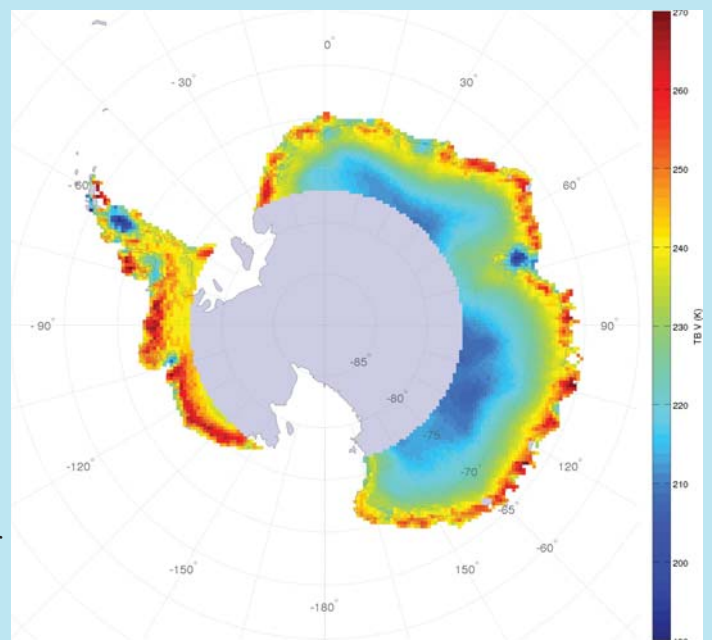


Aquarius, Salinity and the Cryosphere

The objective of the Aquarius/SAC-D mission is to measure sea surface salinity all over the globe. According to the Aquarius website, <http://aquarius.nasa.gov/>, “Just as too much or too little salt in our diets affects our health, so too do high and low salinity have profound effects on how the ocean circulates, how freshwater cycles around Earth and how our climate works. The concentration of salt on the ocean surface — the part of the ocean that actively exchanges water and heat with Earth’s atmosphere — is a critical driver of ocean processes and climate variability. To better understand the regional and global processes that link variations in ocean salinity to changes in the global water cycle - and how these variations influence ocean circulation and climate - NASA built and launched Aquarius, the primary instrument aboard the international Aquarius/Satélite de Aplicaciones Científicas (SAC)-D observatory.”

Developed collaboratively between the U.S. and the Argentinian space agencies, the Aquarius/SAC-D satellite mission was designed to monitor Sea Surface Salinity (SSS) using a combination of passive and active microwave observations. Ludovic Brucker (GESTAR/USRA) works on developing algorithms to estimate snow properties from space using state-of-the-art multilayer snow evolution and emission models. In exploring the application of Aquarius/SAC-D to cryospheric studies, Dr. Brucker spent the past several months developing weekly-polar-gridded products that contain data from Aquarius: L-band radiometers, L-band scatterometer, and retrievals of salinity. Aquarius data at latitudes higher than 50° were averaged and gridded into weekly products of brightness temperature, normalized radar cross section, and sea surface salinity. The new weekly-polar-gridded datasets start in August 2011, with the first Aquarius observations, and will be updated on a monthly basis. His satellite products, plus a user guide, are available on the NASA Goddard Cryosphere Science Research Portal: <http://neptune.gsfc.nasa.gov/csb/index.php?section=273>.

The cryosphere has been extensively studied using passive microwave satellite observations for over 40 years. The first imaging radiometer, launched in 1972, was the Electrically Scanning Microwave Radiometer (EMSR) that provided the earliest maps of the global sea ice cover. In 1978, the longest continuous passive microwave data record started with the launch of the Scanning Multichannel Microwave Radiometer (SMMR). This data record, used to monitor sea-ice cover properties, ice sheet melt, and snow on land, continues to the present with Special Sensor Microwave Imager Sounders (SSM/I, SSMIS) and Advanced Microwave Scanning Radiometers (AMSR-E, AMSR2). The lowest frequency observations available at high latitudes were at ~7 GHz with SMMR and the AMSRs (and only at 18 GHz with the SSM/Is). Since late 2009, passive L-band observations from the Soil Moisture and Ocean Salinity (SMOS) mission have been routinely collected over both polar regions; as mentioned, since August 2011, Aquarius/SAC-D has provided both passive and active L-band observations. Similar observations will be collected with the upcoming Soil Moisture Active/Passive (SMAP) mission (launch date: late 2014). While these missions have been primarily designed for the monitoring of either salinity or soil moisture, new applications are being developed to study the cryosphere.



Map of Aquarius brightness temperature observed by radiometer 3 at vertical polarization over the Antarctic ice sheet during the last week of August 2013. Grid cells with land fraction less than 0.25 were masked. (Image Credit: Ludovic Brucker, USRA/GSFC)

(Continued on page 2)

(Aquarius, cont'd)

Investigations showed that the L-band radiometric observations contain information about sea ice thickness, and soil physical state (freeze/thaw) in subarctic environments. Moreover, specific regions of the Antarctic ice sheet can be used as calibration and validation sites for L-band radiometers, because the L-band radiation can reach hundreds to thousands of meters deep, where the ice properties are very stable. This particular aspect of L-band observations opens new research topics and motivates the development of innovative approaches to study long-term climatic changes over the ice sheets, perhaps retrieving data on centuries-old ice over the Antarctic Plateau. To allow for an efficient use of the Aquarius data over the polar regions, and to move forward our understanding of the L-band observations of ice sheet, sea ice, permafrost, and polar oceans, three weekly-polar-gridded products were developed.

A recent paper by Ludovic Brucker, Emmanuel Dinnat and Lora Koenig, titled “Weekly-gridded Aquarius L-band radiometer/scatterometer observations and salinity retrievals over the polar regions: Applications for cryospheric studies”, was published in *The Cryosphere Discussion* (2013) and presents the products, maps and time series of Aquarius weekly-polar-gridded data over the Greenland and Antarctic ice sheets, sea ice in both hemispheres, subarctic land where seasonal snow and frozen soil exist, and the polar oceans. A brief analysis of L-band observations is given to encourage future use of these products.

At the 2013 AGU conference in San Francisco, CA, Dr. Brucker will be giving a talk on December 9th in the remote sensing of the cryosphere session to present these new products and their potential. Further, he will be the chair of an invited session at the upcoming 2014 IEEE International Geoscience and Remote Sensing Symposium (IGARSS) titled “L-band remote sensing of the cryosphere using SMOS, Aquarius, and SMAP radiometers”. Abstracts for this session must be submitted before January 13, 2014. Visit <http://www.igarss2014.org/> for more information.

2013 Antarctic Mission: News from Operation IceBridge

As part of the OIB multimedia support team, **Jefferson Beck** (GESTAR/USRA) has produced and narrated a video from Operation IceBridge, Antarctica 2013, that details the preparation, the equipment, the flight paths, the scientists’ and staff’s journeys, and the ultimate arrival of NASA’s P-3 research aircraft at McMurdo Station, where scientists set up their equipment for use in this year’s mission. Click here to view the video titled “First Landing: IceBridge P-3 on the Sea Ice Runway”: <http://www.youtube.com/watch?v=oehz4KXdYBU>, and stay tuned for the next installment, “The Science Begins”.

As with any mission to Antarctica, weather can play a factor and this time was no exception; the mission was shortened, and as of December 2, the crew was on their way back to the U.S. More information on the 2013 Antarctic mission can be found at http://www.nasa.gov/mission_pages/icebridge/news/fall13/.



Image above: NASA P-3 lands Nov 16th. Photo by Jefferson Beck, from the Operation IceBridge blog. Visit <http://blogs.nasa.gov/icebridge/>.

New Hires

GESTAR welcomes the following members:

Manisha Ganeshan
Daeho Jin
Min-Jeong Kim
SeungKuk Lee
Junhua Liu
Daniel Perez-Ramirez
Thomas Stanley
Kristen Weaver
Brad Weir
Tian Yao

Students

Amon Dow III (Morgan State University) is working with Tom Kucsera on digitizing the height characteristics of smoke plumes observed from the MISR (Multi-angle Imaging SpectroRadiometer) instrument on board the TERRA satellite using IDL GUI interfaced software developed at JPL called MINX (MISR Interactive eXplorer).

Moving On

Thomas Diehl left in early September and has returned to Europe for a new position.

Yoo-Geun Ham has accepted a new position in South Korea.

Edoardo Pasolli is now a Postdoctoral Fellow at Purdue University.

Ronald Albright, Zhibin Sun and Jiansong Zhou are also pursuing new opportunities.

SAVE THE DATES!

The 5th Annual Goddard Film Festival is scheduled for *January 15, 2014* in the Building 3 Auditorium. There will be 10am and 11am showings.

Also, watch your inbox for announcements on the NASA Goddard SED Poster Party, scheduled for *January 29, 2014* from 1pm - 4pm.

Maniac Talk

GESTAR thanks the following scientists who presented talks this past fall: Lorraine Remer, University of Maryland, Baltimore County/NASA Goddard (Sept) and David Atlas, NASA Goddard, (Sept); Alexander Marshak, NASA Goddard (Oct); Josefino "Joey" Comiso, NASA Goddard (Nov) and John Mather, NASA Goddard and Nobel Prize Winner in Physics, 2006 (Nov).

Please visit the Maniac Talk site to review the 2014 schedule and to access videos of previous presentations. Thanks again to Charles Gatebe and Bill Hyrbyk for their continued assistance with these well-attended events.
<http://maniactalk.gestar.usra.edu/>

GESTAR Annual Picnic

On Thursday, November 21st, GESTAR staff and scientists gathered at the Goddard Rec Center for an afternoon of enjoying good food, meeting new hires, and reconnecting and swapping stories. GESTAR extends well-deserved thanks to the planning team: Cecile Rousseaux, Deepthi Achuthavarier, Radina Soebiyanto, Ryan Barker, and Senior Meeting Coordinator Lynette Queen.



From left to right: Bill Corso, GESTAR Director; Radina Soebiyanto; Deepthi Achuthavarier; Cecile Rousseaux. Not pictured: Ryan Barker and Lynette Queen.
(Photo by Amy Houghton, GESTAR/USRA)

The exploration of Mars, the Red Planet, continues with MAVEN

On November 18, 2013, MAVEN (Mars Atmosphere and Volatile Evolution), NASA's latest mission to Mars, was launched and is expected to go into orbit around Mars in September 2014. The goal of this mission is to determine how the planet's atmosphere evolved from warm and wet to cold and dry. MAVEN's Principal Investigator Bruce Jakosky of University of Colorado at Boulder gave a presentation at the National Air and Space Museum in late September 2013, detailing the goals of MAVEN.

Michael Lentz (GESTAR/USRA) of the NASA Goddard Conceptual Imaging Lab created many visuals conveying the atmospheric changes on Mars over billions of years ("Mars Transition", <http://svs.gsfc.nasa.gov/vis/a020000/a020200/a020201/>). Earlier this year, **Daniel Gallagher** (GESTAR/USRA) produced a visualization titled "MAVEN Magnetometer", which conveyed the importance of this instrument on MAVEN: "The Goddard-built MAVEN magnetometer will be a sensitive tool investigating what remains of the Red Planet's magnetic "shield." It will play a key role in studying the planet's atmosphere and interactions with solar wind, helping answer the question of why a planet once thought to have an abundance of liquid

water became a frozen desert. "The MAVEN magnetometer is key to unraveling the nature of the interactions between the solar wind and the planet," said MAVEN PI Bruce Jakosky." Further information on this mission is available from sites at both NASA http://www.nasa.gov/mission_pages/maven/main/index.html and University of Colorado at Boulder <http://lasp.colorado.edu/home/maven/>.

Also, at an earlier MAVEN event held at the University of Colorado at Boulder on October 22, 2013, NASA Administrator Charles Bolden gave a keynote speech in which he recognized three specific individuals from NASA Goddard: Christopher Scolese, Director of NASA Goddard; Colleen Hartman, Deputy Director of Science; and **Charles Malespin**, who is both alumnus of CU Boulder and key player with the Sample Analysis of Mars onboard the Curiosity rover. Administrator Bolden recognized Dr. Malespin's work on SAM and put forth the possibility of how discoveries from SAM and those from MAVEN may overlap. GESTAR also congratulates Dr. Malespin on receiving an award from the Solar System Exploration Division of NASA GSFC "in recognition of [his] dedication and service to the NASA community".

Recent Publications

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~ We've Moved! ~

GESTAR at NASA Goddard Space Flight Center is now located in Building 33, H102-H106.

The GESTAR Team: Universities Space Research Association, Morgan State University, IMSG, Johns Hopkins University, Institute for Global Environmental Strategies, and Ball Aerospace and Technologies.
 Visit us at <http://gestar.usra.edu/>.

The GESTAR Newsletter is published by GESTAR/USRA. Any comments/suggestions/ideas can be forwarded to Amy Houghton, Editor at ahoughton@usra.edu.