The continental Antarctic ice sheet contains a large percentage of the Earth's fresh water. If this entire ice sheet were to melt into the ocean, the additional fresh water would create major changes in the world's coastlines as well as in oceanic ecosystems. In recent years scientists have become more aware of global warming and its forces in the environment. As a result, researchers have begun to study floating Antarctic ice shelves in an attempt to chart movements and changes and predict the likelihood of a disaster.

Floating ice shelves are formed when an ice sheet flows off the land and into the ocean. Once in the ocean, the shelf comes in contact with warm ocean waters, causing it to melt.

David Holland, of the Courant Institute of Mathematical Sciences in New York, is working on four different projects with a number of specialists to create computational models of the polar ocean, ice, and atmospheric environments. By working with researchers in a variety of fields, Holland and other scientists can begin to understand the role of ice in the ocean environment from a broader viewpoint—considering the perspectives of multiple disciplines.

"I work with oceanographers, glaciologists and applied mathematicians," said Holland. "The oceanographers look at how water cycles through Antarctica, and what happens when this water touches the ice shelves. Glaciologists look at what keeps the ice in place. Efficient computational solution techniques come from the applied mathematicians. By combining these perspectives, we can learn more about what's happening in the Antarctic and also in the Arctic."

Including multiple aspects of the environment is an effective way to study global climate change. This process requires massive amounts of computational power. For this reason, Holland takes advantage of ARSC's new SV1, which provides him with the latest in vector processing technology.

**Modeling Polynyas**

One of Holland's efforts includes a project to model a polynya, or large-scale hole in the sea-ice cover. One particular example appeared in Antarctica from 1974-1976. The goal of this project is to learn more about the birth, maintenance, and death of a polynya.
HPC NEWS

In August, ARSC produced the 200th issue of the T3E Users' Group Newsletter, and celebrated by making some changes to the publication. Editors Tom Baring and Guy Robinson renamed it the ARSC HPC Users' Newsletter to better reflect the continued growth of ARSC computing platforms and to meet the broader needs of the high performance computing (HPC) community in general.

The newsletter's new name and broader mission coincides with the arrival of ARSC’s new Cray SV1 parallel vector platform supercomputer, in addition to the start of a new partnership with the U.S. Army Engineer Research and Development Center Major Shared Resource Center and Silicon Graphics Inc. (SGI) to build a 512-processor Origin 3800 supercomputer (see Challenges page 11).

“We’re excited about the expanding scope of our newsletter,” said Guy Robinson, ARSC research liaison, MPP specialist and co-editor of the ARSC HPC Users' Newsletter. “We hope that our new focus will work positively to help build a community between scientists in the high performance computing world.”

The ARSC HPC Users’ Newsletter provides a biweekly forum for HPC users worldwide. The publication discusses programming models and techniques, development tools, applications and other issues of importance to users of HPC systems. The newsletter disseminates information on a variety of issues and includes “Quick Tips” which provide practical answers to questions posed by readers, users and staff.

The ARSC HPC Users’ Newsletter’s focus is on ARSC resources which currently include a massively parallel processing Cray T3E and a vector parallel processing Cray SV1. The web edition and subscription information can be found at http://www.arsc.edu/pubs/HPCnews.shtml. A list of topics, an index of “Quick Tips” and a search engine can also be found at this url.

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Viewpoints

Historically, partnerships have been an important part of many scientific and creative endeavors. Through cooperation, people and organizations can achieve more and accomplish things at a faster pace. ARSC was founded on this same principle. Through the cooperation of the Department of Defense’s (DoD) High Performance Computing Modernization Program, ARSC and the University of Alaska Fairbanks, the center has evolved into an important resource for computational research in DoD and academic communities.

In the past few months, ARSC has taken the idea of partnerships and collaboration and expanded it to involve more organizations and more people, all in an effort to push ARSC high performance computing to a higher level. In September, ARSC signed an agreement with the U.S. Army Engineer Research and Development Center Major Shared Resource Center (ERD C M SRC) to build a 512-processor, single image Origin 3800 system (see Challenges page 11). Through this collaboration, both centers hope to develop new opportunities in hardware, software, networking, visualization and mass storage that will benefit both the DoD and academia.

In October, ARSC partnered with the Albuquerque High Performance Computing Center (AH PCC) to bring cluster computing to ARSC’s users (see below). The arrival of a small cluster from AH PCC will bring fresh opportunities to users who are new to the field of supercomputing, or who simply need a place to test and benchmark their code. Through this agreement, ARSC users will gain access to AH PCC’s larger clusters located in New Mexico.

ARSC is also working on two additional collaborations, one with the U.S. Army Cold Regions Test Center (CRTC) in Fort Greely, Alaska and the other with the Communications Research Laboratory (CRL) of Japan, which will expand existing relationships between CRL and UAF. Through these partnerships researchers will benefit from sharing resources and technology and participating in mutually beneficial projects.

We are confident that these collaborations will not only bring new opportunities to ARSC, but will work to facilitate ARSC contributions to new developments in the field of high performance computing. ARSC is proud to be a part of this exciting industry, and proud to join forces with other organizations which share our goals of new discoveries and cutting-edge research.

Frank Williams
Director

ARSC bits and bytes

❖ In September, ARSC welcomed three new UAF faculty members to the center. These faculty will work part time at ARSC and part time in their respective departments. Darrell Hicks will be working jointly with the center and the Department of Mathematical Sciences. Lorie Liebrock and Glenn Chappell will be working jointly with the center and the Department of Computer Science.

❖ In October, ARSC staff installed the center’s first Linux cluster. The 16-processor machine arrived at ARSC from the Albuquerque High Performance Computing Center (AH PCC). The machine will be used in the spring semester by joint appointee Lorie Liebrock for a UAF computer architecture class, as well as for ARSC classes and projects.

❖ In September, ARSC hosted a network training workshop through the National Laboratory for Applied Network Research (N LAN R) which is located at the Pittsburgh Supercomputing Center (PSC). Talks on TCP/IP tuning, multicast and IPv6 were given by Andrew Adams and Michael Lambert of PSC and Phil Dykstra of WareOnEarth. These talks provided network staff and users with ideas for tuning systems and applications and making more effective use of networks. Network utilization may be more easily examined using tools such as the Active Measurement Program (AMP), developed by N LAN R. ARSC is part of the N LAN R AMP mesh and will soon be part of the developing Defense Research and Engineering Network (DREN) AMP mesh.
Wieslaw Maslowski
Department of Oceanography
Naval Postgraduate School

Julie McClean
Department of Oceanography
Naval Postgraduate School

Mathew Maltrud
Los Alamos National Laboratory

Snapshot of sea surface temperature (in degrees Celsius) from a 0.1-deg" forced with daily winds from the Navy Operational Global Atmospheric field and frontal systems appear very rich. Statistics of these features are key to reproduce features and processes important to Navy prediction.

Wieslaw Maslowski and Julie McClean are partners in a Department of Defense Challenge Project allocation, which allows them large amounts of computer time to tackle especially important and large problems. The two researchers at the Naval Postgraduate School in Monterey, California are working to perfect ocean and sea ice models in an effort to predict climate variability in response to human-forced or natural variability. Their efforts will be useful to the US Navy as a prediction system to forecast ice and oceanic conditions in the Arctic, which will help in such applications as search and rescue as well as short-term climate studies.

Maslowski is using ARSC resources while McClean is using resources available at the Army Research Laboratory (ARL) Major Shared Resource Center.

"I used ARSC resources in 1999 for testing and preliminary running as a non-Challenge user. I appreciate the help from ARSC during that period as it enabled a smooth transition to ARL as their primary Challenge user," said McClean.

Maslowski is working with a kind of modeling technique called coupling, which McClean will also eventually use. Coupled modeling is at the cutting edge of supercomputing research. A decade or so ago, when the field was new, researchers worked to perfect models of one type or another—for instance, an atmospheric model or an ice model. As these models became more reliable, and supercomputing technology grew through the development of computers that could handle larger problems, researchers began working to put more than one model together. This technique is called coupling—the process of fitting more than one model together to create a more accurate picture of the world. McClean's current Los Alamos Laboratory Parallel Ocean Program model is the largest ocean model ever to be run. Once this model is perfected, it will be coupled with ice and atmosphere models to create an extremely large, holistic model.

Modeling the Arctic Ocean

Maslowski and his fellow researchers are studying the role of the Arctic Ocean and adjacent marginal seas in the global ocean and climate. They work toward development of a new state-of-the-art coupled ice/ocean model for predictive use in the Pan-Arctic region, as well as test a general circulation model to assess its potential use in the forecasting system.

"Better understanding of critical physical processes controlling the ice and ocean circulation and its variability in the Arctic Ocean will allow more realistic representation of this region in global climate models," says Maslowski.

Maslowski and his team have been evaluating improvements due to increased resolution in Arctic-region models. From this, they have learned that the higher-resolution models indeed give a much more accurate picture of the model. However, a model at the resolution that the researchers need will require massive computational power.

"The resulting three-dimensional numerical grid of our model domain consists of millions of points, and at each of
these points multiple calculations are carried out to solve the set of discretized mathematical equations describing ice-ocean dynamics and thermodynamics,” says Maslowski. “This means that the model requires computers that are able to perform billions of operations per second—a performance available only from a supercomputer.”

What is unique about Maslowski’s work is that by using supercomputing technology, he and his fellow researchers are at the cutting edge of developing increasingly realistic modeling resolution. For example, they were the first to include the Canadian Archipelago at a high enough resolution to realistically represent the export of fresh water through this important but previously neglected pathway. The researchers also use dye tracers which allow them to track the temporal and spatial distribution of major water masses in the Arctic Ocean, and verify the model results with observations of various oceanographic tracers.

**Parallel Ocean Program**

McClean and her team are using a state-of-the-art global model to study the changes in ocean currents, temperature and salinity over periods ranging from a week to several years. Their model is using a horizontal resolution of about 10 kilometers at the equator decreasing to about three kilometers near the poles, with 40 vertical levels. With this model, the researchers are producing very realistic currents as well as the associated eddies or rings found in the ocean. The final model produces a realistic simulated ocean that can be used to understand the ocean's character and motions where researchers do not have real data.

“The model equations do not simulate all ocean processes,” said McClean. “However, as the power of supercomputers increases, so does our ability to simulate a wider range of ocean movements.”

McClean is responsible for preparing, running, analyzing and evaluating the global 0.1-degree, 40-level POP model. The data produced will be used in the future global coupled prediction system. Parts of the data from this model will also be given to Maslowski’s team for testing with other components of the future prediction system.

“The POP model will likely be used as the ocean component of a global atmosphere/ocean/ice-coupled Navy prediction system that will produce forecasts of future oceanic conditions for periods of up to five days,” said McClean. “Fields from this model will also provide the larger-scale ocean conditions for regional ocean, ocean/atmosphere or ocean/ice models which can also be used to produce forecasts.”

The Navy hopes that McClean’s and Maslowski’s work will move the field closer to meteorological and oceanographic prediction within the next decade by producing a high-resolution global coupled air/ocean/ice model which assimilates data by providing the initial conditions from which a forecast is performed.
Summer Visitors at ARSC

ARSC staff started out a busy summer this year by hosting the center's first West Point cadet interns. Caleb Williams and David Balcom arrived at ARSC in June for a three-week internship as part of an effort by the U.S. Military Academy to give cadets real-world experience beyond the classroom.

Under the direction of ARSC user services staff members Tom Baring and Guy Robinson, Balcom and Williams assessed the usability of ARSC tutorial software and learned about parallel computing by testing the capabilities of the Cray T3E using a parallel virtual machine algorithm.

In addition to working at the center, the cadets had their first opportunity to live in a college dormitory outside of a military environment. The cadets joined other ARSC and UAF interns and toured the Alaska Synthetic Aperture Radar Facility, the UAF Museum, Eielson Air Force base's Cope Thunder Facility and the Cold Region Test Center in Fort Greely, Alaska. Both ARSC and the cadets found the experience rewarding, and ARSC looks forward to continuing the program next summer.

Alaska Research Summer Challenge

This summer marked the third annual Alaska Research Summer Challenge hosted by ARSC, under the direction of Program Manager Betty Studebaker. The summer intern program is part of a coordinated effort by ARSC and the Pan American Center for Environmental Studies (PACES) at the University of Texas at El Paso (UTEP) to increase the pool of future professionals in the areas of computer science, mechanical engineering, electrical engineering, supercomputing and visualization applied to scientific problems. The program encourages development of the ability of the students to apply computer- and information-based technologies to real world problems. Four students from UTEP and one student from the University of Alaska Anchorage (UAA) joined ARSC staff for a summer of learning.

William Boyd, a junior in electrical engineering at UTEP, worked with aerospace communication and electrical engineering Ph.D. student Shawn Houston, who is also an ARSC user consultant, to perform basic analysis of a rectenna using simulation software and laboratory experiments. A rectenna is a combination of a rectifying circuit and an antenna. The project was sponsored jointly by the Space Grant Program of Alaska at the UAF Institute of Northern Engineering, the Electrical Engineering Department and ARSC. The simulations were carried out on ARSC's SGI workstations.

Carmen Arroyo, also a junior in electrical engineering at UTEP, worked with William Boyd on mapping slotted waveguide antennas as part of the Space Grant Program. The results from Arroyo's work will help determine the best transmit antenna for optimal transmission and reception of the rectenna.

Melissa Ramirez, a senior in computer science at UTEP, worked with ARSC joint faculty members Chris Hartman and Bill Brody to add menu functionality to the two re-
Rosario Chavez, a senior in computer science at UTEP, worked in the ARSC visualization lab digitizing museum artifacts. The museum collections department loaned a mineralized ivory harpoon head and a set of wooden dance figures made by native Alaskan Lame Jacob at the Bethel fishing camp in 1936. The items were digitized using a Microscribe™ and the Maya™ software package, available to ARSC through an educational partnership. Chavez then colored and texturized the digital representations to create realistic three-dimensional images of the objects.

Chavez's work has important implications for the future of preserving native artifacts. The resulting images can be used by researchers through an online three-dimensional image database of the museum's collections. Accurate three-dimensional models can be used by researchers in lieu of the actual objects, which is especially appropriate for extremely fragile or rare objects that are in great demand for study. This was the first time the museum participated in the program, and staff at both the museum and ARSC are excited to continue the effort next year.

Researchers Get In Touch with ARSC

In addition to student interns, several ARSC researchers ventured to Fairbanks this summer to meet with ARSC staff, attend conferences and work on improving their projects. Wieslaw M aslowski (see Challenges page 4) of the Naval Postgraduate School met with research liaison and massively parallel processing specialist Guy Robinson. While in Fairbanks, M aslowski was able to meet with other Arctic Ocean researchers as well as discuss visualization ideas for his Department of Defense Challenge project allocation.

Don Morton of the University of Montana made his annual trip to Fairbanks in July. Morton worked with ARSC technical services staff to explore some of the aspects of setting up ARSC SGI workstations as a cluster. Morton has spent the last six years working on clusters of Linux workstations. At the end of his visit, Morton gave a talk outlining his goals and efforts in using Linux clusters for low-end research and development activities in computational science.

"Summer is a busy time in Interior Alaska," said ARSC Director Frank Williams. "We're happy to take advantage of this time of year to work with our users from far away, expand projects and encourage energetic participation in the field of high performance computational research."
ARSC Brings More Storage On-Line

Moving an entire STK PowderHorn Tape Silo is no small task. But ARSC staff, with the help of some StorageTek experts, accomplished just that in August. The current ARSC silo had to be moved just a few feet to make room for a second silo. The addition of the new silo nearly doubled ARSC’s current storage capacity. It was needed to accommodate the growing terabytes of data ARSC researchers are producing on the systems.

“We think bigger research problems come bigger data sets,” said ARSC storage specialist Gene McGill. “We currently store about 24 terabytes of data, and that number is growing at a rate of about 1.7 terabytes per month.”

In order to accommodate this data, ARSC’s second storage silo, a StorageTek 9310, was connected to the first, also a 9310. The old silo held two StorageTek Timberline drives, and four StorageTek Redwood drives. The new silo holds eight StorageTek 9840 drives. The increased room of the new silo allows room for 5,554 additional tapes—each storing up to 20 gigabytes of data. In addition to the increased storage, users will notice a reduction in the amount of time it takes to load their data onto the systems.

“The new drives get data to the user faster,” said McGill. “Both the new 9840s and the old Redwoods transfer data at about 10 to 11 megabytes per second. But where the Redwoods take 30 seconds to mount to the beginning of a tape, the 9840s mount in 13 seconds. The 17-second difference may not sound like much—but in those 17 seconds the 9840 could have transferred 170 megabytes of data. That’s ten average-sized files on the Cray T3E, all transferred before the Redwood even got started.”

The StorageTek silos provide a place to store the massive amounts of data ARSC users produce on the Cray supercomputers so that the local disks remain available for other researchers’ work. When a user runs his or her code again, and needs to access previously created data, two robotic arms inside the silo scan the bar-coded tapes to find a particular tape and load its data. After installation of the second silo, both silos were connected with a pass-through port allowing the robotic arms to pass tapes between the silos.

“This upgrade positions ARSC for future growth,” said Barbara Horner-Miller, ARSC’s associate director. “Our goal is to be ahead of the curve in providing the resources our users need.”

We currently hold about 24 terabytes of data, and that number is growing at a rate of about 1.7 terabytes per month.
Modeling Ice Sheets (continued from page 1)

Holland and his colleagues are proposing a new theory for polynya formation based on ice-ocean-topography interaction using a regional general circulation model.

Although scientists are not sure how polynyas form, these structures play an important role in the life of the sea-ice cover. Exposing the surface water increases heat exchange from the ocean to the atmosphere. Through increased heat exchange, polynyas can increase melting in the sea ice. When sea ice melts, freshwater is added to the ocean—thereby changing the salinity of the water in the area. Ocean circulation encourages growth or shrinkage and thus affects the life of a polynya by changing its size.

“Science is based on observations of nature,” says Holland. “It’s a difficult task to pull something out of a computer code that explains why nature likes to work in a certain way. This is why we have to combine both observational data and computational data—and test them against one another.”

Ice and Ocean Interaction

All of Holland's projects deal with ice and ocean interactions. In another study he is looking at how geostrophic eddies influence the sea-ice field. Geostrophic eddies are currents in the ocean that move differently than the main current, due to forces produced by the Earth's rotation.

Holland and his colleagues have found that effectively modeling oceanic eddies affects the outcome of sea-ice simulations. His model results show that the ocean eddies act to continuously reduce the sea-ice concentration. This finding helps other researchers make more accurate models. Oceanic interactions such as this add additional dynamics to Holland's model. These dynamics also create a need for finer resolution and significant supercomputing resources.

Because Holland's model encompasses both sea ice and ice shelves, the structural size of his code is effectively doubled. By adding ice on the ocean surface, additional topography is created, which increases the size of the model. During the summer of 2000, Holland visited ARSC to work with user services staff members Guy Robinson and Tom Baring, so that he could learn how to use OpenMP and MPI constructs to make his model run faster, and more efficiently.

While at ARSC, Holland also worked with Trinette Kaufman, one of ARSC's summer interns from the University of Alaska Anchorage. Kaufman spent the summer benchmarking Holland's code. Through her efforts, Holland was able to increase the speed of his model.

As the field of supercomputing research grows, computational models are growing, too. As with many new fields in science, early computational models sought to look at the small aspects of a problem, test for accuracy against real-life observations, and then build on those models. Today, as the field of high performance computing grows, researchers are expanding their models to encompass more aspects of a problem. With this growth comes a need not only for more computational power, but also an equally pressing need for more communication between researchers in different fields.

“Scientists want to find out new things about nature,” says Holland. “At the end of the day you have to clear everything off your desk and ask yourself ‘what have I learned?’”

Further information on any of the above topics may be found at the web site http://fish.cims.nyu.edu/intro_research.html.

ARSC Welcomes a new Supercomputer

In September ARSC welcomed a new Cray SV1 parallel vector supercomputer and retired the older Cray J932se. The new machine, also named Chilkoot, will provide 16 times the processing speed, four times the disk space and four times the memory of its predecessor. Final installation was completed in the middle of September, and the machine was available for users by the end of September.

“Our Cray J90 was overwhelmed by our researchers' huge computational problems,” said Barbara Horner-Miller, ARSC’s Associate Director. “The Cray SV1 will provide additional computational cycles that are needed by both the High Performance Computing Modernization Program and our academic researchers.”

The new SV1 is available for use by academic and Department of Defense researchers at ARSC. It is equipped with 32 processors, four gigawords of memory and two terabytes of disk storage.

ARSC's new Cray SV1, located in the Butrovich Computing Facility in the basement of the Butrovich building on the University of Alaska Fairbanks campus is the only white SV1 in the world. The white color represents the center's concentration on arctic research. (ARSC Photo)
ARSC Currents

Using Technology to Expand Scientific Research

Guy Robinson
ARSC Research Liaison/MPP Specialist

In the field of supercomputing, we are perhaps most familiar with numerical data—be it the raw data as measured by a scientist in the field and scribbled in a notebook, or gigabytes transmitted hourly from a satellite passing far overhead. All forms of data contribute valuable pieces to the scientific record. Ready access to this data is important if scientists are to successfully conduct research. Data of many kinds and from many sources must be collected and combined in a reliable manner.

Access to numerical data is facilitated by the growth of high-speed data networks, the World Wide Web and the creation of graphical images to aid the understanding of detail or to give a summary of content. But we must not forget that data is also contained in the wide variety of physical samples and other objects that have been carefully collected by arctic researchers over many years, if not over lifetimes. During every arctic summer, researchers carefully scour arctic soils collecting fragile pieces of geologic and archaeological history to be taken back to the lab to be examined.

Access to such physical collections can be difficult—either due to restriction on how much can be on display at one site or by the need for researchers or the artifacts themselves to travel to numerous locations. Collections must be carefully monitored and maintained in order to preserve these pieces of history for future researchers.

In an effort to investigate possible solutions for accessing of these artifacts, Rosario Chavez, a senior in computer science at the University of Texas at El Paso, and an ARSC summer intern, used the various hardware and software available in the ARSC visualization laboratories to create three-dimensional models of selected objects from the University of Alaska Museum collection.

The concept behind this project was that a three-dimensional model with which a researcher can interact could provide much more detail than a simple set of photographs. As Chavez and her advisors at the Museum found, with current technology the effort needed to create a highly accurate representation of even a simple artifact is considerable. Faster methods will be needed to encompass complete collections and less intrusive means of creating the models will be necessary to deal with fragile items. This experiment was a small step in determining what is needed to make entire collections available for meaningful research over networks.

Curators of established physical collections and managers of emerging data collections face the problem of access to data and the problems in making that data available in a form that is useful for research activity on a daily basis. Collections must be both searchable and expandable, and relationships must be shown between different components. Many of the skills and techniques developed by curators to cope with physical collections can be adapted to data collections once reliable means of creating and disseminating digital artifacts have been secured.

Visualization software and solid modeling packages combined with high-speed networking and access grid nodes, which allow groups of people to interact with one another from across the world, promise to make more data available to researchers than ever before. These technological advances also present many new ways to expand the collaborative foundation on which scientific progress depends—permitting greater interaction between researchers than ever before and continuing to expand the open culture of science.

Data of many kinds and from many sources must be collected and combined in a reliable manner.
ERDC Partnership Brings New Opportunities to ARSC

In July of this summer, ARSC and the U.S. Army Engineer Research and Development Center, a Department of Defense Major Shared Resource Center (ERDC MSRC), along with Silicon Graphics Inc. (SGI) announced a collaborative agreement to build and evaluate a 512-processor single-system image using the newest NUMAflex modular technology.

The SGI Origin 3800 series machine will be installed at ERDC MSRC in Vicksburg, Miss. and will provide access to authorized researchers via high-speed networks from anywhere in the nation.

"This venture provides a way for the two centers to evaluate one of the newest emerging technologies,” said ARSC Director Frank Williams. “An opportunity like this sets the stage for wise investment in future hardware. Our involvement in setting up a large SGI Origin 3800 system will help us be smarter in evaluating other computing platforms and at the same time give our users access to the newest high performance computing architecture."

Initially, ARSC will contribute 128 processors, as well as ideas, expertise, and research applications for the testing stages of the project.

"The installation of this 512-processor system will give government and academic researchers across the country access to the most advanced NUMA shared-memory computing architecture available today,” said Bradley Comes, director of the ERDC MSRC. “A partnership like this across academia, government and industry enhances opportunities for information exchange, which can only help the scientists do better research. We look forward to the opportunity to work with all our partners.”

Who we are and what we do...

The Arctic Region Supercomputing Center supports research in science and engineering with an emphasis on high latitudes and the Arctic. ARSC is a part of the DoD High Performance Computing Modernization Program and the University of Alaska Fairbanks.

Hardware

ARSC operates a 272-processor, 450 MHz CRAY T3E System named Yukon with 68 gigabytes of distributed memory and 522 gigabytes of disk storage. The T3E System has a peak potential parallel performance of over 230 gigaflops.

ARSC also operates a 32-processor CRAY SV1 vector parallel supercomputer with four gigawords of shared memory and two terabytes of disk storage. The SV1, named Chilkoot, provides peak potential parallel performance of 38.4 gigaflops.

Visualization hardware includes numerous Silicon Graphics workstations, a Pyramid Systems ImmersaDesk and a professionally-equipped video editing studio.

ARSC data storage resources include two StorageTek robotic tape silos which can accommodate hundreds of terabytes of data.

ARSC staff

Specialists at ARSC provide expertise in visualization, massively parallel supercomputing, storage, parallel vector supercomputing, code optimization and networking.

The close relationship of ARSC with the University of Alaska extends the center’s expertise to include specialty areas of the university’s research institutions. These include ice, ocean, and atmospheric coupled modeling; regional climate modeling; global climate change; permafrost, hydrology and arctic engineering; magnetospheric, ionospheric and upper atmospheric physics; petroleum and mineral engineering; and arctic biology.

Communication

Connectivity to ARSC is provided by an OC12 (622M bps) extension to the Seattle Pacific/Northwest GigaPoP where direct peering provides access to the Defense Research and Engineering Network, Internet2’s Abilene network, the vBNS network, and the commodity Internet.
George Blamey, a doctoral candidate at the University Alaska Fairbanks Institute of Marine Science, is using ARSC resources to learn how to use valuable tools that will help her produce a model and visualize the results from her research.

Blamey began her research by using data from Al Hermann, an ARSC researcher from the National Oceanic and Atmospheric Administration’s Pacific Marine Environmental Laboratory. Hermann provided Blamey with a data set similar to the one she will eventually produce as part of her research. By using this data, she was able to learn the complex visualization software packages CAVE5D and Vis5D. In addition, Blamey used Vis5D files created by Hermann to create CAVE5D files. These files enabled her to explore the data on ARSC’s Pyramid Systems ImmersaDesk.

This image shows the three-dimensional representation of Hermann’s data created by Blamey. The data depicts an oceanic eddy found off the coast of Alaska. The image at left shows the early formation of this eddy, while the image at right shows the final stages of development. Biological communities may thrive in an eddy, but as the eddy spins off and collapses, the community may perish due to the resulting environmental changes. This and other eddies may play an important role in the fisheries productivity of the Gulf of Alaska. By using three-dimensional visualization software, the researchers were able to better study this important feature.

Blamey’s work will continue into the biological aspects of oceanic modeling. As a part of this research, she is working with ARSC user Sarah Hinckley of the National Marine Fisheries Service to develop a three-dimensional biological model which Blamey will use to explore the ecosystem processes in the Alaska Coastal Current.