



Watershed Dynamics

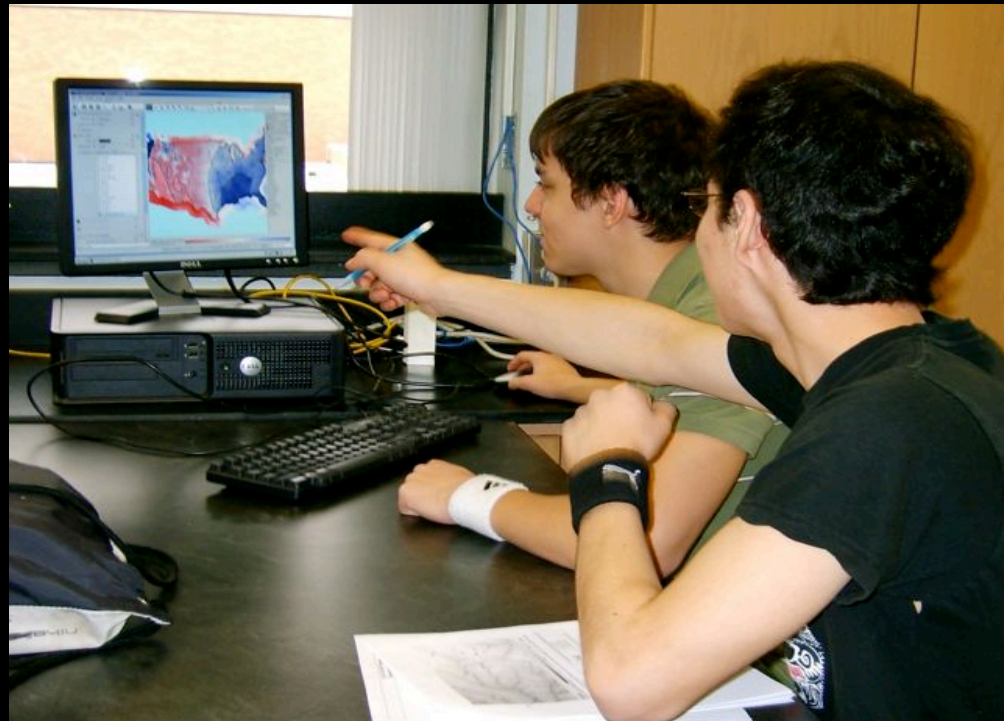
This work is supported in part by NASA and the National Science Foundation under NSF grant GEO-0627923. However, any opinions, findings, conclusions, and/or recommendations are those of the investigators and do not necessarily reflect the views of NASA or the Foundation.



Project

Students conduct active scientific investigations using GIS tools to access and analyze real-time hydrologic, geospatial, and remote sensing data sets.

Students from Aida Awad's classroom at Maine East High School in Chicago work together to interpret NARR precipitation data.



OSEP

Office of Science, Technology, Engineering, Mathematics (STEM) Education Partnerships

- Teacher training and development of research based curricula
- Providing out-of-school learning opportunities for students
- Supporting faculty participation in K-12 programs
- Facilitating partnerships that support STEM education

Learn more at

www.osep.northwestern.edu



GLOBE

Global Learning and Observations to Benefit the Environment

- Worldwide hands-on, primary and secondary school-based science and education program.
- Promotes and supports students, teachers and scientists to collaborate on inquiry-based investigations of the environment and the Earth system working in close
- Partnership with NASA, NOAA, and NSF Earth System Science Projects (ESSPs)



Learn more at www.globe.gov

CUAHSI

Consortium of Universities for the Advancement of Hydrologic Science, Inc.

- Community of scientists
- Established to develop infrastructure and services for the advancement of hydrologic science and education
- 5 programmatic areas
 - Informatics
 - Instrumentation
 - Synthesis
 - Observatories
 - Education



Learn more at www.cuahsi.org

CUAHSI is supported by membership dues and the National Science Foundation (NSF-0753521).

FieldScope

by National Geographic Society

National Geographic FieldScope is a web-based mapping, analysis, and collaboration tool designed to support geographic investigations and engage students as citizen scientists investigating real-world issues - both in the classroom and in outdoor education settings.



Learn more at <http://fieldscope.us>

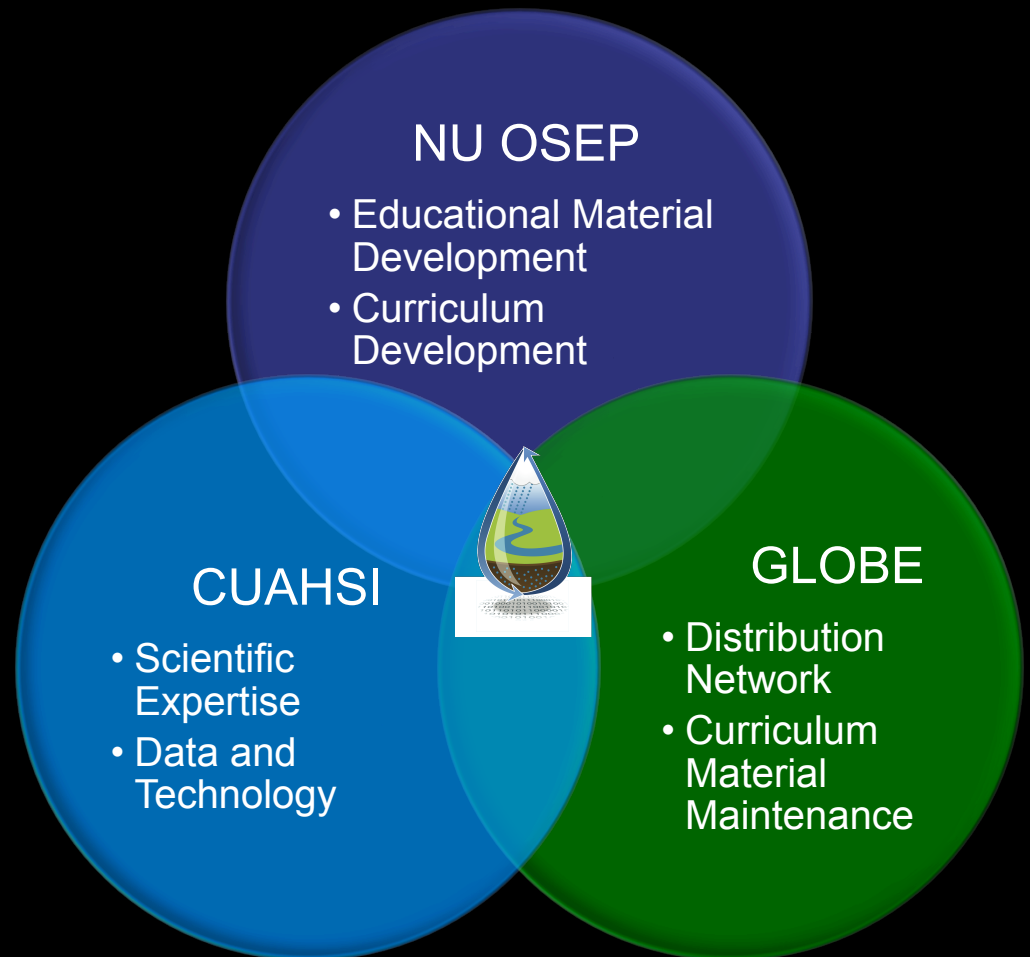
Partners

Members of each group contribute in their area of expertise:

- **OSEP** provides expertise in K-12 STEM educational components, curriculum materials, teacher training, and educational technology

- **CUAHSI** contributes scientific content and specialized technology tools that provide access to authentic data sources

- **GLOBE** facilitates distribution to a worldwide network of teachers and teacher trainers.



Curriculum

Two 1-2 week-long modules targeted at middle & HS earth and environmental science classes

1. Water Availability

- When does precipitation come?
- Where does it go?

2. Human Impact on the Watershed

- What is a watershed?
- How do humans impact the watershed?
- As land cover changes over time, how does streamflow respond?

Cyberlearning tools and data

| Activity | Technology | Data |
|-------------------------------|---------------------------------------|--|
| Water Availability | Cmap concept maps | |
| | My World GIS Web-GIS by FieldScope | NARR (NCEP, National Weather Service, NOAA, Dept of Commerce) NCEP-DOE AMIP-II reanalysis |
| Human Impact on the Watershed | NetLogo computational models | DEM (USGS) Aerial image (Terraserver) |
| | My World GIS Web-GIS by FieldScope | NLCD (USGS, EPA, NOAA, NASA, et al) Stream Gage data (USGS via NWIS and CUAHSI HIS) |

Water Availability

| Activity | Content |
|-------------------|--|
| Investigation I | Introducing Natural Water Availability Activating student prior knowledge |
| Investigation II | Annual Precipitation in the U.S. Getting students into GIS data |
| Investigation III | Annual Precipitation, Evaporation, & Surface Runoff Comparing datasets |
| Investigation IV | Seasonal Precipitation and Surface Runoff |

Important Resources

GIS is at <http://wd.fieldscope.us/>

Curriculum is at <http://wd.northwestern.edu>

GLOBE <http://www.globe.gov>

About the curriculum:

4 investigations, each divided into 3 parts:

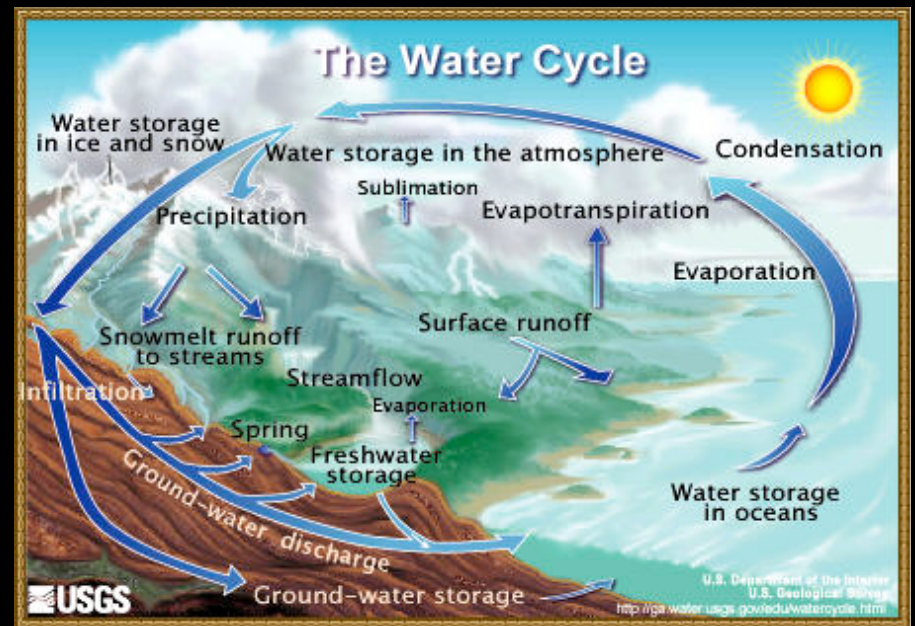
Teacher materials, student activity guides, student response sheets

Investigation I:

Activating student prior knowledge

Students answer questions to help them build a concept map.

- Where does the water in your area come from?
- What season or months of the year are the wettest? The driest?
- What evidence have you seen that would indicate that there is sometimes too much water in your area?



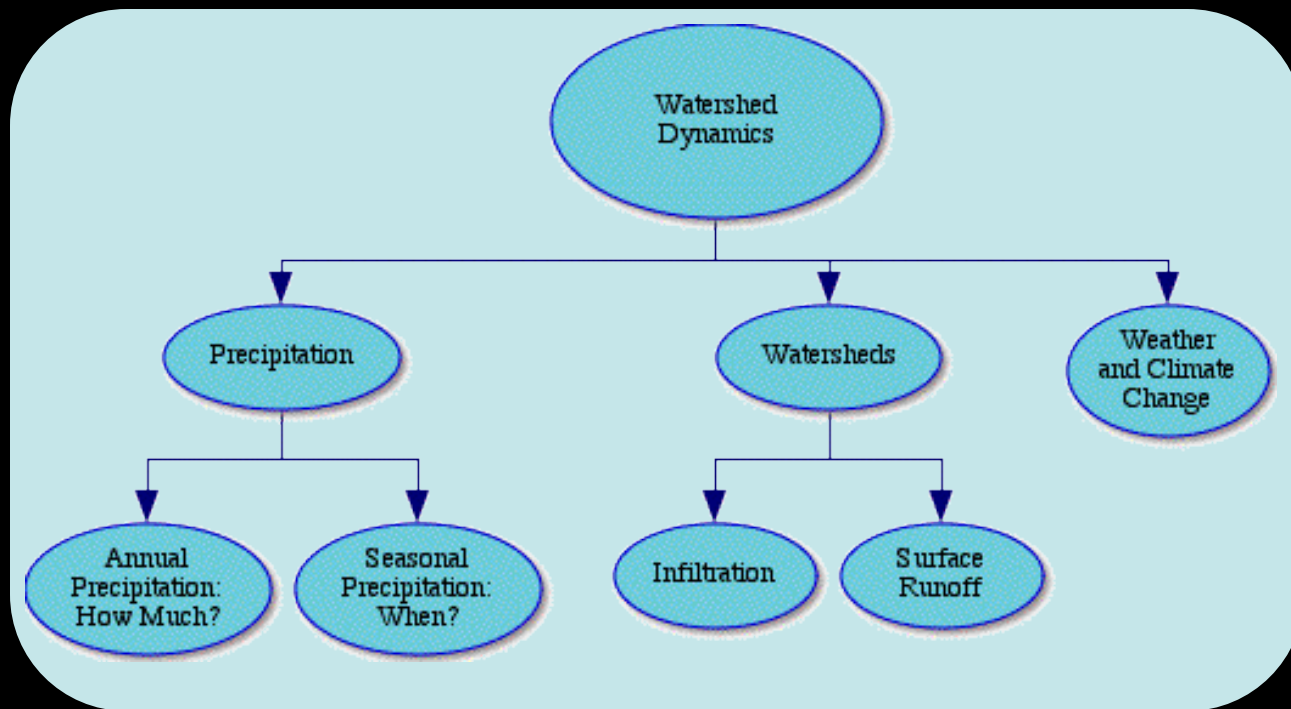
Page 7 (teacher)

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Investigation I:

Activating student prior knowledge

Students use CMAP (a concept mapping tool) to organize their thoughts. Here is a sample of how students can develop a concept map.



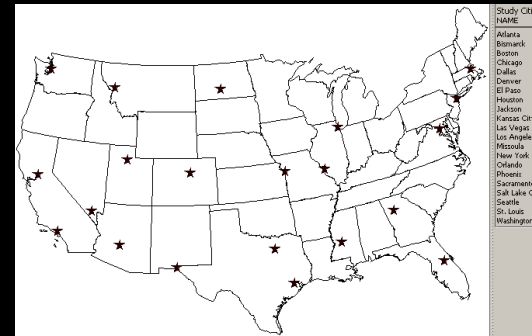
Investigation II, Part 1: Annual Precipitation

Before students access real data, they make predictions about where in the country there is a lot of rain (**blue**) and where there is less rain (**red**) based on readings about regions.

Little Rock, Arkansas-- Arkansas saw only 34 inches of rainfall during 2005 to maintain the state's natural beauty that it markets to attract tourists for fishing, boating, swimming and other recreation. Forecasters say Arkansas usually receives about 50 inches of rain each year.

“Burn bans, drought hit Arkansas.” [U.S. Water News Online](#). January 2006

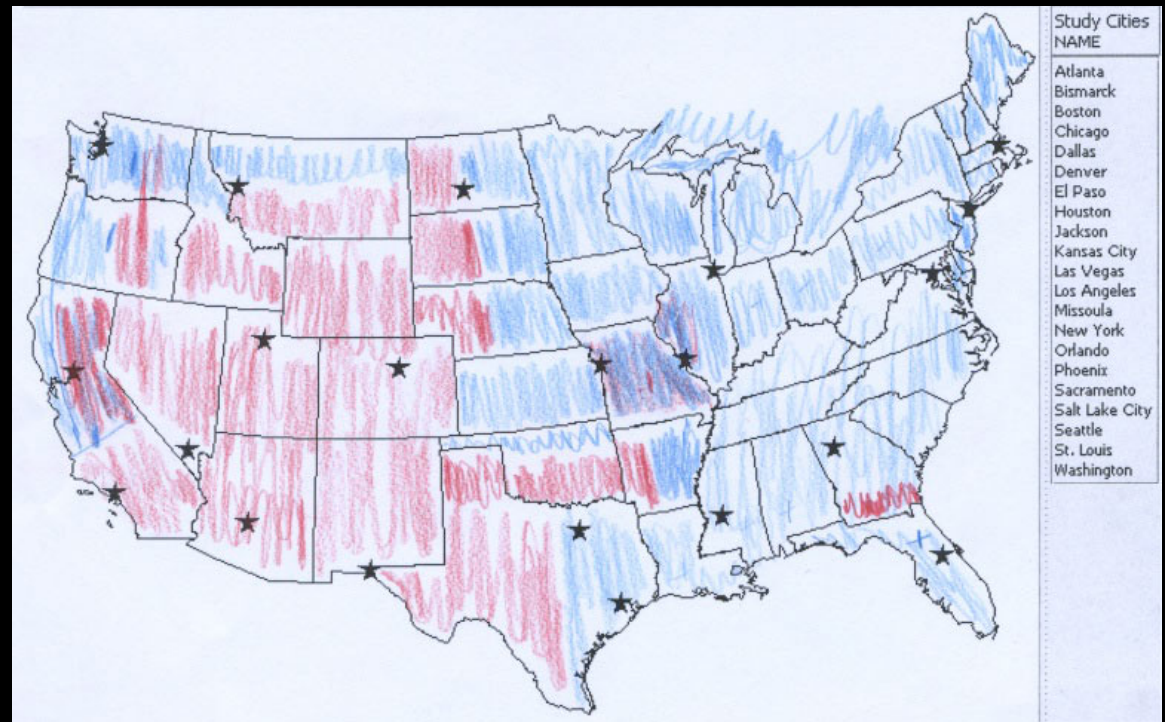
They color-code the data on paper maps.



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Page 23 (student)

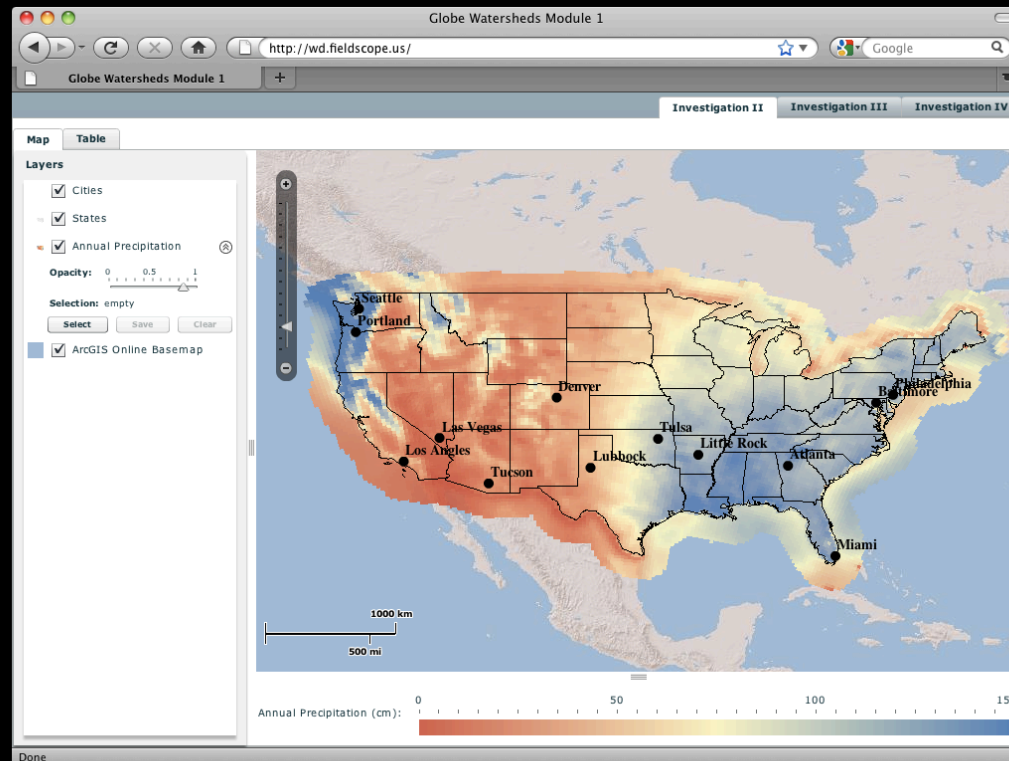
Investigation II, Part 1: Annual Precipitation

Students create maps and can compare their interpretations with other students in the class.



Investigation II, Part 2: Annual Precipitation Using GIS

Now that students have drawn prediction maps, they are ready to work with the online GIS tools.



Begin Activity

Module 1: Water Availability
(FieldScope, US, NARR data)

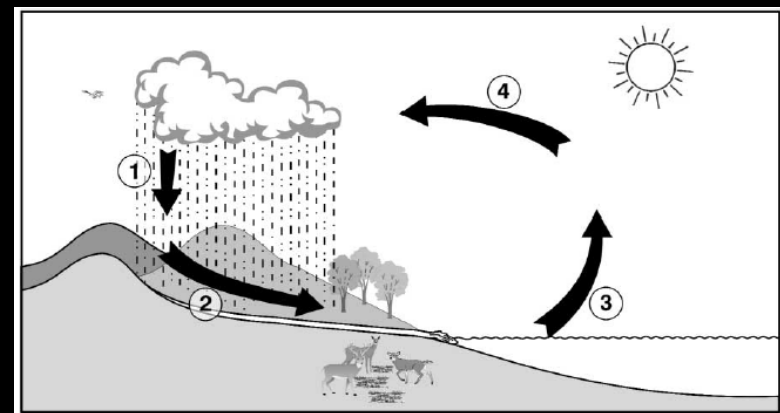
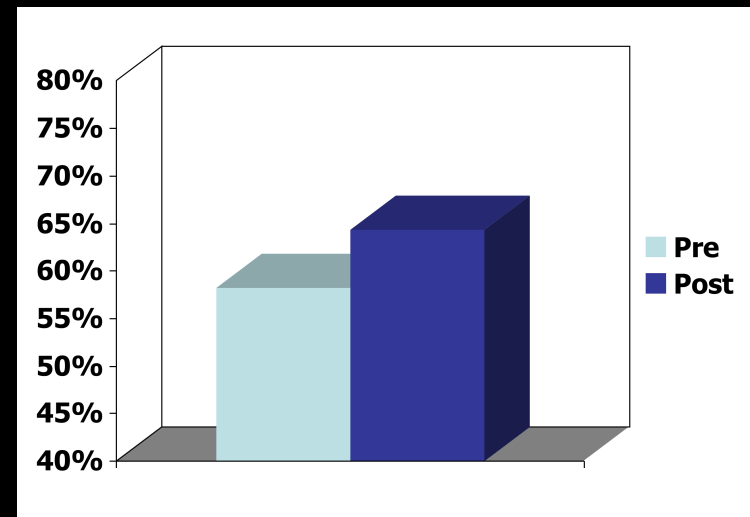
Investigation II, Part 2

Professional Development of- and Pilot Testing by-Teachers

| | Water Availability | Human Impacts on the Watershed |
|-------------------------------|--------------------|-----------------------------------|
| Teacher Training Workshops | August 7-9, 2007 | August 12-14, 2008 |
| Participants | 23 teachers | 21 teachers 2 teacher trainers |
| States represented | 12 | 13 |
| Number of Students | 422 | 354 |

Module 1 Learning Gains

- Score gain for 402 students
 - Pre-test average=58.2%
 - Post-test average=64.3%
 - significant 6.1% gain
 - t-statistic = 5.13, $p < .0001$
 - effect size = 0.27
- 6-item assessment
 - Students' knowledge of the water cycle and patterns in the U.S.
 - Reliability levels of 0.30 (pretest) and 0.47 (posttest), using Cronbach's Alpha

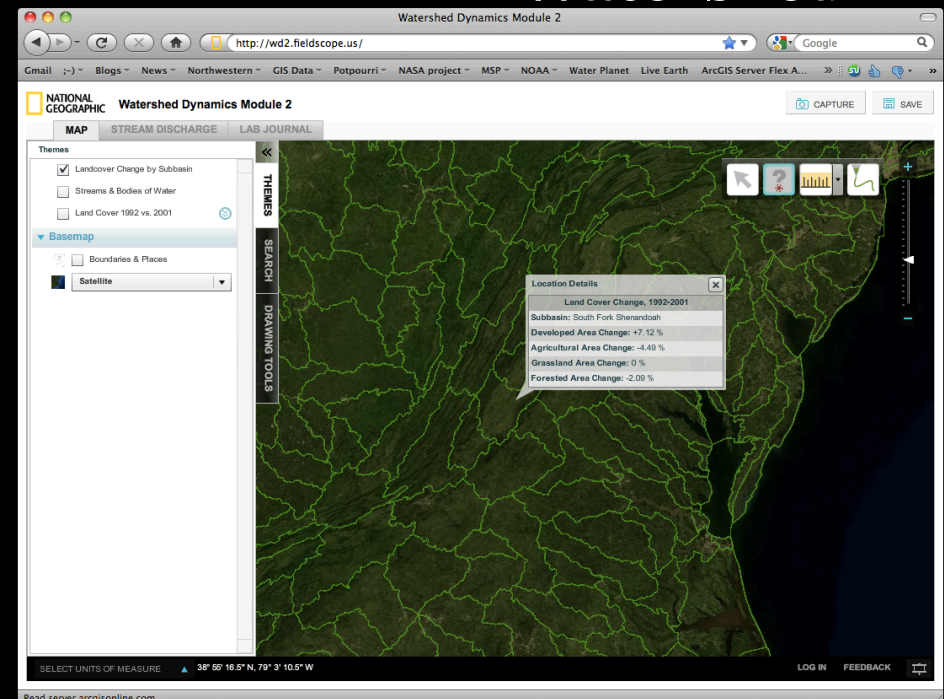
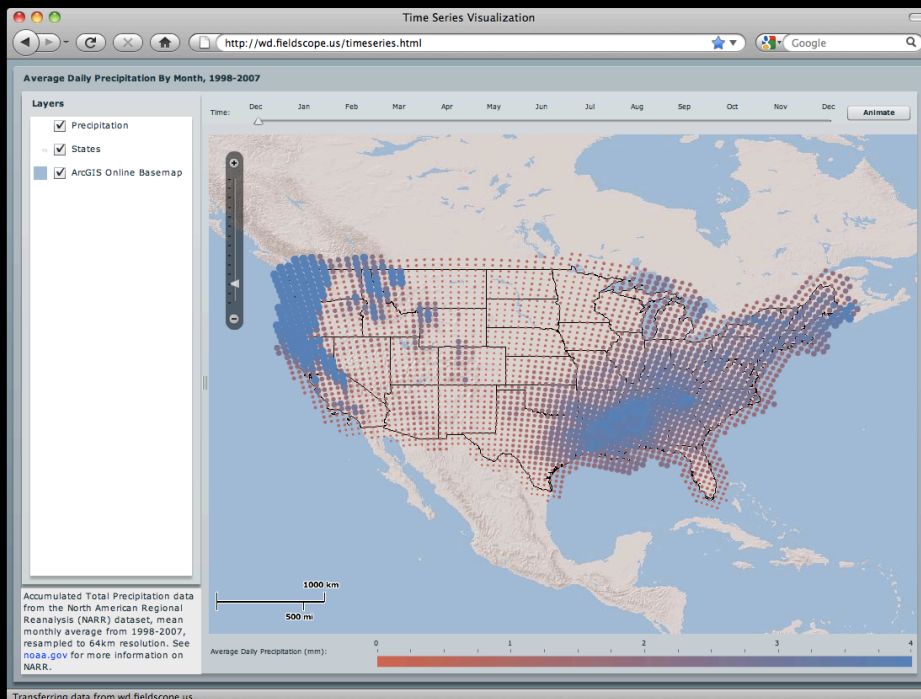


Item 5) Which part of the water cycle is represented by arrow 3 in the diagram above?

Other Tools

Time Series

Human Impacts on the Watershed

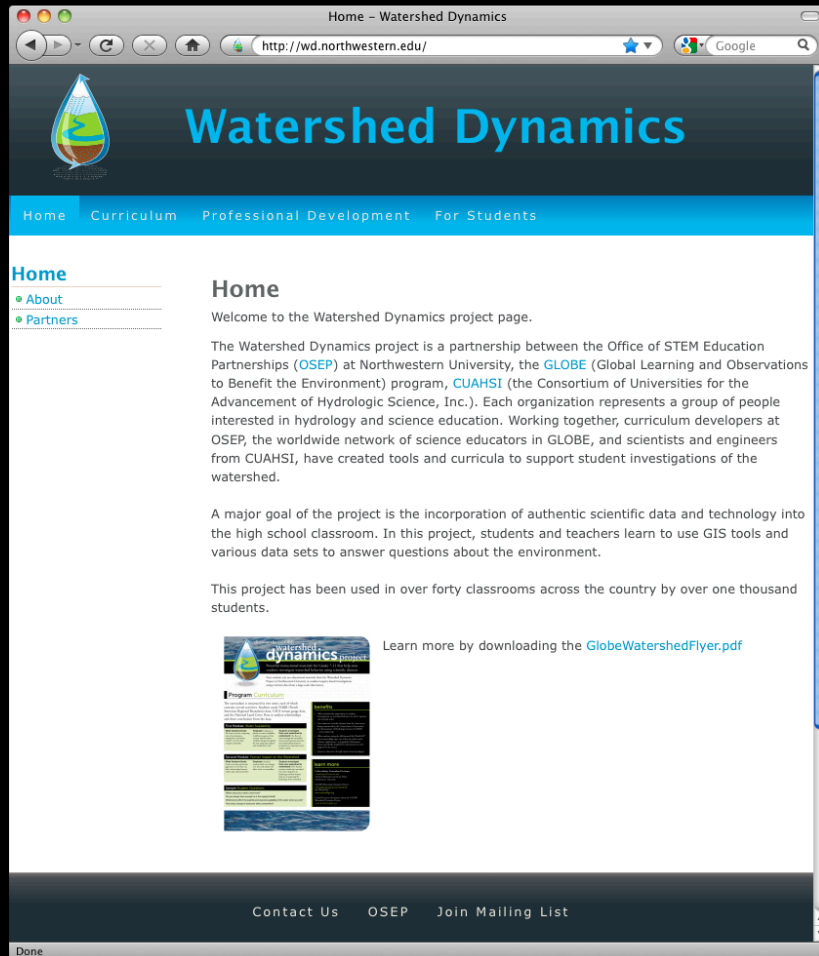


[wd.fieldscope.us/
TimeSeries.html](http://wd.fieldscope.us/TimeSeries.html)

wd2.fieldscope.us

(Not pictured) International data at wdi.fieldscope.us

For more information visit: wd.northwestern.edu



Contact Information:



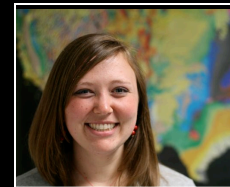
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