Engaging the next generation of researchers through education

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Outline

- Why Education and Outreach?
- Strategies
- Undergraduate
- Graduate and professional
- Middle school/high school
- General public

Why Education and Outreach?

- Need new generation of scientists, engineers, and policy makers
  - Students have to discover geophysics
    - See that it is interesting and challenging
    - Be introduced to career opportunities
- Help generate support for science
- Educate the public about hazards, encourage preparedness
- **IRIS E&O Mission:** We advance awareness & understanding of seismology and geophysics while inspiring careers in Earth Sciences

IRIS E&O Strategies

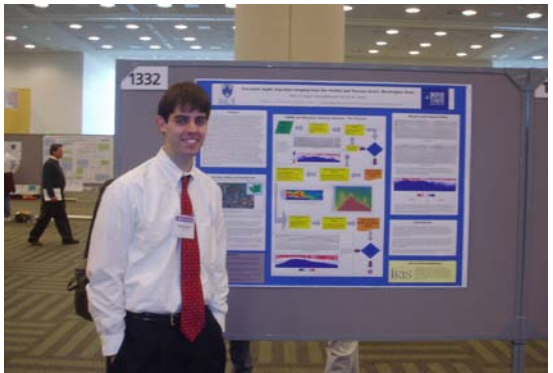
- Focus on seismology and the use of data
  - Narrow content area that capitalizes on our strengths
- Examine existing resources and identify needs
- Develop or enhance products that meet those needs
- Result is a variety of products for a range of audiences and level of interaction
  - Immersive experience, limited participants
    - 14 summer undergraduate interns
  - Short interaction, broad audience
    - 12 million museum visitors/year

Summer Research Experiences for Undergraduates (REU)

- Encourage more students to choose careers in Earth science
  - Initially a few students working with Consortium members during the summer
- 99 undergraduates have taken part since 1998
  - 49 faculty have hosted, representing 39 Consortium institutions
- 85% of alumni have attained or are pursuing a graduate degree in a field of geoscience

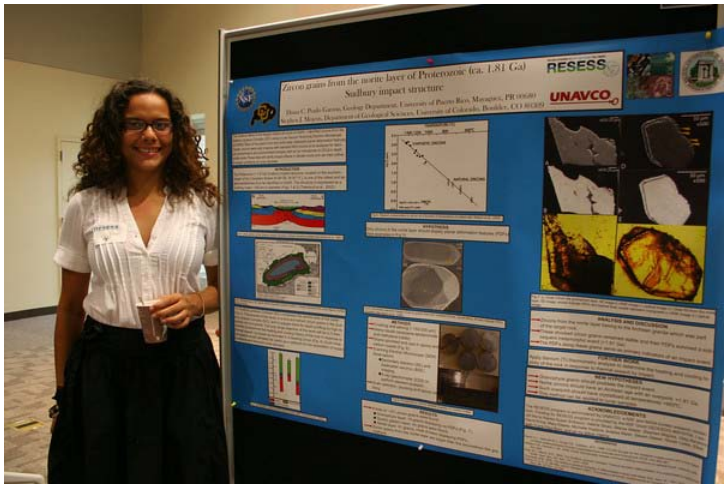
Virtual REU

- Student community is established through 1-week orientation at New Mexico Tech
  - Intro to seismology research topics, data analysis, field trips
  - 14 students in 2010
- Connection through rest of summer via online communication
  - Blogs, discussion forum
  - Alumni mentor interaction
- Interns present results at Fall AGU meeting and meet at intern alumni reception
- Potential model for Central American training?



Longer term mentoring

- UNAVCO RESESS program
  - Designed for underrepresented minority students
  - Initial 1-2 summers spent in Boulder, CO
  - Extensive mentoring in research, writing, presenting
  - Multi-year program
  - Students who might not have completed undergrad degree are now in grad school



Engaging students in USArray

Transportable Array siting through 2010

- 100 students
- 38 universities
- Nearly 970 sites

Process

- University PIs hire student teams
- Teams receive one week of training
- 2-student teams spend 9 weeks doing site reconnaissance

Field experiences for students

- Researchers often need field assistants for projects
- Many students are interested in field work
  - Hard to find opportunities if not at research institution
  - IRIS REU funding limited to US citizens

- New online database service planned for next year
- Similar to job site, not limited to US institutions or students
  - Pis will submit projects, students will submit CVs
  - Will promote to students from physics, engineering, etc.
- PI application process will be structured to provide learning experience

Graduate and professional training

- USArray data processing workshop in 2009 and 2010
  - Advanced graduate student and early career level
  - Goal is for students to develop new processing techniques
- Data Management System training courses
- PASSCAL training courses

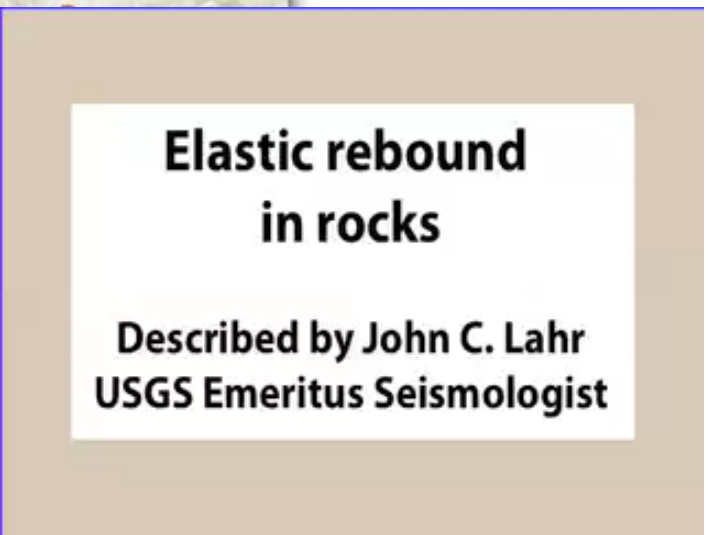
- Potential area of growth for IRIS

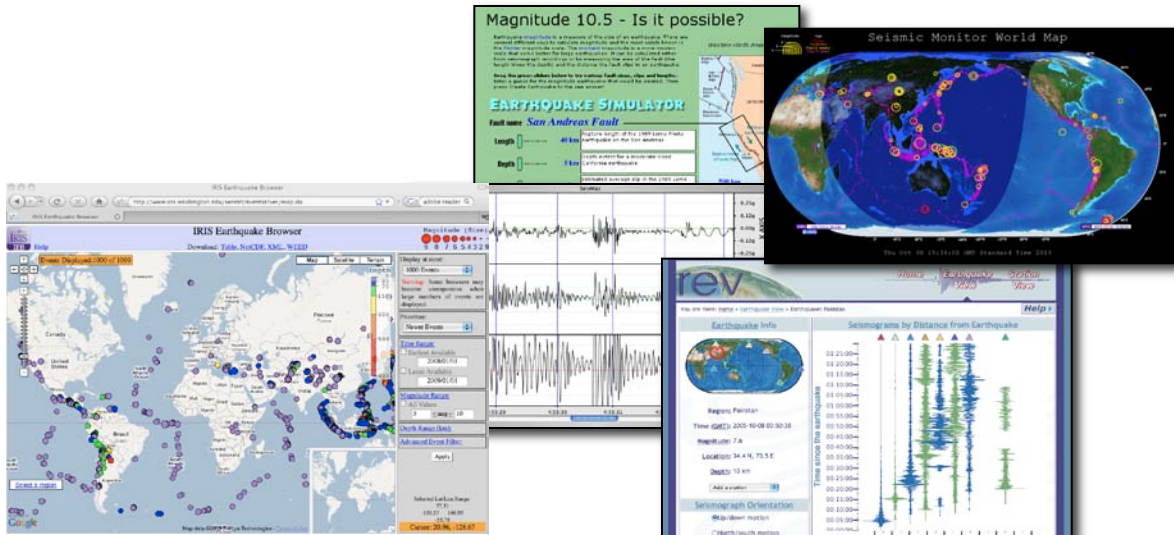
Teacher Professional development

- Improve teacher knowledge and confidence
  - Encourage use of tools and data
- In person workshops – 1 hour to 3 days
  - Ongoing connection and support is most effective
- Leverage via interactions with other groups
  - Support for workshops conducted by others
  - Thousands of teachers reached by monitoring Earth Science & Physics listservs
- Can't reach enough teachers
  - Moving towards online training and train-the-trainer workshops

Web Resources

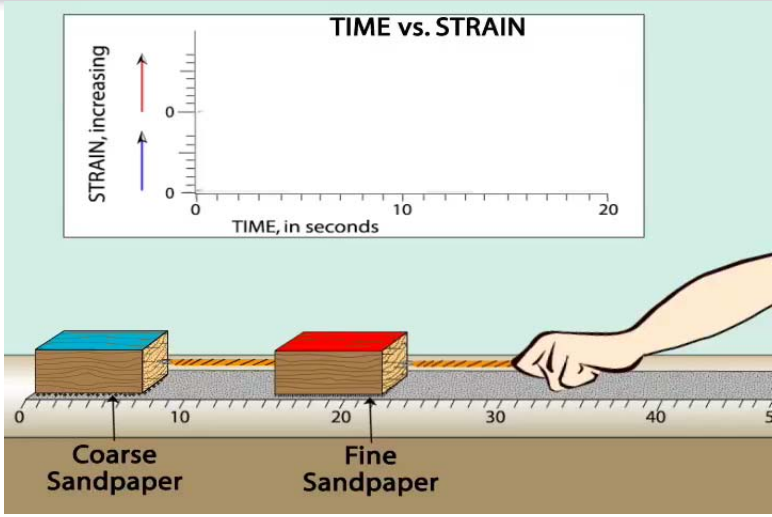
- Primary means of distribution of E&O resources
  - Social networking sites tied to main E&O site
- Activities developed for school and college classroom
- Supported by animations, visualizations and videos
- Interactive software is critical for successful use of seismographs and seismic data.

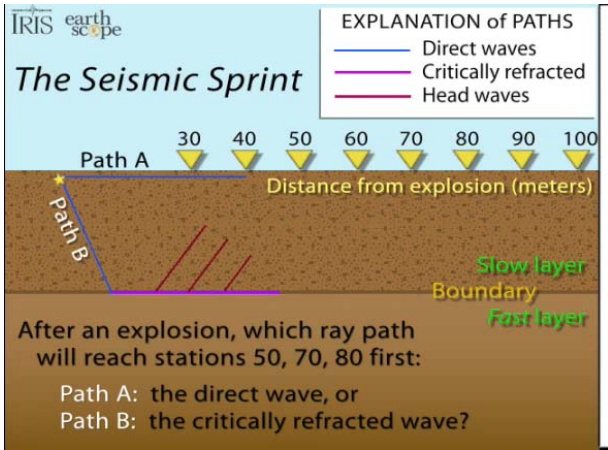


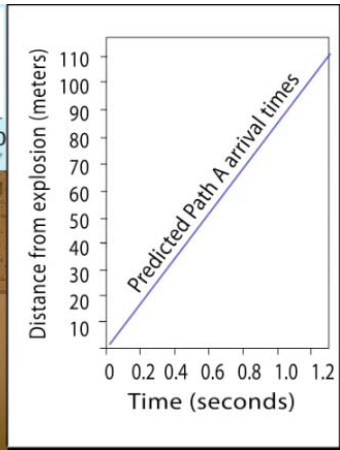


Animations

- Over 40 animations available online
  - Created by Jenda Johnson
- Illustrating concepts related to plate tectonics, earth structure, earthquakes, and volcanoes
- Linked to activities and Teachable Moments

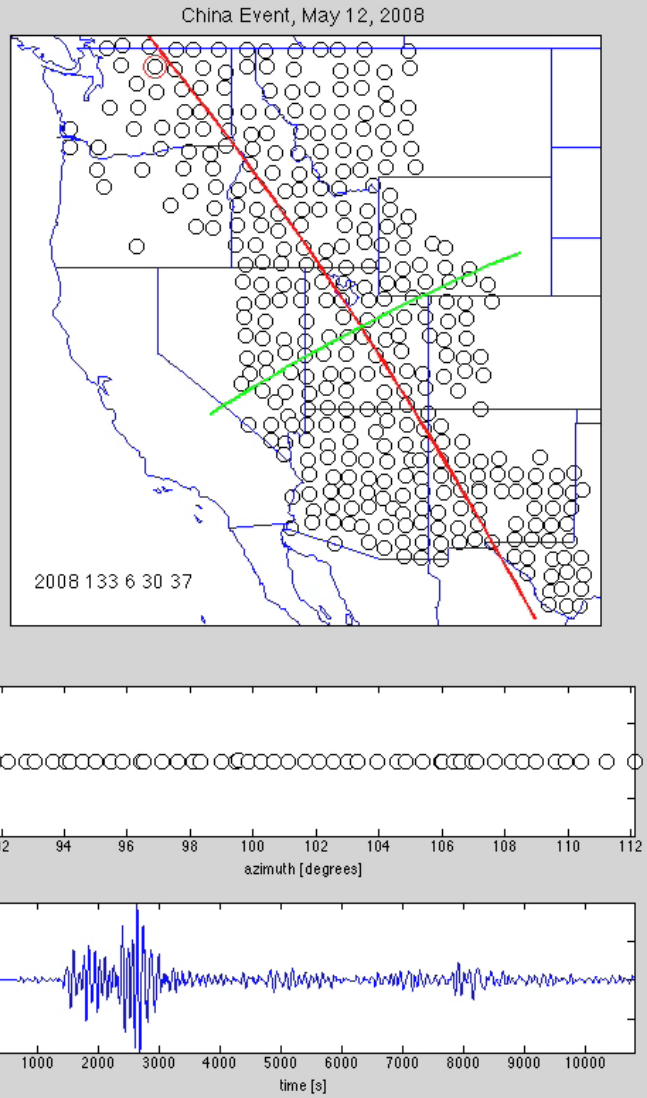






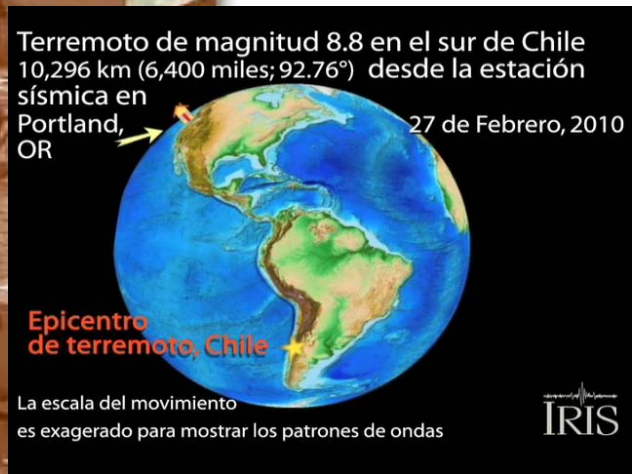
Visualizations of USArray data

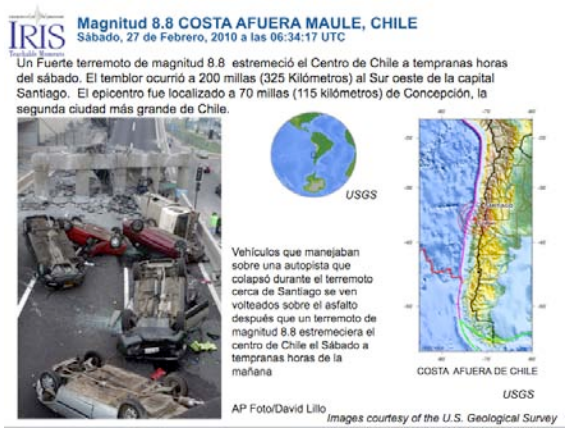
- Specialized versions for some newsworthy earthquakes
  - Developed by Chuck Ammon and Bob Woodward
- Automatic versions now available for all M6+ events via the IRIS Data Management System

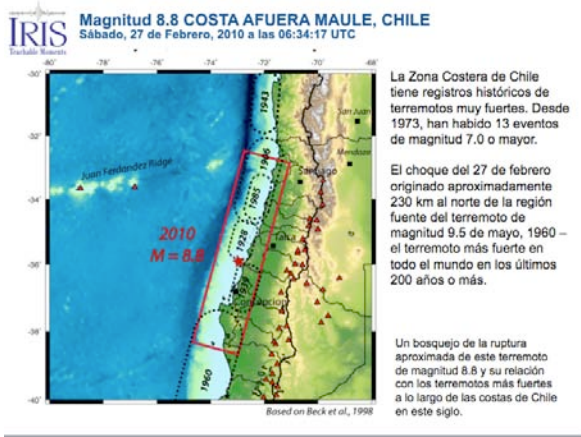


Teachable Moment slide sets

- Newsworthy earthquakes motivate students
- Wide range of online resources available but college faculty and teachers have little time to prepare
- Slide sets produced within 1 day
  - Most content from other groups, particularly USGS
  - Try to tell a story
  - In English and Spanish

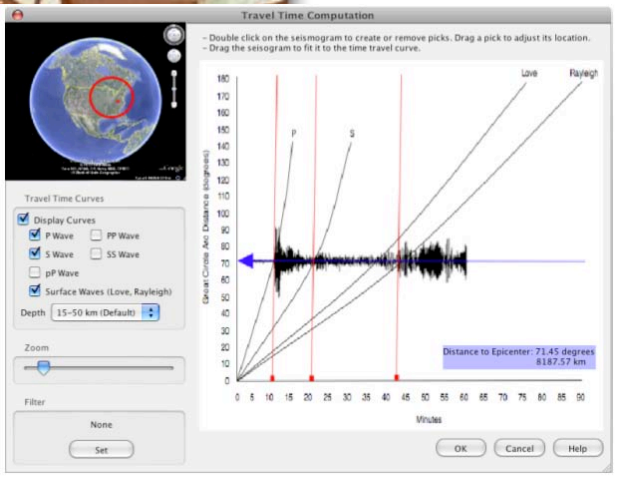


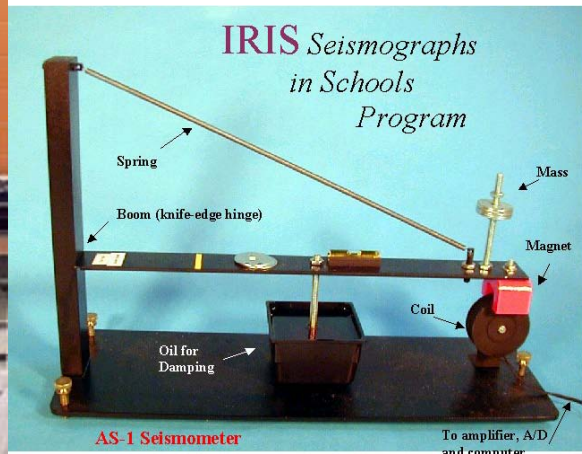




Seismographs in Schools

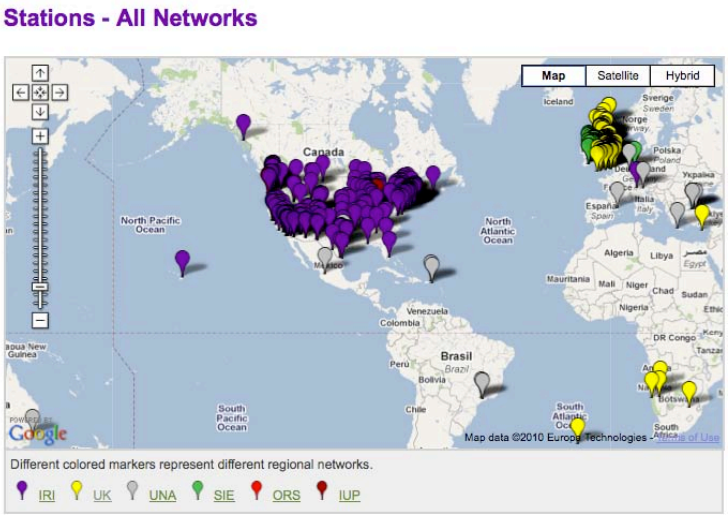
- Promote awareness of local and global seismicity
- Engages students in collecting, analyzing and drawing conclusions from data
- Web database to improve connections between schools
  - Near real time 24 hr displays
    - Gives schools visibility in the community
  - Find-a-teacher tool to contact other schools
  - Discussion forum to share questions





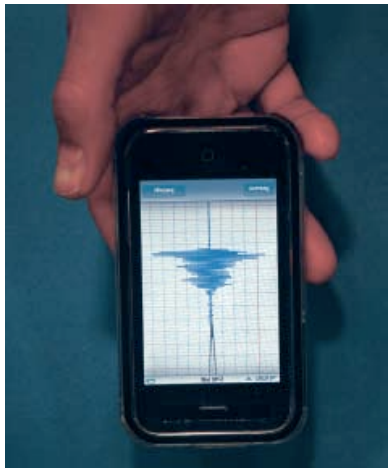
International collaboration

- IRIS provides shared web database
  - UK and Ireland use as their data storage
- For each network
  - Can have own web portal
  - Cross-registration of schools
    - Over 150 US schools
    - 200 international schools



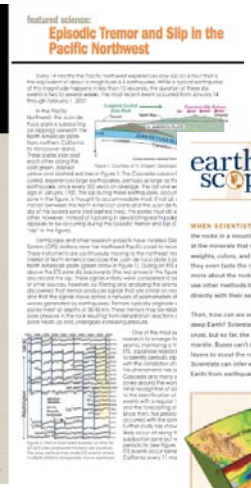
Low cost accelerometers

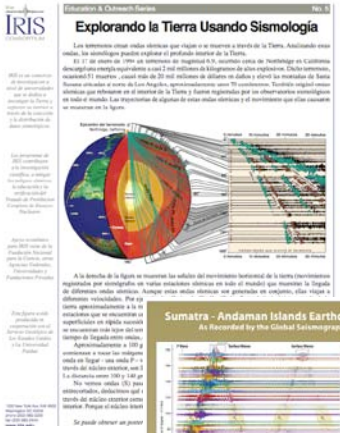
- USB sensors, iPhones, laptops
  - Students predict and measure shaking
  - Connect personal experience to recorded earthquakes – USGS shakemaps
- Real time earthquake recording network
  - J. Lawrence, Stanford and E. Cochran, UC Riverside
  - Over 1300 global sensors recording earthquakes
  - Will send sensors to schools for cost of postage

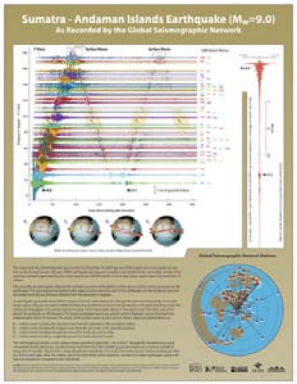


Publications

- Provide fundamentals of seismology and broaden awareness
- Over 100,000 educational posters have been distributed to 22 different countries
- Several posters and all 1-pagers are available in Spanish







Public Displays

- Inspire public interest in the science of seismology and related fields
- Demonstrate that we live on an active planet
- Started with large displays in major museums
- Modified focus to smaller, customizable display in more locations

Active Earth Display

- Simple real-time display designed for visitor centers, small museums, universities, schools
  - Joint content development with UNAVCO, EarthScope National Office
- Customizable selection of pages to display
  - Near real-time seismicity and ground motion, GPS data, tsunami warnings
  - Anyone can apply for their own display and add their own content
- Over 40 active accounts, reaching over 75,000 visitors per year

Public Outreach

- IRIS/SSA Distinguished Lecture Series
  - Convey the excitement of seismology to a general audience
  - Recognize members of the IRIS community
  - 17 Lecturers have given over 99 presentations to up to 400 people
- Targeted materials for USArray
  - Press releases and articles as array moves across US

Temporary exhibits for the public

- USA Science and Engineering festival in Washington DC

Cooperation with other organizations

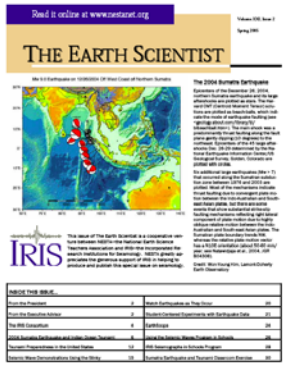
UNAVCO

SCEC

USGS
science for a changing world

SSA

IRIS
Member
institutions



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Conclusions and Lessons Learned

- Design each product or service for a specific audience and desired depth of involvement
- Ongoing support and group interactions are critical at all levels
- Where possible, consider options for virtual delivery and interactions
- Leverage impact through collaborations