**2016 Esri Science Symposium**

Special keynote address, discussion panel, and reception to engage and enlighten scientists at the UC on the hot topics and pressing issues of the day such as climate change, sustainability, visualization and geodesign of Earth futures, and related growth in geospatial technology for the betterment of both science and society. The symposium seeks to "broaden the tent" of participation at the UC beyond the traditional geographers and GIScientists, to those working in the *domain* sciences (e.g., ocean science, hydrology, ecology, forestry, climate science, geology/geophysics, agricultural science, conservation biology, sustainability science and/or geodesign, health sciences, and the social sciences). A further aim is to (re)crystallize a community of scientists normally scattered throughout the week in disparate sessions, by providing a special venue at the UC for them to network with and sharpen each other accordingly.

The symposium will start with a keynote address delivered by a world renowned environmental scientist, followed by a conversational response panel of distinguished speakers, who will react to the keynote, and discuss further how best to implement its vision from an information technology/informatics/GIS perspective. The symposium will end with a brief open discussion/Q&A with the audience and followed immediately by hosted reception with delicious appetizers and drinks.
WELCOME SCIENTISTS!

1st Annual Esri Science Symposium
Esri and the Scientific Community
by Dawn Wright, Esri Chief Scientist

Main Components of Esri’s Program to Support the Scientific Community

The diagram above shows the various aspects of our comprehensive program to support the science community, drawing on the interplay between and among universities, government agencies, and various consultancies, nonprofit, for-profit, and other organizations focused on science. Program components include:

- Field initiatives for graduate and undergraduate students, students with a science focus. Many of these lead to immediate employment with Esri and the GCs.
- Visitor Program: If considering an extended visit to residence of the GCs, please set the guidelines on the field-based program.
- A new $50,000 grant to fund research organizations in the United States. See esri.com/grant.
- Informal collaborations or partnerships on a range of research projects. See recent examples at esri.com/recipes.
New Global Content Challenge

go.esri.com/content-challenge

The Prizes

First place: $10,000 or software equivalent
Second place: $5,000 or software equivalent
Third place: $2,000 or software equivalent

View the full judging criteria at:
go.esri.com/content-challenge

Key Dates

Aug. 29, 2016 | Competition opens
Nov. 11, 2016 | Competition closes at 5:00 p.m. (PST)
Dec. 5, 2016 2017 | Winners announced

Top winners will be honored at:
Esri Federal GIS Conference
Washington, DC
Esri Education GIS Conference
San Diego, CA
Esri Press Scientific Monographs, *Esri Store*
STEM and GIS E-Book, esriurl.com/stemgis

STEM and GIS in Higher Education

We are pleased to offer this e-book in two
AGU Calls for Abstracts, fallmeeting.agu.org/2016

- Exploiting Big Earth Data: GIS and Beyond
- Communicating Science through Data Driven Storytelling
- Architecture and Integration Testbed for Earth/Space Science Cyberinfrastructures
- Spatial Data Infrastructure for Earth and Space Sciences: Analyzing, Visualizing, and Sharing Multidimensional Earth Science Data
2016 Esri Science Symposium Keynote Speaker Bio:

Margaret Leinen, a highly distinguished national leader and oceanographer, is the director of the Scripps Institution of Oceanography at UC San Diego, UC San Diego’s vice chancellor for marine sciences and dean of the School of Marine Sciences. She is also President of the American Geophysical Union (the world’s largest scholarly organization for solid Earth, oceanic, atmospheric, hydrologic, space, and planetary sciences), a member of the distinguished Leadership Council of the Joint Ocean Commission Initiative, past chair of the Atmospheric and Hydrospheric Science Section of the American Academy for the Advancement of Science, and past president of The Oceanography Society.

Prior to joining Scripps in 2013 as its 11th director, she served as Vice Provost for Marine and Environmental Initiatives and Executive Director of Harbor Branch Oceanographic Institute, a unit of Florida Atlantic University. Prior to that she served for seven years at the National Science Foundation (NSF) as Assistant Director for Geosciences and Coordinator of Environmental Research and Education. She oversaw a budget of $700 million, led government-wide planning for climate research, and co-led government planning for ocean research. While at NSF, she presided over and directly influenced some of the most consequential programs in marine, atmospheric, and Earth science.

Leinen received a doctorate in oceanography from the University of Rhode Island (1980), a master degree in geological oceanography from Oregon State University (1975), and a bachelor degree in geology from the University of Illinois (1969). She has received distinguished alumna awards from all three institutions.
What will be necessary to understand and protect the planet...and us?

ESRI User Conference Science Symposium
June 28, 2016

Margaret Leinen
Director, Scripps Institution of Oceanography and
Vice Chancellor for Marine Science, UC San Diego
Figure 2. Change in Sea Surface Temperature, 1901–2012

Change in sea surface temperature (°F):

-1 -0.5 0 0.5 1 1.5 2 2.5 3 3.5 4

+ = statistically significant trend

Insufficient data

IPCC, 2013
Understanding the physical ocean in the 1990s
Ocean heating: our view from ship records

- hand compilations of all available temperature data from cruises from five different scientists averaged at two year time intervals
- substantial error, but…
- clear increase in heating over last 40 years
Argo

National contributions - 3839 Operational Floats

Latest location of operational floats (data distributed within the last 30 days)

March 2016

ARGENTINA (2)  AUSTRALIA (378)  BRAZIL (11)  BULGARIA (2)  CANADA (55)  CHINA (156)  ECUADOR (2)  EUROPE (6)  FINLAND (5)  FRANCE (333)  GERMANY (123)  GREECE (7)  INDIA (125)  IRELAND (7)  ITALY (47)  JAPAN (199)  KENYA (1)  MAURITIUS (3)  MEXICO (2)  NEW ZEALAND (12)  NORWAY (10)  POLAND (3)  SOUTH AFRICA (1)  SOUTH KOREA (56)  SPAIN (9)  TURKEY (3)  UK (134)  USA (2138)
Our view of ocean heating from ARGO

Slope of regression line (red) is 82 ZJ/decade = 0.51 W/m², normalized to Earth area.
Deep ocean and unsampled regions add about 0.07 and 0.1 W/m².
Our view of ocean heating from ARGO

The contour lines indicate regions greater than 2 W/m².
Note the strong warming in the mid-latitude Southern Hemisphere.
Trends over the 10-year record are influenced by interannual variability.

Roemmich, 2016
Figure 2. Change in Sea Surface Temperature, 1901–2012

Change in sea surface temperature (°F):

-1  -0.5  0  0.5  1  1.5  2  2.5  3  3.5  4

+ = statistically significant trend

Insufficient data
Our view of ocean heating from ARGO

The contour lines indicate regions greater than 2 W/m².

Note the strong warming in the mid-latITUDE Southern Hemisphere.

Trends over the 10-year record are influenced by interannual variability.

Roemmich, 2016
Deep ARGO: extending global sampling to the ocean bottom

- Close the planetary budgets heat, freshwater, and steric sea level.
- Quantify the climate-critical deep ocean meridional overturning circulations.
Understanding the solid Earth, its structure and movements
Earth Sciences version of Hubble Space Telescope
Enables comprehensive survey of continent
Named the #1 “Epic Project” by Popular Science in 2011
The US Array: a massive increase in the resolution of seismic measurement
Vertical velocities of deformation along the San Jacinto fault system in southern California predicted by a 2006 numerical earthquake cycle deformation estimate

-Smith-Koner and Sandwell, 2016
Spatially-filtered vertical velocities from 1164 permanent GPS receivers of the EarthScope Plate Boundary Observatory show a good match to vertical velocity predicted from an earthquake cycle model published in 2006 - Howell, Smith-Kontor, Frazer, Tong, and Sandwell, Nature Geosciences, 2016
HPWREN: High Performance Wireless Research and Education Network
A Wireless Safety and Education Network for Society and Science
http://hpwren.ucsd.edu/

San Diego Supercomputer Center
UCSD
San Diego State University
NSF
HPWREN: environmental sensor networks

- sensors in remote sites
- communications
- internet accessible
- real time
- research networks
- high quality data
- public safety networks
- reliable
- resilient
14 May 2014:  
9 Simultaneous Active Fires in San Diego County

San Diego County Red Mountain Fire Cameras

Southeast (left)  “Highway” Fire  
Southwest (center rear)  “Poinsettia” Fire  
West (right)  “Tomahawk” Fire
Goal: Simulate fire growth in southern California

Run FARSITE and Firefly

Inputs:
- Landscape (topography, fuel, etc.)
- Weather (wind, temperature, humidity, etc.)
- Ignition perimeter

Outputs:
- Fire perimeters
- Intensity, flame length, spread rate, etc.

Towards an Integrated Cyberinfrastructure for Scalable Data-Driven Monitoring, Dynamic Prediction and Resilience of Wildfires
Use Case: Fire Growth
Historical Fires - 2013 Mountain Fire
Santa Ana Condition Parameters
Fire Growth Model - 6 Hour Burn
2016 Esri Science Symposium

For “Storify” of tweets captured during the keynote, Q&A, and the reception:
https://storify.com/deepseadawn/2016-esri-science-symposium

For a Flickr album of photos:
http://esriurl.com/sciphotos