NEX
NASA EARTH EXCHANGE

Earth Science Collaborative for Global Change Science

nex.nasa.gov

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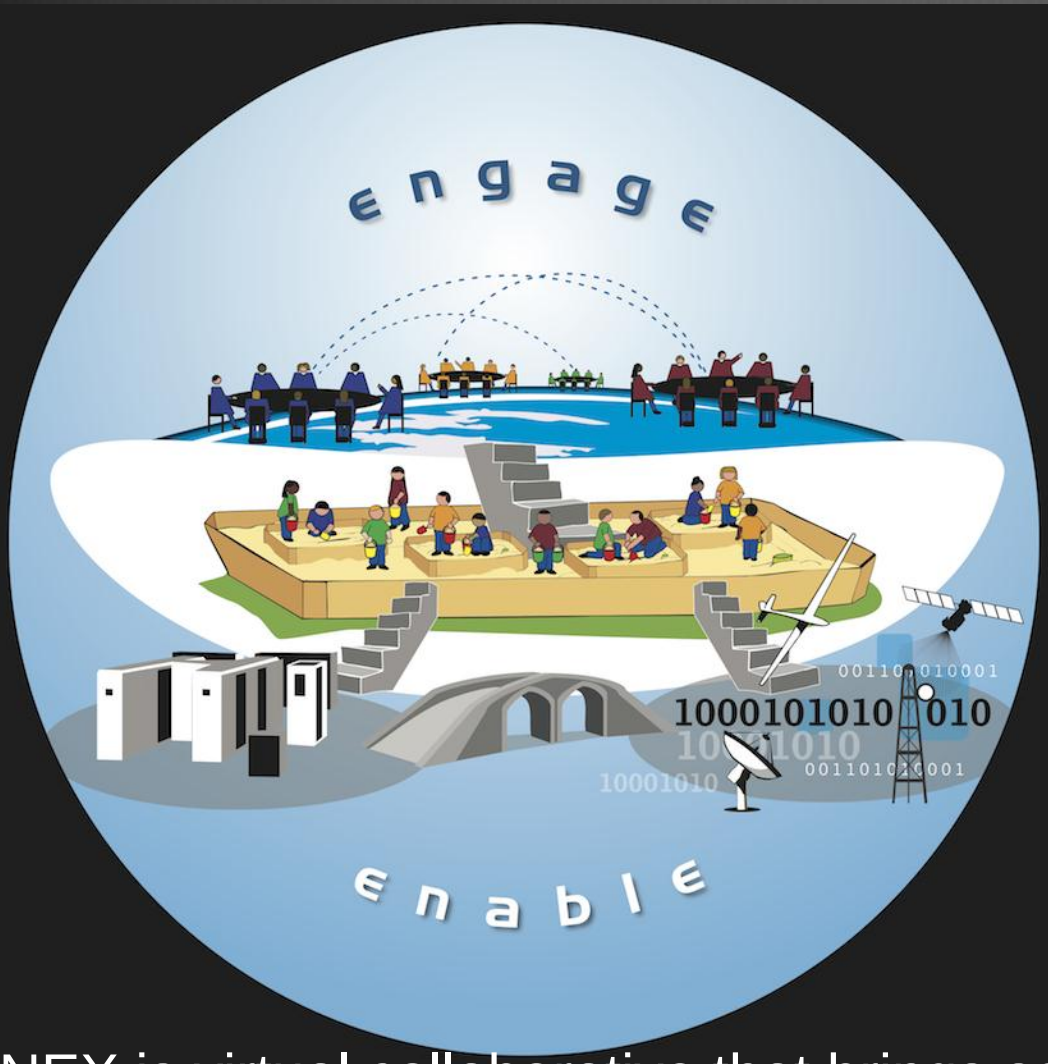
NASA Earth Exchange (NEX)



- **Why we built NEX?**
- **How we built NEX?**
- **Who gets access to NEX?**
- **What does NEX enable?**

NEX is virtual collaborative that brings scientists and researchers together in a knowledge-based social network and provides the necessary tools, computing power, and data to accelerate research and innovation.

Data collection platforms

Earth Science Data Operations

Mission Operations

Science Operations

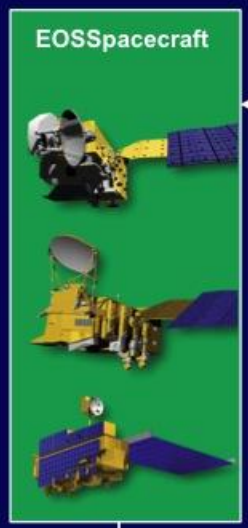
Data Acquisition

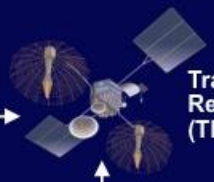
Flight Operations, Data Capture, Initial Processing, Backup Archive

Data Transport to Data Centers/ SIPSs

Science Data Processing, Data Management, Interoperable Data Archive, and Distribution

Distribution and Data Access





Direct Broadcast (DB)

NASA Integrated Services Network (NISN) Mission Services

Internet

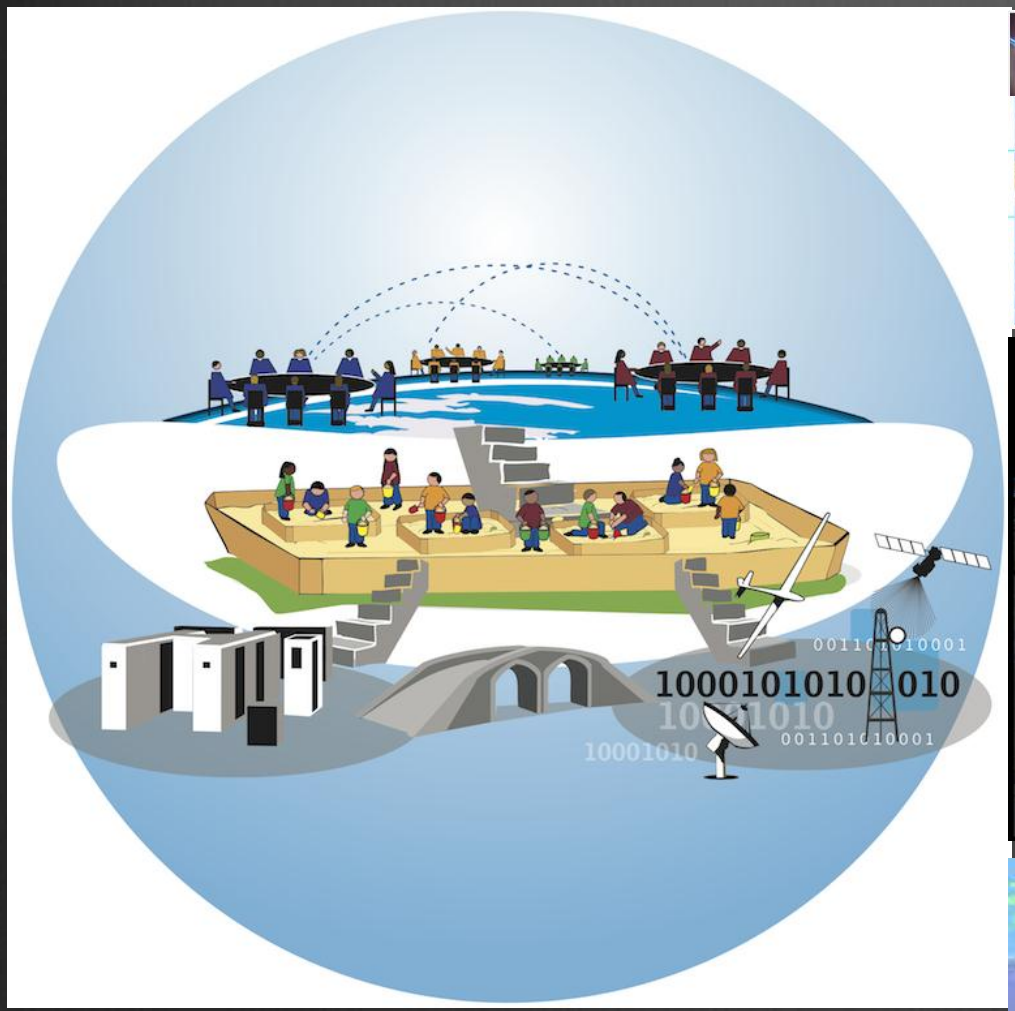
(Search, Order, Distribution)

- Research
- Education
- Value-Added Providers
- Interagency Data Centers
- Earth System Models
- International Partners
- Decision Support Systems

Drivers for an Earth Science Collaborative

- Researchers spend on average 60-80% of their time dealing with data (finding, ordering, waiting, downloading, pre-processing...)
- Moving data sets that are getting larger each year over WAN is getting expensive & time-consuming
- Sharing knowledge (codes, intermediate results, workflows) is difficult. Repeated low level IT efforts waste time and resources
- No standard mechanisms for transparency and repeatability

NEX Implementation



9PB of on-line storage
50PB of tape storage
512 CPUs readily accessible, 180,000 total

COLLABORATION
(over 250 members)

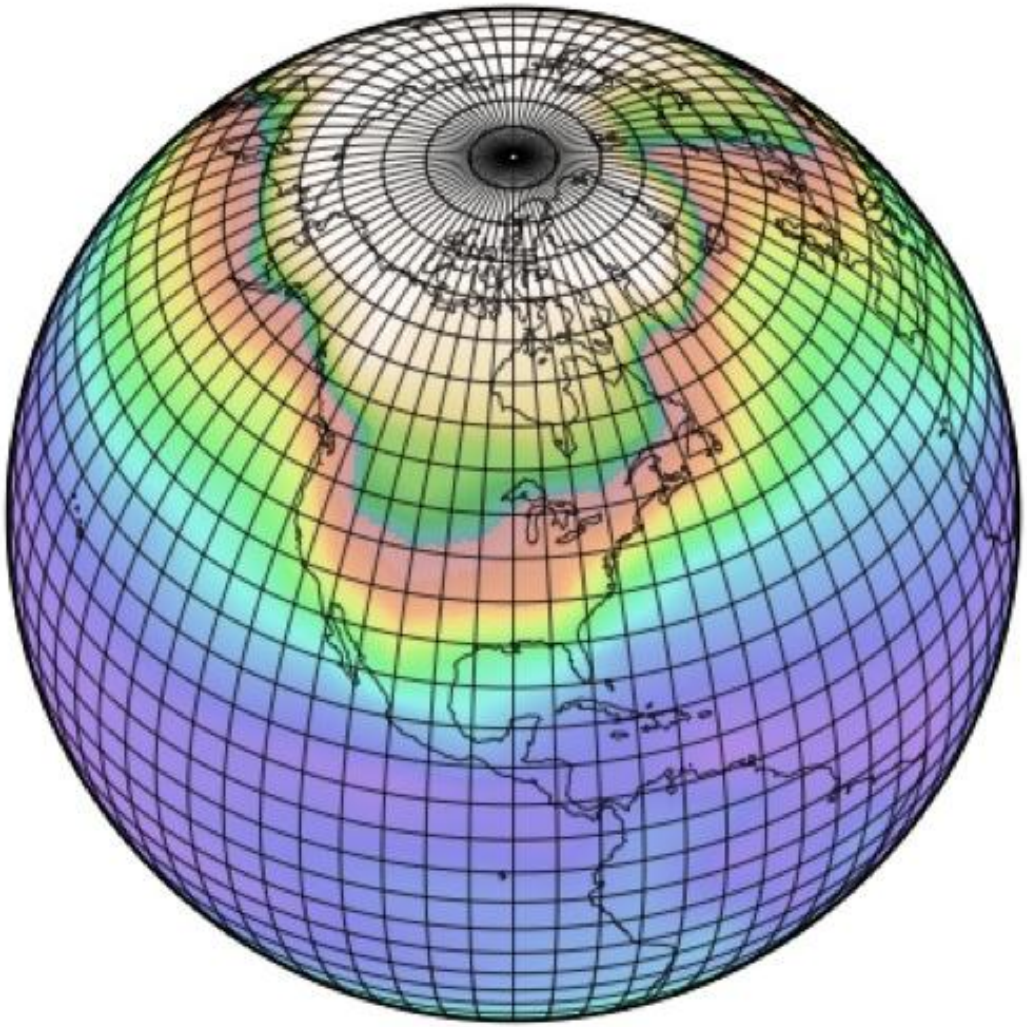
COMPUTING
(9PB, 180,000 cores)

Centralized Data Repository
(over 400 TB of data)

Access to ready-to-use data

Available data: Landsat, MODIS, AVHRR,
CERES,TRMM, GRACE
CMIP5, NCEP

Access to models/analysis tools



Climate, Weather, Hydrology, Ecology

Knowledge capture

Access to workflows to build upon

GEOPHYSICAL RESEARCH LETTERS, VOL. 38, L07402, doi:10.1029/2011GL046824, 2011

Widespread decline in greenness of Amazonian vegetation due to the 2010 drought

Liang Xu,[1] Arindam Samanta,[1,2] Marcos H. Costa,[3] Sangram Ganguly,[4] Ramakrishna R. Nemani,[5] and Ranga B. Myneni[1]

Received 19 January 2011; revised 3 March 2011; accepted 8 March 2011; published 8 April 2011.

[1] During this decade, the Amazon region has suffered two severe droughts in the short span of five years – 2005 and 2010. Studies on the 2005 drought present a complex, and sometimes contradictory, picture of how these forests have responded to the drought. Now, on the heels of the 2005 drought, comes an even stronger drought in 2010, as indicated by record low river levels in the 109 years of bookkeeping. How has the vegetation in this region responded to this record-breaking drought? Here we report widespread, severe and persistent declines in vegetation greenness, a proxy for photosynthetic carbon fixation, in the Amazon region during the 2010 drought based on analysis of satellite measurements. The 2010 drought, as measured by rainfall deficit, affected an area 1.65 times larger than the 2005 drought – nearly 5 million km^2 of vegetated area in Amazonia. The decline in greenness during the 2010 drought spanned an area that was four times greater (2.4 million km^2) and more severe than in 2005. Notably, 51% of all drought-stricken forests showed greenness declines in 2010 (1.68 million km^2) compared to only 14% in 2005 (0.32 million km^2). These declines in 2010 persisted following the end of the dry season drought and return of rainfall to normal levels, unlike in 2005. Overall, the widespread loss of photosynthetic capacity of Amazonian vegetation due to the 2010 drought may represent a significant perturbation to the global carbon cycle. **Citation:** Xu, L., A. Samanta, M. H. Costa, S. Ganguly, R. R. Nemani, and R. B. Myneni (2011), Widespread decline in greenness of Amazonian vegetation due to the 2010 drought, *Geophys. Res. Lett.*, *38*, L07402, doi:10.1029/2011GL046824.

1. Introduction

[2] There is concern that in a warming climate the ensuing moisture stress could result in Amazonian rainforests being replaced by savannas [*Cox et al.*, 2004; *Salazar et al.*, 2007; *Huntingford et al.*, 2008; *Malhi et al.*, 2008], in which case the large reserves of carbon stored in these forests, about 100 billion tons [*Malhi et al.*, 2006], could be released to the atmosphere, which in turn would accelerate global warming significantly [*Cox et al.*, 2000]. Hence, the drought sensitivity of these forests is a subject of intense study – recent articles on the response and vulnerability of these forests to droughts illustrate the various complexities [*Phillips et al.*, 2009; *Saleska et al.*, 2007; *Samanta et al.*, 2010a, 2010b; *Malhi et al.*, 2008; *Brando et al.*, 2010; *Anderson et al.*, 2010; *Meir and Woodward*, 2010]. Severe d
as those associated with the El Niño Southe
(ENSO), when the plant – available soil moistu
a critical threshold level for a prolonged period,
result in higher rates of tree mortality and in
flammability [*Nepstad et al.*, 2004, 2007; *da*
2010]. The drought of 2005, however, wa
ENSO-related droughts of 1983 and 1998 – it
severe during the dry season in southwestern A
not impact the central and eastern regions [*M*
2008]. Of particular interest are reports of lo
[*Phillips et al.*, 2009], decreased vegetation mo
[*Anderson et al.*, 2010] and higher fire counts
2007] during the 2005 drought, and contradict
vegetation greenness changes inferred from sat
tions [*Saleska et al.*, 2007; *Samanta et al.*, 2
This lively state of current affairs is documente
items [*Tollefson*, 2010a, 2010b].

[3] On the heels of the once-in-a-century [*M*
2008] drought in 2005, comes an even more s
in the Amazon region [*Lewis et al.*, 2011]. The
2010 drought still need to be investigated and
unknown, but like the 2005 drought it was
coincided with the dry season. The *Rio Negro*
the Manaus harbor is one of the most useful
acterization indexes in Amazonia because it i
fall totals over the entire western Amazon ba
longest available time series record in the region
This index was at its lowest level (13.63 m ab
reference level, not 13.63 m lower in October
term average for that month, as stated by *Lewis*
since 1902 on October 23, 2010 (Figure 1). Th
in 2005 was 14.75 m, or eighth lowest in the
Negro Manaus time series (Table S1). The
channel, *Rio Solimões*, also reached record
between October 14 and October 23, 2010 a
tions on its course (Tabatinga, Itapéua, Care
intins). The river levels began to ascend with
rains in mid- to late-October 2010. As of N
2010, the *Rio Negro* level is tracking the
recorded river stage recovery (Figure 1). Year
the driest year on record according to these ri

[4] There is presently only a single report on
the 2010 drought on Amazon vegetation, name

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[2]Atmospheric and Environmental Research Inc., Lexington, Massachusetts, USA.
[3]Department of Agricultural and Environmental Engineering, Federal University of Viçosa, Viçosa, Minas Gerais, Brazil.
[4]Bay Area Environmental Research Institute, NASA Ames Research Center, Moffett Field, California, USA.
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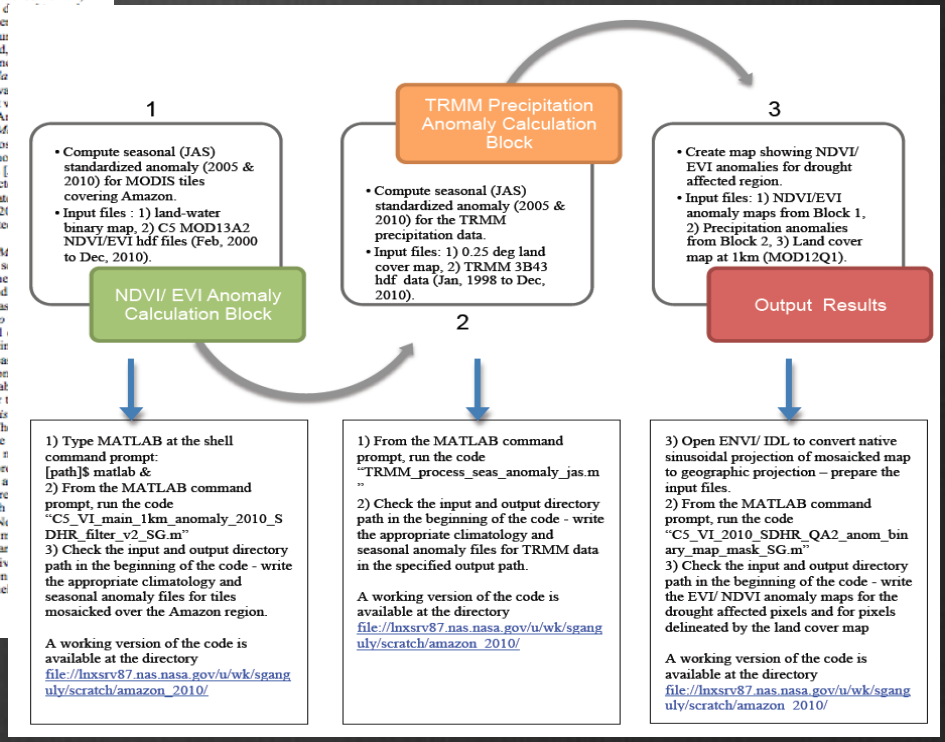
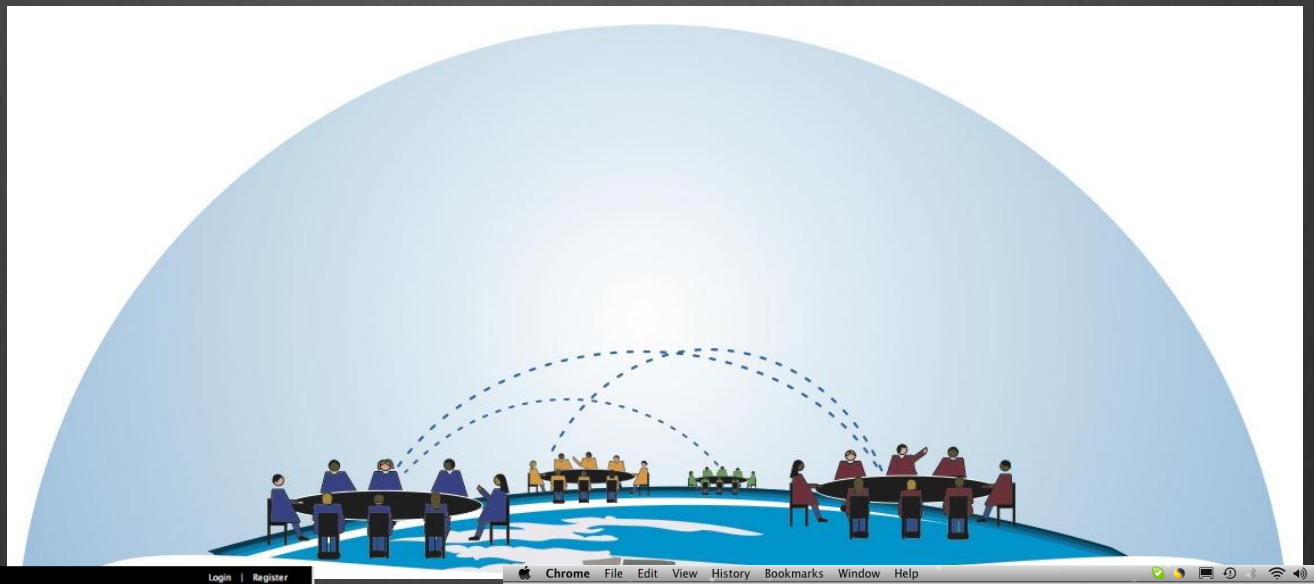
0094-8276/11/2011GL046824



Network




NEX NASA Earth Exchange
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Search
HOME
RESEARCH AREAS
PROJECTS
RESOURCES
MEMBERS
Modeling Strategies for Adaptation to Linked Climate and Land Use Change in the United States
Home
Resources
Members
Resources
1 Publications
2 Others
Related Research Areas
Carbon Cycle & Ecosystems, Climate Variability & Change
Over the coming century, changes in climate and land use and land cover (LULC) have the potential to create major changes in land surface temperature, watershed runoff, and ecosystem productivity throughout much of the world. There are a number of potential best management practices (BMPs) for land use planning and design that could be implemented to mitigate impacts resulting from changes in climate and land use. We propose to use a coupled land use - climate change modeling approach to explore the potential impacts of climate and land use change on productivity, watershed outflow and other processes under different adaptive BMP scenarios. The model will simulate implementation of BMPs to varying degrees, and various adaptive scenarios will be compared to "business as usual" scenarios to evaluate the potential benefit of the BMPs. Results from the simulations will be summarized on a decadal time-step and at the small watershed and local jurisdiction (e.g. county) scale.
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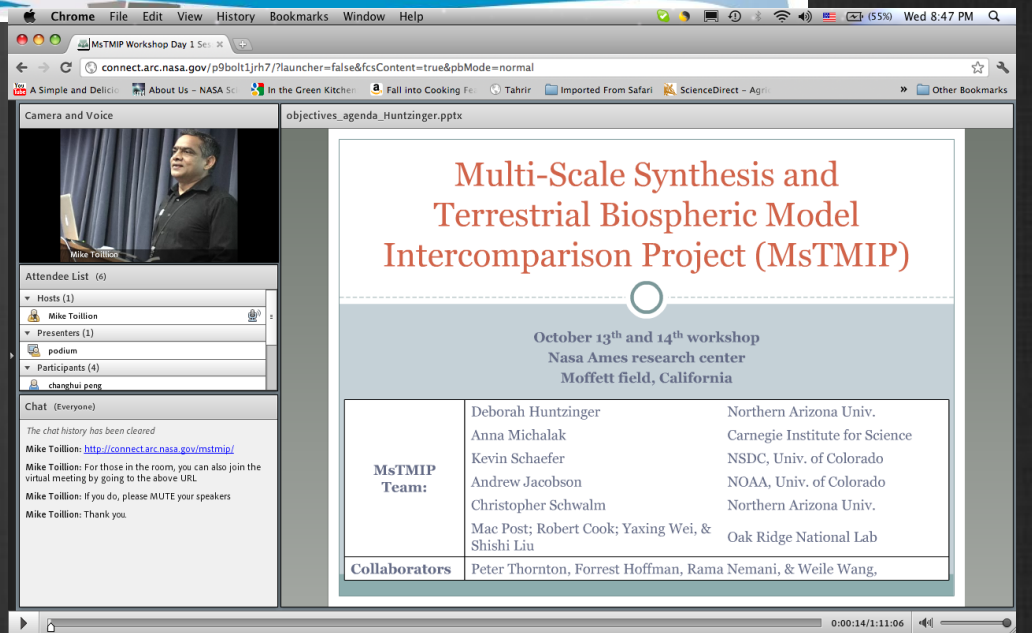
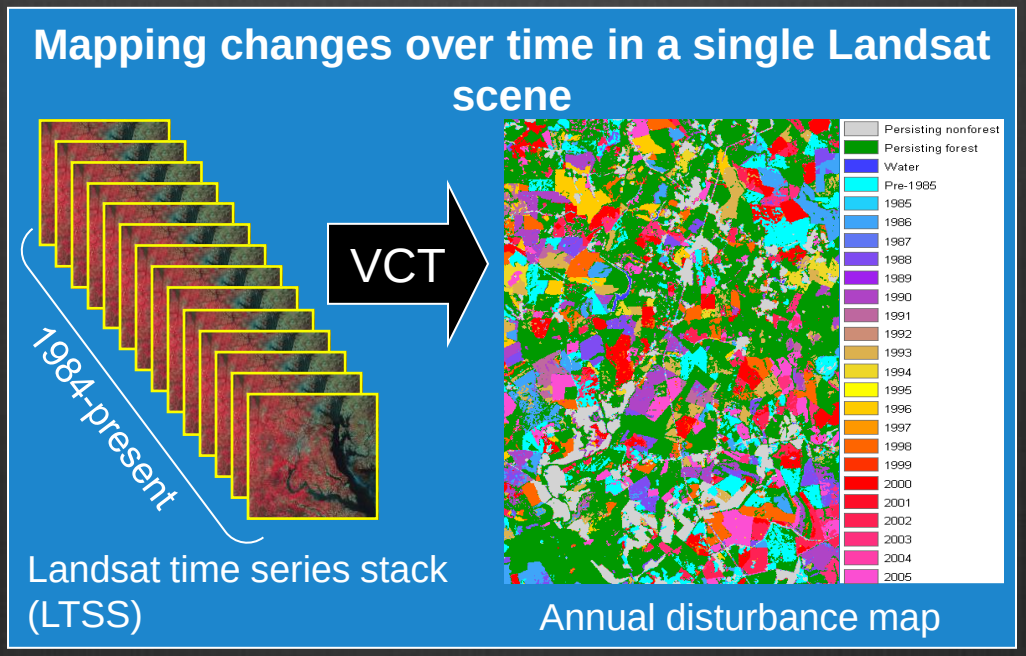
Woods Hole Research Center 149 Woods Hole Road Falmouth, MA 02540-1644
Phone: 508-444-1530 Fax: 508-444-1830
Email: sgoetz@whrc.org
http://www.whrc.org/about/cvs/sgoetz.html
http://lciuc.umd.edu/project_details.php?projid=197
Project Highlight
5 members / 3 resources
Started: Aug 10, 2010
Last Activity: Mar 26, 2011
Admin:
NDC-cmilesi
NDC-fmelton
Scott
Editors:
NDC-rnemani
NDC-wwang3
What can I do on this project?
New Member
Scott Goetz
Joined 6 months, 3 weeks ago
Related Projects
The Expansion of Rubber ...
1 members
4 resources
A New Method For ...
1 members


Chrome File Edit View History Bookmarks Window Help
Wed 8:47 PM
MsTMIP Workshop Day 1
connect.arc.nasa.gov/p9bolt1jrh7/?launcher=false&fcsContent=true&pbMode=normal
Camera and Voice
Mike Toillion
Attendee List (6)
Hosts (1)
Mike Toillion
Presenters (1)
podium
Participants (4)
changhui peng
Chat (Everyone)
The chat history has been cleared
Mike Toillion: http://connect.arc.nasa.gov/mstmip/
Mike Toillion: For those in the room, you can also join the virtual meeting by going to the above URL
Mike Toillion: If you do, please MUTE your speakers
Mike Toillion: Thank you.
objectives_agenda_Huntzinger.pptx
Multi-Scale Synthesis and Terrestrial Biospheric Model Intercomparison Project (MsTMIP)
October 13th and 14th workshop
Nasa Ames research center
Moffett field, California
MsTMIP Team:
Deborah Huntzinger — Northern Arizona Univ.
Anna Michalak — Carnegie Institute for Science
Kevin Schaefer — NSDC, Univ. of Colorado
Andrew Jacobson — NOAA, Univ. of Colorado
Christopher Schwalm — Northern Arizona Univ.
Mac Post; Robert Cook; Yaxing Wei, & Shishi Liu — Oak Ridge National Lab
Collaborators
Peter Thornton, Forrest Hoffman, Rama Nemani, & Weile Wang,
0:00:14/1:11:06

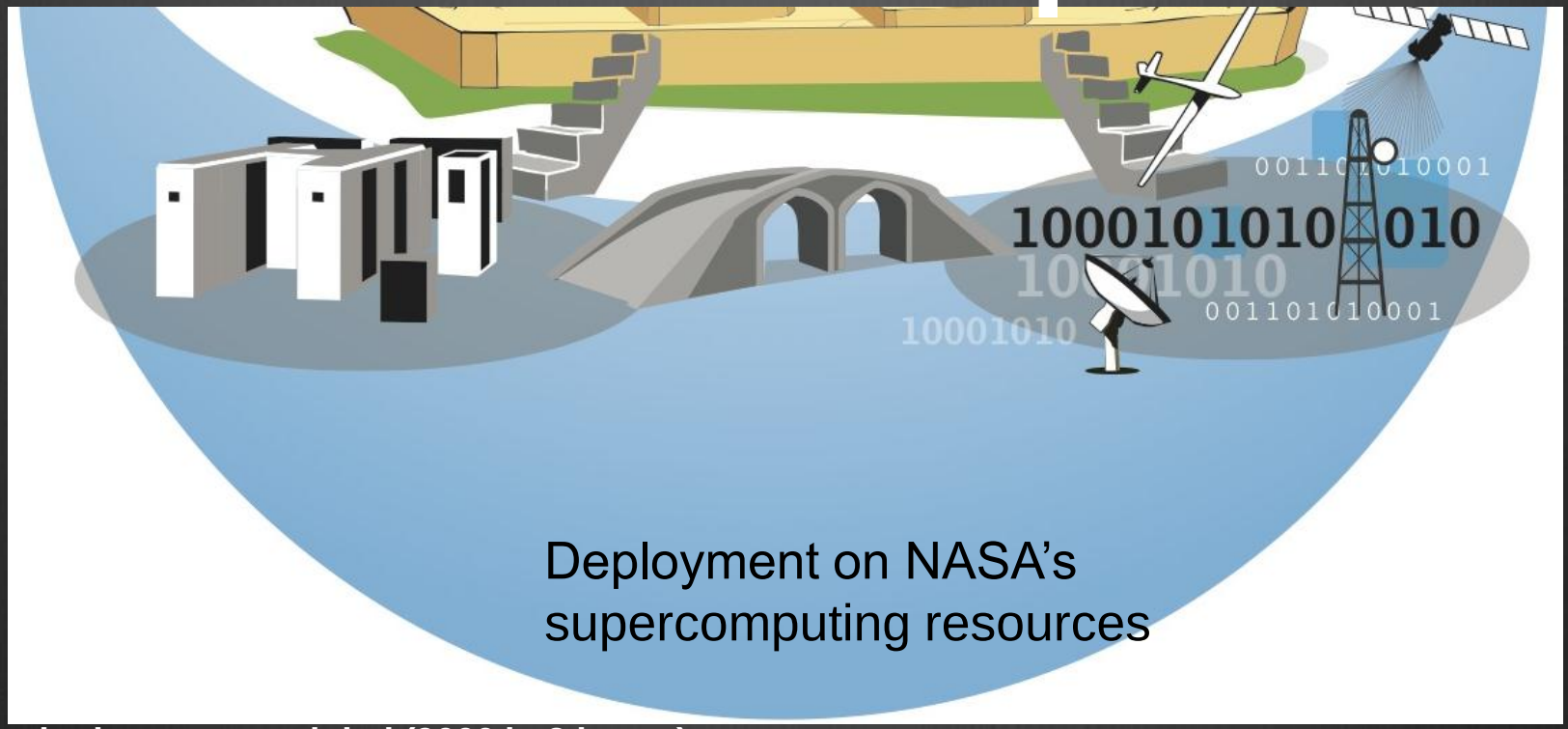
Prototype

Smaller platform for prototyping and development efforts

Two 48 core clusters 200TB storage in each

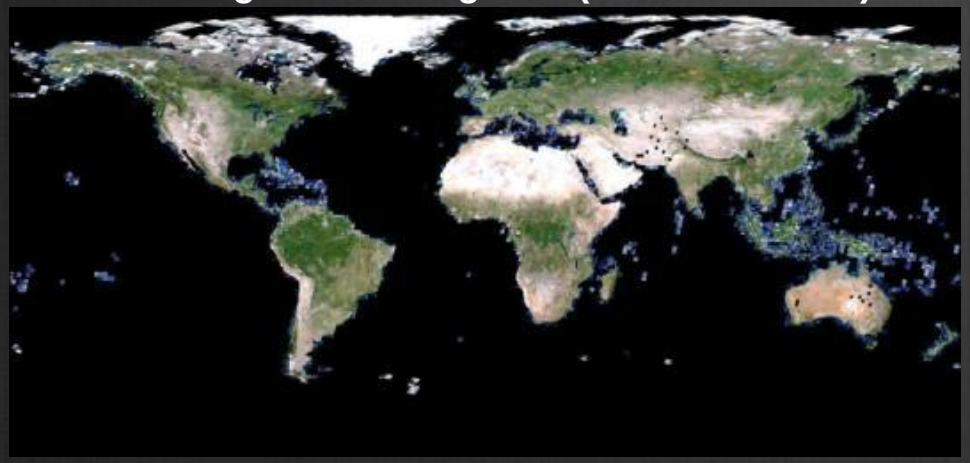


Scale it up



Deployment on NASA's supercomputing resources

From a single scene to global (9000 in 3 hours)

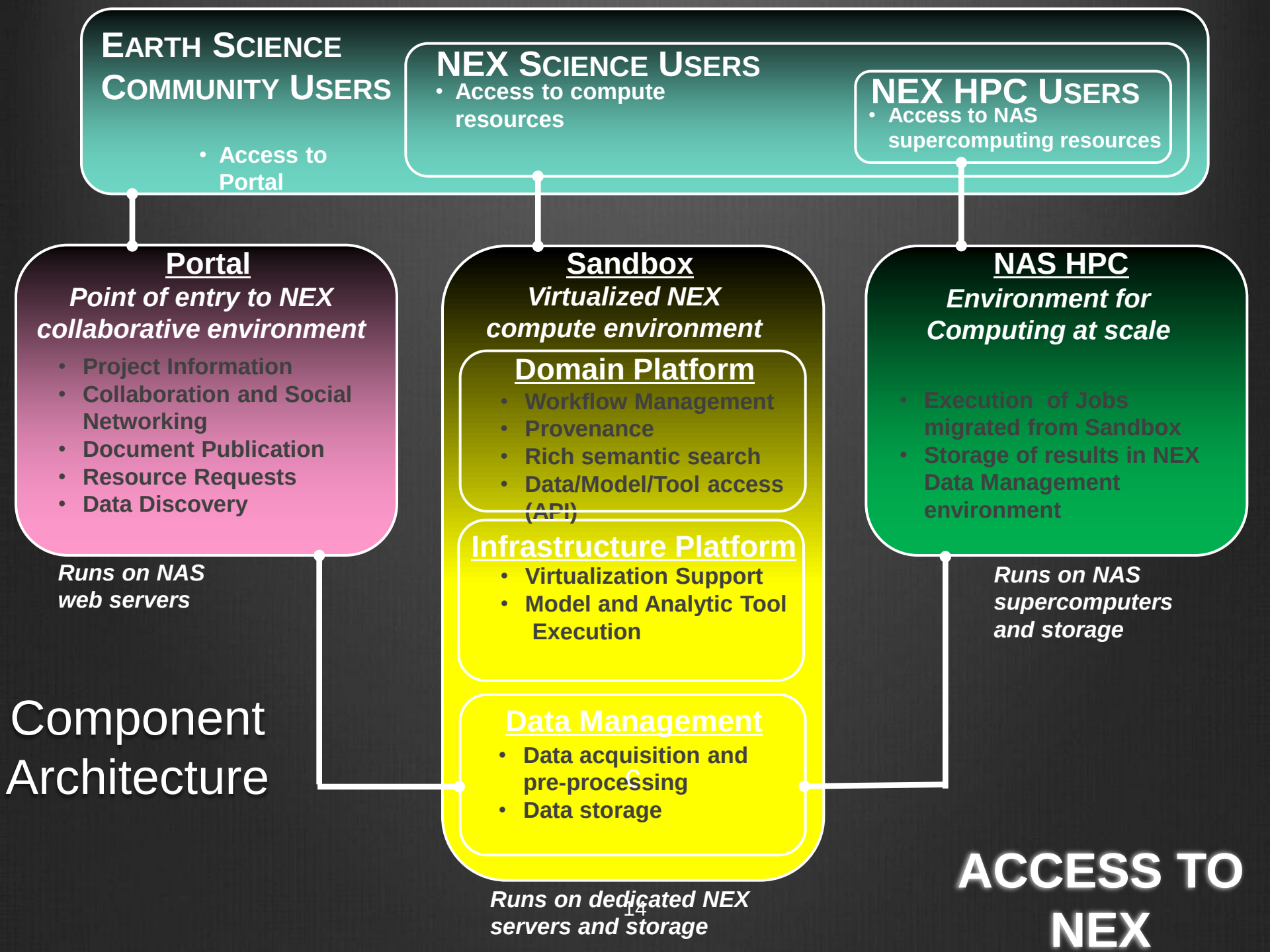


WorldView-2, 50cm, 8 bands (NGA)

NEX Summer Program

Training the next generation Earth scient

Engage Inspire Enable


EARTH SCIENCE COMMUNITY USERS
• Access to Portal
NEX SCIENCE USERS
• Access to compute resources
NEX HPC USERS
• Access to NAS supercomputing resources
Portal
Point of entry to NEX collaborative environment
• Project Information
• Collaboration and Social Networking
• Document Publication
• Resource Requests
• Data Discovery
Runs on NAS web servers
Sandbox
Virtualized NEX compute environment
Domain Platform
• Workflow Management
• Provenance
• Rich semantic search
• Data/Model/Tool access (API)
Infrastructure Platform
• Virtualization Support
• Model and Analytic Tool Execution
Data Management
• Data acquisition and pre-processing
• Data storage
Runs on dedicated NEX servers and storage
NAS HPC
Environment for Computing at scale
• Execution of Jobs migrated from Sandbox
• Storage of results in NEX Data Management environment
Runs on NAS supercomputers and storage
Component Architecture
ACCESS TO NEX

“INFRASTRUCTURE AS A SERVICE”

“PLATFORM AS A SERVICE”

“SOFTWARE AS A SERVICE”

“Science as a service”

"Science as a Service"

NEX members not only get access to these resources..

Computing

- ***Sandbox***
  - 2 x 48 core servers, 128 GB
  - 163 TB storage each
  - 90 users
- ***HPC***
  - 64 Nehalem based nodes
    - Pleiades specialized queue
  - 12 active users
  - 450 TB storage

Data

Data (450 TB)

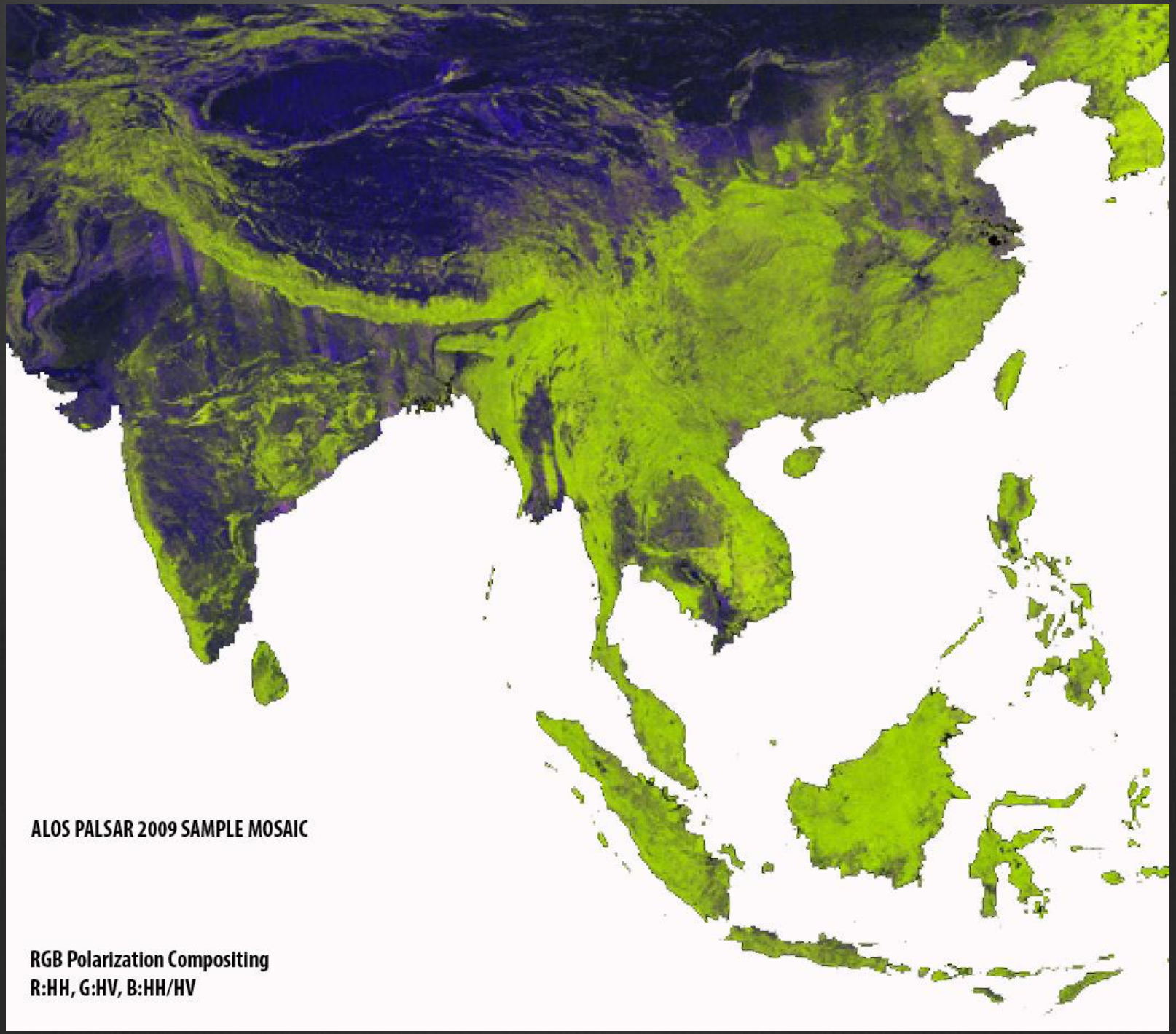
- Landsat (>1.5M scenes)
- MODIS
- TRMM
- GRACE
- ICESAT
- CMIP5
- NCEP
- MERRA
- NARR
- PRISM
- DAYMET

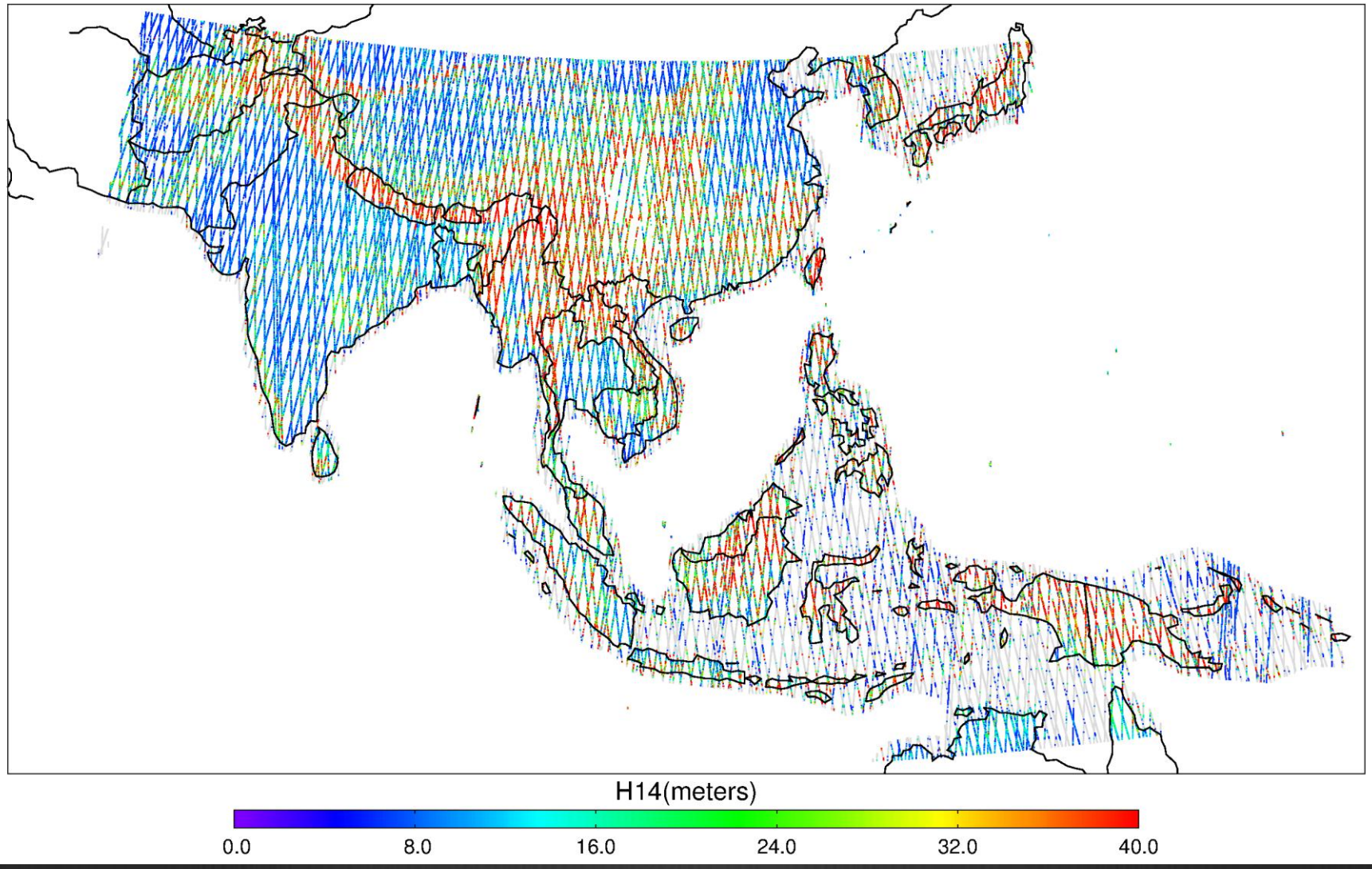
Codes

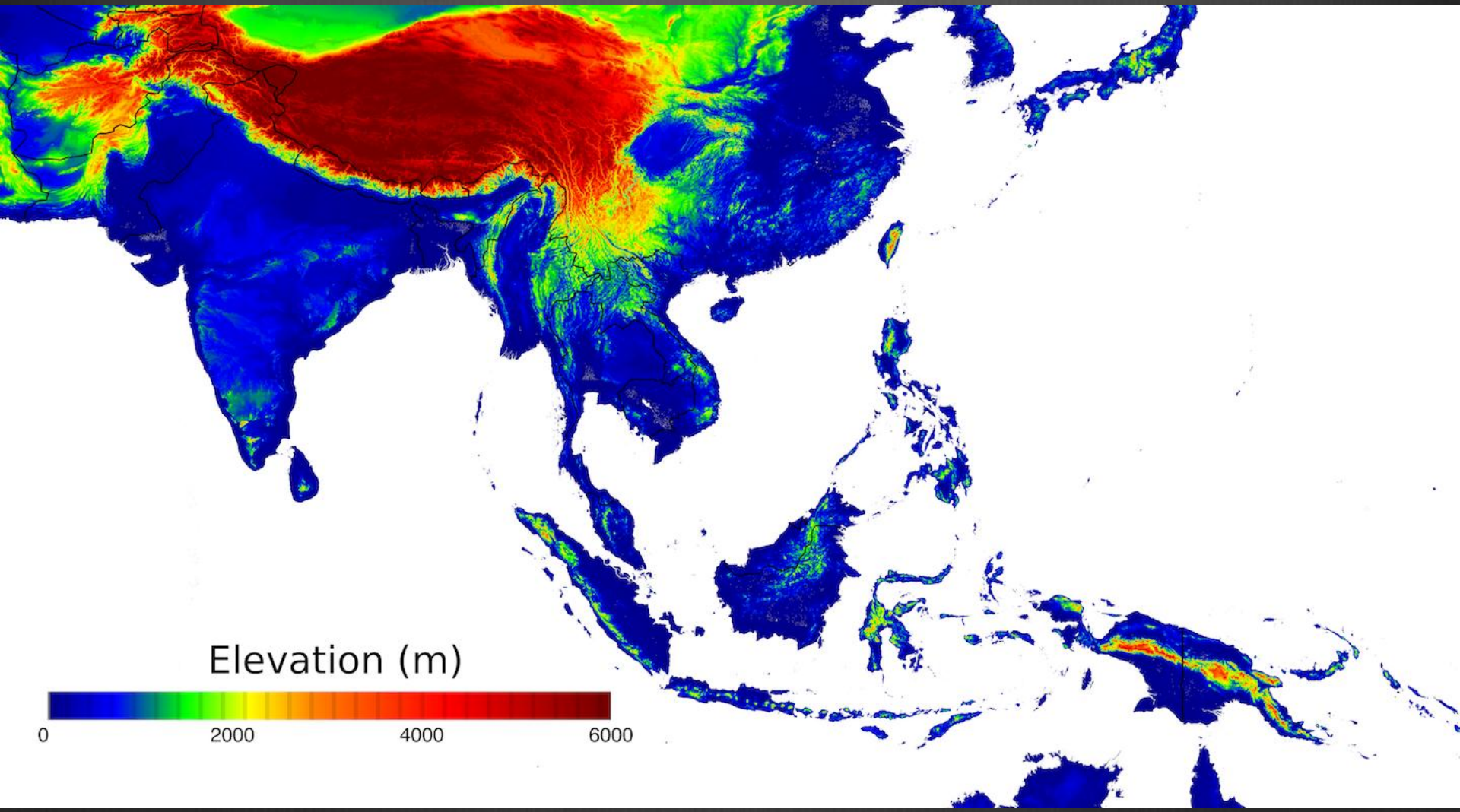
Model Codes

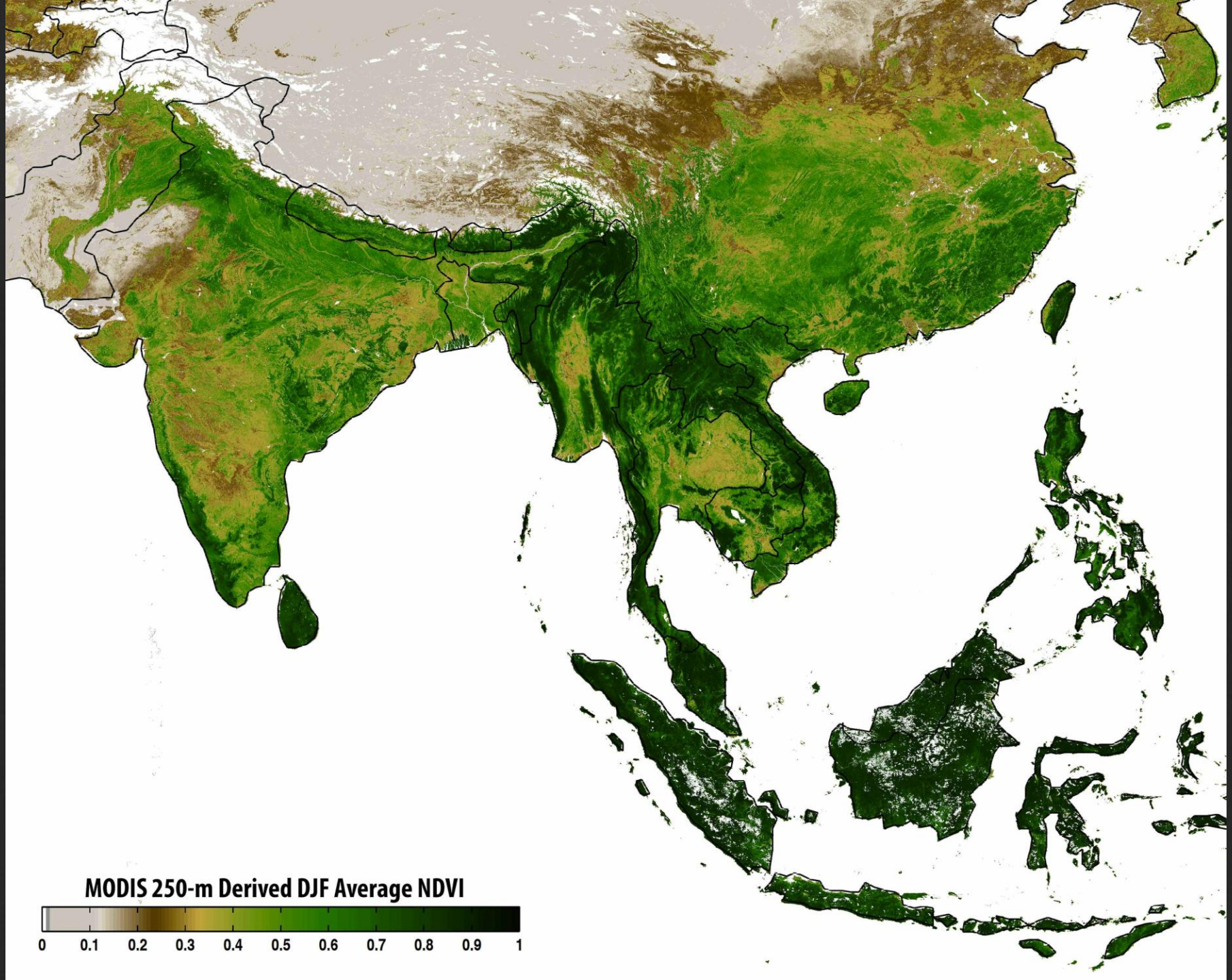
- GEOS-5
- CESM
- WRF
- RegCM
- VIC
- BGC
- CASA
- TOPS
- BEAMS

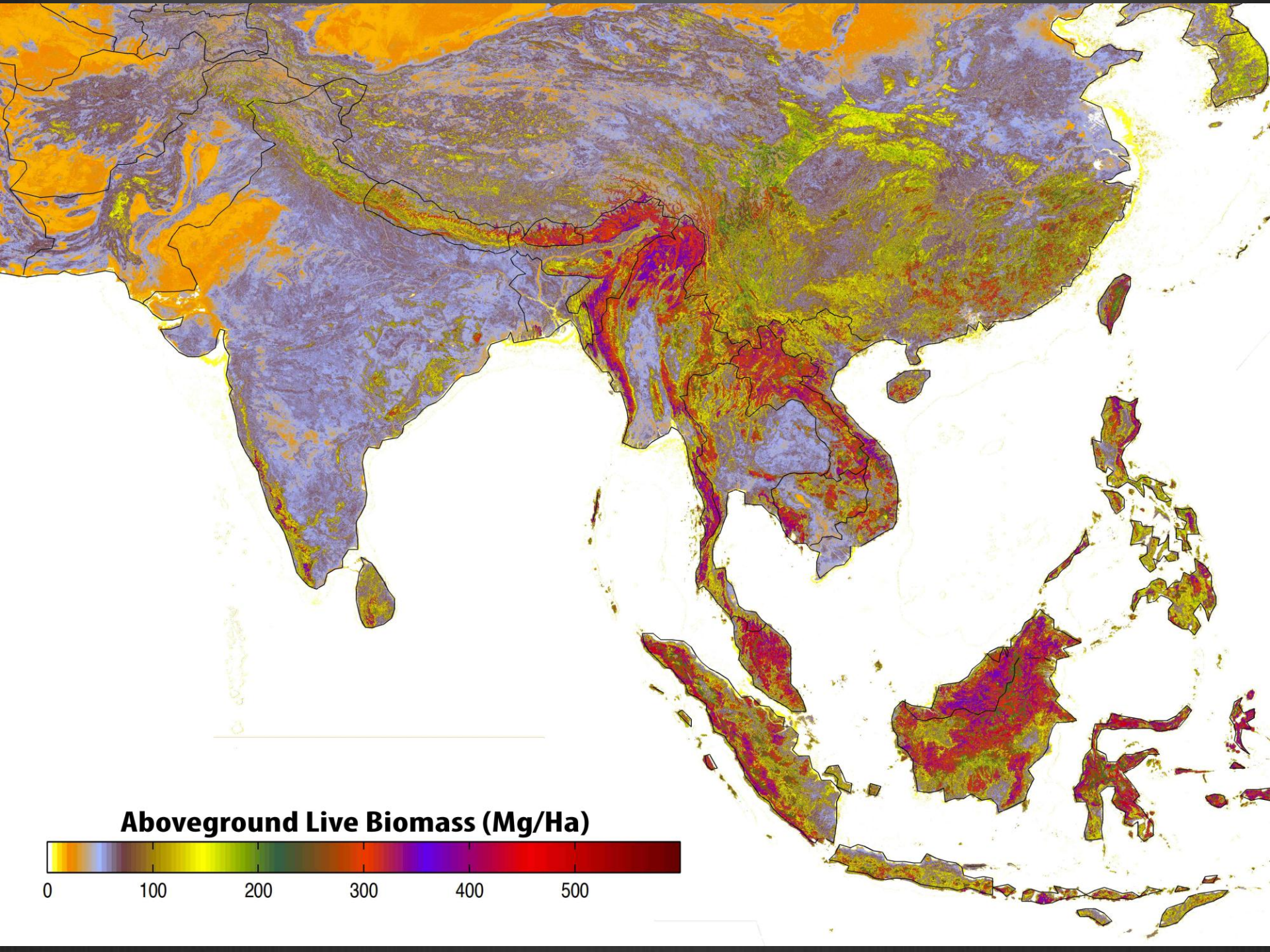
But also a large number of scientific workflows..

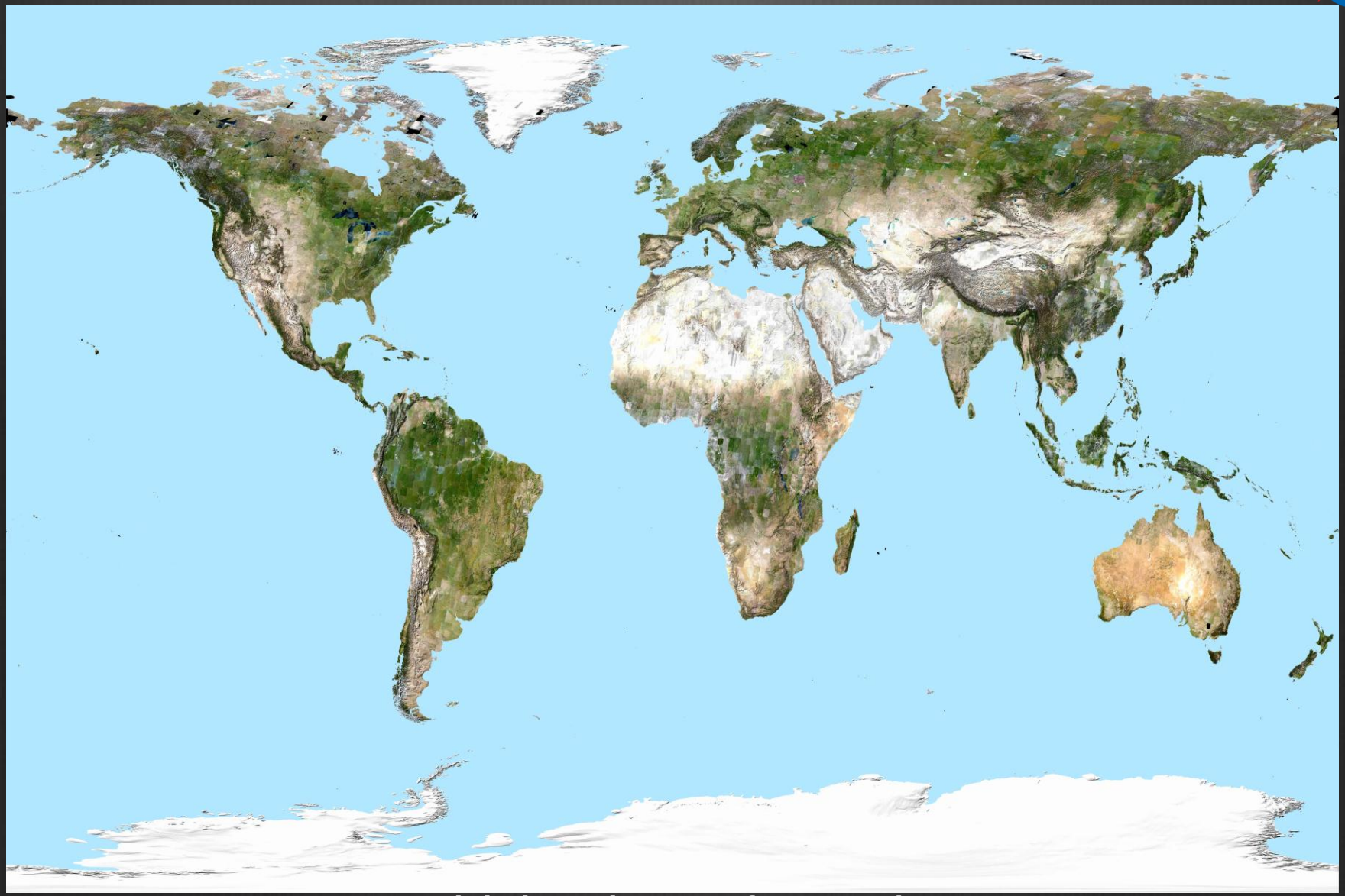

ALOS PALSAR 2009 SAMPLE MOSAIC
RGB Polarization Compositing
R:HH, G:HV, B:HH/HV


H14(meters)
0.0
8.0
16.0
24.0
32.0
40.0


Elevation (m)
0
2000
4000
6000


MODIS 250-m Derived DJF Average NDVI
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Aboveground Live Biomass (Mg/Ha)
0
100
200
300
400
500



Global Land Survey from Landsat
Creating portraits of the planet at 30m, 1972-2010

NEX Supporting MEaSUREs Program.

Web-enabled Landsat Data (WELD, David Roy, SDSU)

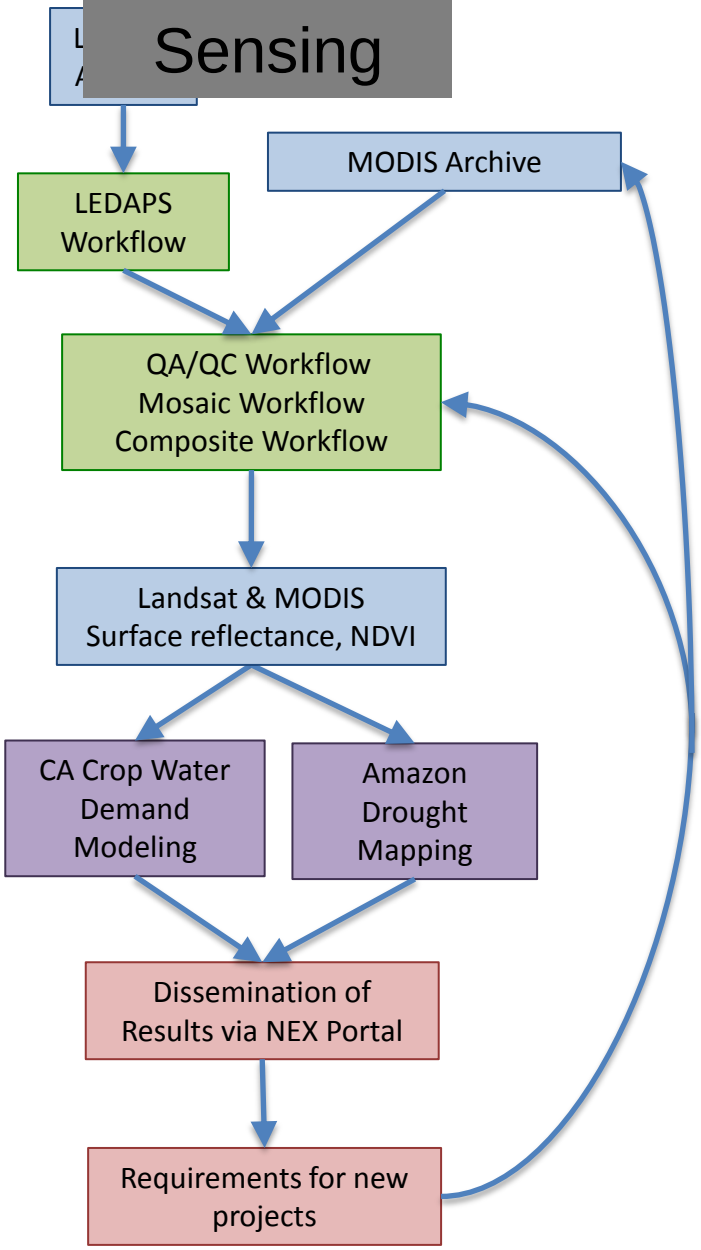
Creating Global Monthly Landsat Composites

Processed over 6,000 scenes each month using WELD system

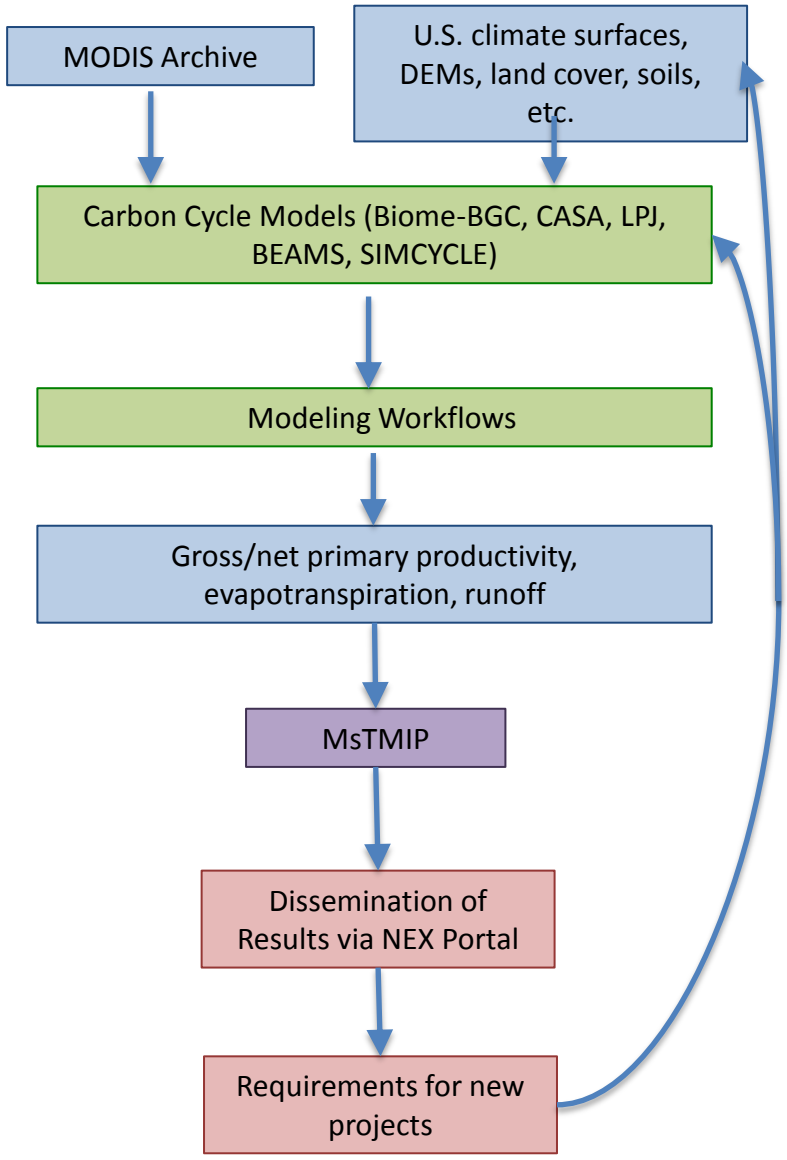
MODIS / Landsat

NEX: Scientific Workflows
2010

Remote Sensing



Modeling



NEX: Scientific Workflows 2012

Remote Sensing

Landsat Archive

MODIS Archive

LEDAPS Workflow

TOPS: QA/QC Workflow
Mosaic Workflow
Composite Workflow

WRF Workflow

Landsat & MODIS Surface reflectance, NDVI

TOPS Anomaly Detection Workflow

Workflows for modeling LAI, Biomass, Disturbance, Spp. Niche, Crops . . .

USGS DWR Fallowed Land Mapping

N. American Forest Dynamics (NAFD)

U.S. LAI / Biomass

Global Biodiversity Mapping

CA Crop Water Demand Modeling

METRIC ET Modeling

Bay-Delta SESAME / Salmon Modeling

Cons. Intl. Fire Risk Modeling

WELD

Dissemination of Results via NEX Portal

Requirements for new projects

Modeling

MODIS Archive

U.S. Climate Surfaces, DEMs, land cover, soils, etc.

Downscaled CMIP3, TOPOMET Downscaled CMIP5

Carbon Cycle Models (Biome-BGC, CASA, LPJ, BEAMS, SIMCYCLE, etc.), Biodiversity / niche models

TOPS: Modeling Workflows + Climate Scenario Workflow

Gross/net primary productivity, evapotranspiration, runoff

MsTMIP

Modeling of shifts in spp. ranges

NCA: Climate & land use change

NPS Climate Change Modeling

Climate Change Impacts on NASA Centers

Carbon Tracker

Diagnosing N.A. Carbon cycle

Dissemination of Results via NEX Portal

USGS Climate Drivers & Biol. Resp.

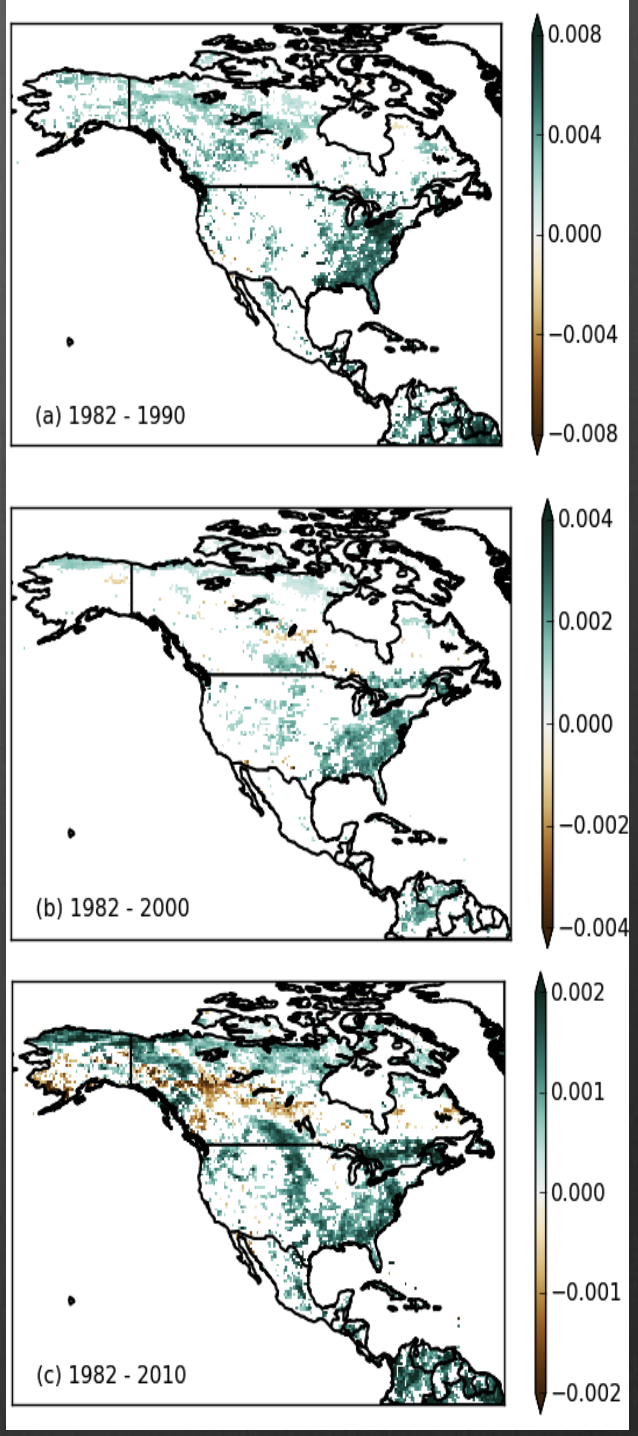
Requirements for new projects

Summer Short-Course

GitNEX.

Historical AVHRR Data Analysis

- **GIMMS AVHRR NDVI, 1982 – 2011**
- **Special issue of open journal "Remote Sensing"**
- **35 manuscripts in preparation**
- **All codes, intermediate results to be available on NEX**
- **All workflows used in generating the manuscripts will be available on NEX**
- **Focus on phenology, global productivity and climate model diagnostics**



Summary

- Lowers the barrier of entry (co-locating data, model codes, and compute resources).
- Allows knowledge sharing (through workflows and virtual machines).
- Provides a framework for transparency, reproducible/verifiable results.
- Platform for prototyping or extending applications.
- THINK BIG!