015.

Results of several aircraft campaigns to provide needed details for better process understanding as well as better spatial coverage were analyzed and published during 2016. Among these campaigns were NASA's Arctic Radiation-IceBridge Sea and Ice Experiment (ARISE), Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE) and the ARM Airborne Carbon Measurements V (ACME-V). Support for the current NASA-funded Atmospheric Tomography Mission (AToM) to study the impact of human-produced air pollution on greenhouse gases and on chemically reactive gases in the atmosphere was also provided.

In addition to these manned aircraft campaigns, US agencies pushed forward the use of Unmanned Aerial Systems (UAS). The second year of the DOE-funded Evaluating Routine Atmospheric Sounding Measurements using Unmanned Systems (ERASMUS) campaign has operated a variety of instrumented UAS during brief but continuing campaign periods at Oliktok Point, Alaska and DOE ARM has also started routine small UAS and tethered balloon operations at Oliktok.

The Multi-disciplinary Drifting Observatory for the Study of the Arctic Climate (MOSAic) campaign has gained support from several agencies and countries that will coordinate multi-year Arctic Ocean drifting stations with an atmospheric studies emphasis but with a strong foundation for linking atmospheric processes to other Arctic systems such as sea ice and oceanic processes. An international Arctic workshop, sponsored by the International Arctic Science Committee (IASC), was co-led and coordinated with support from NOAA's Arctic Research Program.

The Arctic Council's Arctic Monitoring and Assessment Program (AMAP) convened two separate expert groups to synthesize and assess the state of knowledge about the impacts of SLCF's on Arctic climate. The summary report for policy makers was published in FY2015, and in early FY 2016 final reports synthesizing the state of knowledge on methane and black carbon were published.

### **Priorities for 2017**

The Atmosphere Collaboration Team handled 19 milestones for this reporting period. One was deactivated and two are in progress leaving 16 of the milestones met. The Atmosphere Collaboration Team will continue under the IARPC Arctic Research Plan 2017-2012 with a focus on advancing process and system understanding of the changing Arctic atmospheric composition dynamics and the resulting changes in the surface energy budgets.

## Arctic Observing Systems Collaboration Team (AOSCT)

### 2015 Accomplishments

The Arctic Observing System Collaboration Team (AOSCT) advanced three topics in FY16: 1) exploring the role for new and innovative autonomous observing technologies in the Arctic; 2) advancing catalytic national and international community based observing efforts in support of the National Strategy for the Arctic Region; and 3) enhancing the use of discovery tools for observing system collaboration. Additionally, it continued to serve as a venue to sharing information on newly funded activities, particularly in the realm of marine ecosystem studies.

New and innovative technologies emerged as an important topic under the AOSCT this year, as it is increasingly clear that a sustainable Arctic observing system will be heavily reliant on robust autonomous technology. The Innovative Technology for Arctic Exploration (ITAE) Program was formed to expand NOAA's mission capabilities in the face of these challenges; NOAA, DOE and other agencies also sustain efforts to advance the utilization of unmanned aerial systems (UAS). The capabilities of four types of platforms were reviewed over the course of the year including UAS, wave gliders, sail drones, and hover-sondes; each is pushing the envelope on light-weight and reliable sensors that are compatible with such platforms.

At the behest of the Arctic Executive Steering Committee (AESC), AOSCT invited a series of talks on Community Based Observing (CBO) to understand the breath of activities and identify critical areas for progress. The immediate result of these exchanges was the submittal of 3 white papers to the 2016 Arctic Observing Summit (AOS), and significant progress on understanding and methodology at the AOS itself. These events catalyzed a recent NSF award, "Eyes North", to further develop connections across diverse activities and to more swiftly advance the science of community based observing.

The third AOSCT topic addressed the issue that policy makers, stakeholders, and international partners make frequent calls to US agencies to identify and comprehensively catalog the US "Arctic Observing Network". While there is no single comprehensive catalog, a host of tools of varying scopes do address the "what, where and when" of Arctic observing across Federal agencies. AOSCT reviewed the major tools in this category and explored opportunities for greater connectivity across these platforms. A key action was to re-invigorate the Alaska Data Integration Working Group (ADIWG) and promote the use of compatible metadata standards for representing infrastructure so activities can build on one another.

### Priorities for 2017

Arctic Observing System priorities moving forward will be advanced under the Environmental Intelligence (EI) Goal of the next IARPC 5-Yr Plan. The purpose of that team will be to advance frameworks for gathering and generating EI, in which observing systems play a critical role, but must be better linked to research on stakeholder engagement, data stewardship and modeling. It is envisioned that the EI team will be structured into task teams around each Research Objective, with many of the current AOSCT activities falling under Research Objective 9.1: *Enhance multi-agency and outside collaborators participation in new and existing activities to improve best practices, coordination, and synthesis of Arctic observations toward a fully integrated interagency "U.S. Arctic Observing Network" (U.S. AON).*

## Arctic Data Collaboration Team (ADCT)

### Accomplishments

The Arctic Data Collaboration Team advanced two primary themes in FY 2016: 1) identifying the data and cyberinfrastructure requirements of IARPC agencies and other national and international stakeholders; 2) facilitating connection between and among resources that can meet identified requirements. The group served as a venue for information sharing across agencies and projects.

Team chairs and members identified key “communities of practice” that require data and cyberinfrastructure that extends beyond a single discipline or observing domain (e.g. atmospheric science, coastal observations). Following an active role in the Second Polar Data Forum in late 2015, the Team organized meetings focused on the identification of requirements, starting with a webinar on Alaskan Inuit Food Security (18 February). This meeting revealed the complexity of requirements ranging from physical science to social science to economic data and observation methods. The need for better networking between actors (communities, agencies, funders etc.) was highlighted.

Other Team meetings highlighted existing resources and gaps in different domains. For example, on 15 September the Wildfires team presented to the ADCT on existing resources and gaps in cyberinfrastructure for their field. The range of different requirements needed to serve operational (response), forecasting and modeling, and fundamental science was highlighted. The result of this and other meetings are being used as the basis for the development of a cross-agency strategy and action plan that will greatly enhance our ability to effectively and efficiently share existing data (including adoption of standards) and work towards identifying and filling significant gaps. This strategy and plan will include strong connections to international resources and activities.

To this end, the ADCT has been very active on the international stage. Highlights include follow up on the Second Polar Data Forum (<http://www.polar-data-forum.org>) starting with the organization and hosting of a “Town Hall” meeting on data during the Arctic Science Summit Week held in Fairbanks (March 2016). Through a Team lead, there are strong connections with various international initiatives, most notably the IASC-SAON Arctic Data Committee and the Group on Earth Observations’ (GEO) Cold Region Initiative. IARPC, including ADCT and AOSCT, is co-convening the Polar Connections Interoperability Workshop and Assessment Process. See <http://arcticdc.org/meetings/adcm-meetings/interoperability-workshop>. This workshop will make a significant contribution to establishing the status of polar data interoperability and standards requirements both nationally and globally. Specifically, resources have been established to use the workshop to promote the work of U.S.-based initiatives at an international level. Such initiatives include the Alaska Data Integration Working Group, the Exchange for Local Observations and Knowledge of the Arctic, the Antarctic and Arctic Data Consortium.

### Priorities for 2017

The priority for 2017 will be to complete the aforementioned strategy and action plan under several elements of the Environmental Intelligence (EI) Goal of the next IARPC 5-Yr Plan. This will include establishing a clear understanding of the domestic and international data system to assist with establishing strategic priorities and better utilizing existing resources.

## Modeling Collaboration Team (MCT)

### Accomplishments

Numerical modeling crosscuts most, if not all, of the topics in the IARPC 5-year plan. In the current science plan, the Modeling Collaboration Team (MCT) has 27 milestones under which progress is recorded and coordinates with the other collaboration teams to document progress against many more.

Many activities in 2016 involved improving the representation of critical Arctic processes in the various Arctic system models. For example, the Regional Arctic System Model (RASAM), funded by the Department of Energy (DOE), Office of Naval Research, and the National Science Foundation (NSF), incorporated better atmospheric radiation and microphysics code into their atmospheric model, updated the sea ice morphology parameterizations, improved the land hydrology model, added more realistic marine biogeochemistry, and so on.

There were multiple model inter-comparisons efforts during 2016 supported by different agencies. For instance: 1) NSF funded the second phase (2016-2019) of the Forum for Arctic Modeling and Observational Synthesis (FAMOS) to use high resolution models and observations to investigate the role of sub-grid processes in ocean and sea ice models of the Arctic region. 2) The most recent Ice Sheet Model Inter-comparison Project (ISMIP6) is focused on evaluating ice-sheet models under a common framework and is led by National Aeronautical and Space Administration scientists; and 3) Sea Ice Model Intercomparison Project is an ongoing international activity in which several models developed by US agencies participated to evaluate biases in the representation of sea ice in global earth system models.

There were many interagency activities in 2016 that focused on improving the individual component models (atmosphere, ice, ocean, land, etc) that make up the Arctic system. They include a DOE supported group of stakeholders and developers of the Los Alamos Sea Ice Model (CICE) who coordinated further development of the CICE model as a community resource. Additionally, the Systematic Improvement of Reanalyses in the Arctic (SIRTA) was initiated as an IARPC panel to assess strengths and weaknesses of atmospheric reanalyses.

Other interagency efforts included an AGU meeting session in December 2015 organized by ONR and DOE on "Advancing Science of the Arctic System: Exploring the Past and Present to Predict the Future". A follow-on AGU session has been organized for the coming December AGU on "Advancing Science of the Arctic System through Integration and Coordination of Observations and Modeling".

### Priorities for 2017

In the coming year, the MCT will continue working under the Environmental Intelligence Research Goal in *Arctic Research Plan 2017-2021* to integrate Arctic modeling activities and progress across the Federal agencies. There will be an additional focus on the role of models in forecasting the Arctic environment with the upcoming Year of Polar Prediction (YOPP), during which many scientists supported by the federal agencies will participate in inter-comparisons of model forecasts using observations in the Arctic for model assessment and improvement.

## Arctic Communities Collaboration Team (ACCT)

### Accomplishments

ACCT tasks include identifying: (1) issues of food security as impacted by the rapid pace of climate and environmental change; (2) factors enhancing community sustainability and adaptation, well-being, and health in the face of rapid change; and (3) methods of preserving and enhancing culture and language retention. 2016 saw completions for most milestones, while two continued in progress and several were deactivated due to lack of viable prospects. The Team's emphasis has been to encourage research and educational activities on the impact of warming climate, enhancing educational goals related to these activities, and encouraging culture and language preservation.

A number of milestones have been met in establishing or sustaining observing networks and community responses to climate and environmental changes. The National Science Foundation's (NSF) Science, Engineering, and Education for Sustainability (SEES) program is funding Arctic-FROST, an international research exchange project dealing with community sustainability development. Workshops addressing indigenous views on research priorities for southwest Alaska and on the oral history and tradition relating to the Yukon salmon fishery have been funded. This year the Bureau of Ocean Energy Management (BOEM) obtained approval to initiate a social indicators study in coastal Alaska. Much progress has been made on several observing programs, including the creation of local observer networks; the Belmont Process' C budget of Ecosystems, Cities and Villages on Permafrost in the eastern Russian Arctic (COPERA) project supporting Russian environmental data recovery; transitioning NSF's Bering Sea Sub-Network (BEES) into the Community Observing Network (CONAS), and Phase IV of its Exchange for Local Observations of the Arctic (ELOKA).

Milestones on vulnerability research have been met or advanced. These include social and economic research by University of Alaska's Institute of Social and Economic Research (ISER) group and by the National Institute of Mental Health (NIH) Reducing the Incidence of Suicide in Indigenous Groups – Strengths United through Networks (RISING SUN) project evaluating suicide prevention interventions across the Arctic. NSF's Social Indicators for Rural Alaska Communities (SIRAC) initiative will investigate discrepancies between census data and actual conditions in small Arctic communities. A North Slope Science Initiative project has prioritized energy and resource needs; the World Climate Research Program's Climate and Cryosphere Project and the Arctic Council's AMAP group produced an Arctic freshwater assessment. ICC-Alaska completed an Alaska Food Security study, and the Northwest Arctic Borough completed a subsistence mapping project. The Smithsonian completed the first phase of its investigation of Arctic animal crashes among major subsistence species. Several BOEM, NSF, US Fish and Wildlife Service (USFWS), and National Park Service (NPS) projects specifically addressed Arctic resource issues, models, and adaptations needed by communities facing climate change.

Culture, language, and heritage milestones advanced substantially. The US Arctic Council Chairmanship provided a platform for recognizing the importance of indigenous partnerships in science, as did the Smithsonian's 2015 Arctic Spring Festival and the National Academy's fall, 2015 Arctic Matters program. An NSF- NEH-SI partnership documenting endangered languages (DEL) has proven effective. An NSF-Smithsonian project investigating links between oral history, language, archaeology, and climate change in Yakutat Bay was completed. The Smithsonian publication *Early Inuit Studies* documented the development

of Arctic anthropology, and NPS, NSF, SI, NPS and other agencies issued publications supporting Indigenous heritage and language. NSF's Arctic Horizon's process supported the Arctic Social Sciences in the 21st Century: Indigenous Scholarship in the North Decolonizing Methods, Models and Practices in Social Science Research workshop which brought Indigenous scholars together in Fairbanks to explore the role and contributions of indigenous frameworks and knowledge systems in advancing fields of science and informing global solutions. In addition, NSF made several awards in support of Indigenous language preservation and will continue to support such work into the future.

### **Priorities for 2017**

The work of the ACCT will be folded into the new Health and Well-being team under the Arctic Research Plan 2017-2021.

## Human Health Collaboration Team (HHCT)

### Accomplishments

Substantial progress was made for each of the three health priorities that were initiatives for the US Chairmanship of the Arctic Council (2015 -17). Under the theme of Behavioral, Mental Health and Suicide the Reducing the Incidence of Suicide in Indigenous Groups – Strengths United through Networks (RISING SUN) project made considerable progress in identifying a toolkit of common outcomes to be used in evaluating suicide prevention efforts (Milestone 3.7.3.a). Towards improving health through increasing access to in-home water and sanitation services (3.7.1.g), progress was made in developing new innovative technologies and identifying climate-change threats at the September 2016 international conference on Water Innovations for Healthy Arctic Homes. This meeting featured ongoing activities of the Alaska Water and Sewer Challenge and engaged a large group of rural Alaska stakeholders to meet with engineers, health experts, and policy makers. Progress continues to be made in addressing climate-related threats occurring at the interface of human, animal, and environmental health, through a “One Health” approach. The community-based observation networks of the Alaska Rural Alaska Monitoring Program and Local Environmental Observer networks were strengthened and provide exciting new opportunities for interface between local observers and the scientific community.

The world’s largest and longest-running study of persons vaccinated against hepatitis B virus is ongoing in Alaska. Data published through 35 years of follow-up established that the vaccine continues to provide protection and that booster doses are not needed. Through the International Circumpolar Surveillance network, a multinational review of tuberculosis surveillance and epidemiology provides our first comparative evaluation of this ongoing threat in Arctic nations.

### Priorities for 2017

The Human Health Collaboration Team will continue under *Arctic Research Plan 2017-2021* with the addition of new Performance Elements representing research from the 2013-2017 Arctic Communities Collaboration Team. The new plan will emphasize work related to addressing health disparities associated with underlying social determinants of health and well-being. This approach will feature research on topics where improvements in health can occur from improvements in key indicators such as: security of food, water and energy; decreases in violence and adverse childhood experiences; and increased understanding of mental health, substance abuse and the well-being of Alaska’s young people. Continuity with past IARPC plans will be maintained through ongoing work related to occupational health, improving water/sewer and indoor air quality, and monitoring of the health effects of environmental toxins and climate change through application of a One Health approach and by engaging Arctic communities.