

# INTERNATIONAL TSUNAMI MEASUREMENTS WORKSHOP

Estes Park, Colorado, USA June 28-30, 1995

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NSF/CMS-9501539

## 1. **International Post-Tsunami Surveys**

2. Instrumentation

3. Mitigation

4. Modeling Status and Applications

- Participants came from ten countries including Japan (4), Russia (5), Philippines (2), United States (26), Mexico (1), Canada (2), Indonesia (1), Chile (1), Thailand (1), and Australia (1).

## The 1995 Workshop

- There is a problem in gaining access by international teams as this is a disaster area and priority must be given to rescue and recovery activities. However, important data can be lost if the survey is unduly delayed.
- In the initiation phase, experts are assembled on a mostly ad hoc basis depending on available funding and their personal initiative. This may result in a less than optimal response in terms of expertise, international mix of participants and timeliness of the survey.

## The 1995 Workshop Recommendations:

- An international body such as the IOC/ITIC should take the lead.
  - Maintain an international list of people with expertise in relevant areas
  - Train people from countries prone to tsunami attack in the methodology of conducting a comprehensive and valid survey.
  - Provide funding to support such surveys at the level of \$50 - \$100,000 for each survey to assure that the best mix of expertise and nationality.
  - Establish agreements to pre-approve the willingness to permit international tsunami disaster survey teams to visit sites affected by tsunamis in a timely manner.
  - Coordination for such visits to minimize the demands put on the affected country and to assure sensitivity to national concerns and culture. Such surveys should always include national members.
  - Information on geographical maps, bathymetry, topography, location of tide gages, local contacts and organizations, and information on the availability of aerial photography should be kept available.

# The 1995 Workshop

## Implementation of the Field Survey.

- Surveys should be conducted as soon as practical to avoid loss of critical data.
- Both physical data and social data on fatalities, injuries, warnings, and observations on the time between the occurrence of an earthquake if that was observed and the arrival of the tsunami, the direction of approach, first motion, and height sequence of the waves. Data sites should be noted on maps or aerial photographs. Photographs and video film should be taken. Locally available instrumental recordings, maps, newspaper reports, TV footage, etc. should be collected.
- The use of a field guide would help standardize measurements, and methodology.
- Basic reports should be available as soon as possible on INTERnet, with more complete information being available on World Wide Web including photos and other visuals.

## *Recent Major Tsunami Events*

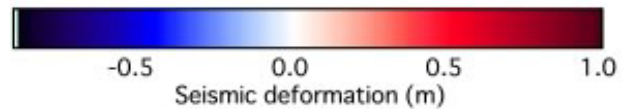
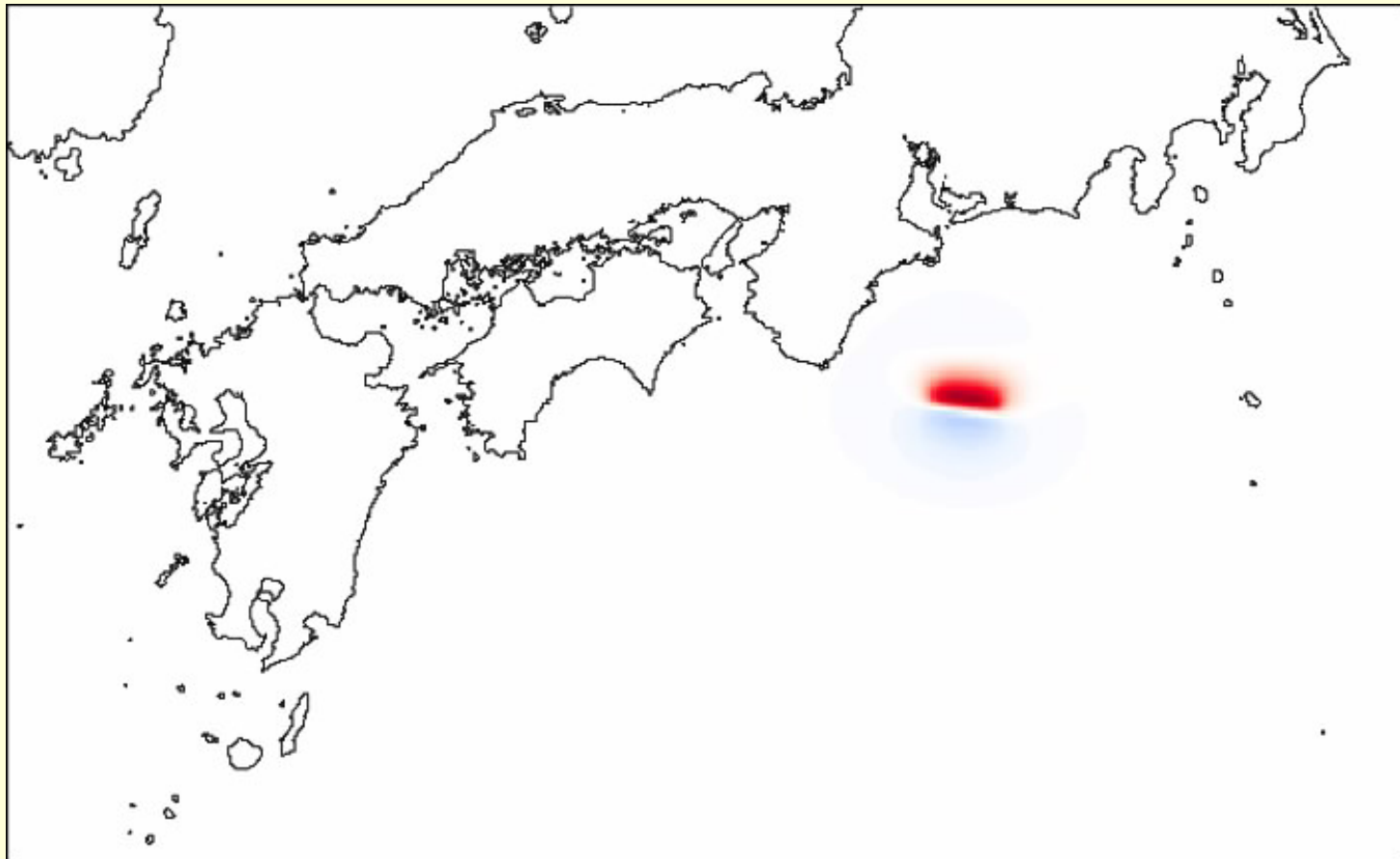
- Japan Sea - Nihonkai Chubu Tsunami (May, 83) - Ms 7.7    100
- Nicaragua (Sept. 92) - Ms 7.2; Mw 7.6; II ~ III    93    9.9 m
- Flores Island, Indonesia (Dec. 92) - Ms 7.5; VIII ~ IX    1712    26.0 m
- Okushiri, Japan (July 93) - Ms 7.2    233    32.0 m
- East Java, Indonesia (June 94) - Ms 7.2    223    11.3 m
- Shikotan, S. Kuril Islands (Oct. 94) - Ms 8.1; IX ~ X    12    7.1 m
- Mindoro, Philippines (Nov. 94) - Ms 7.0    74    7.3 m
- Skagway, Alaska (Nov. 94) - Landslide    1
- La Manzanilla, Mexico (Oct. 95) - Mw 8.0    ← workshop    5.0 m ?
- Irian Jaya, Indonesia (Feb. 96) - Mw 8.0    110    7.7 m
- Chimbote, Peru (Feb. 96) - Ms 6.8; Mw 7.5    12    5.0 m
- Aitape, PNG (July 98) - Ms 7.1; Mw 7.0    ~ 2000    15.0 m
- Vanuatu (Nov. 99) - Ms 7.3    1
- Southern Peru (June 01) - Mw 8.3    > 26    4.0 m
- Tokachi, Japan (Sept 03) - Mw 7.8    0    4.2 m
- Toukaido, Japan (Sept 04) - Mw 7.3    0    5.0 m

# Recent Example:

## Tokaido-Oki Earthquake Sept. 5, 2004

- 19:07, September 5, 2004
  - M 6.8 -- Tsunami watch was issued
- 21:15, September 5
  - Tsunami watch was withdrawn
- 23:57, September 5, 2004
  - M 7.3 -- Tsunami warning was issued
- 02:40, September 6
  - Tsunami warning was withdrawn

# Tokaido-Oki Earthquake: Mw 7.3



## 9/5 19:07, M 6.8 -- Tsunami watch was issued

- 9/5, 21:11 -- Seismic data and tide gage data were posted on MailList: [tsunami-japan@tsunami2.civil.tohoku.ac.jp](mailto:tsunami-japan@tsunami2.civil.tohoku.ac.jp) (DRI)
- 9/5, 22:02 -- EQ mechanisms were posted (USGS & NEID) (AIST)

## 9/5 23:57, M 7.3 -- Tsunami warning was issued

- 9/6, 01:35 -- Tide gage data were posted (Kyoto U.)
- 9/6, 02:22 -- JMA webpage: [http://www.jma.go.jp/JMA\\_HP/jma/press/0409/05d/toukaidouoki01.pdf](http://www.jma.go.jp/JMA_HP/jma/press/0409/05d/toukaidouoki01.pdf) was posted with observed wave forms (tide gages) (Kyoto U.)
- 9/6, 03:63 -- Telephone contacts to local communities were made (Weather News)
- 9/6, 05:09 -- Webpage was made to list all the relevant seismic and tsunami information (Akita U.)



<http://www.hel.ce.akita-u.ac.jp/tsunami/kii2004/>

- EQ Information
  - Epicenter; Magnitudes; Mechanism
- Tsunami Information
  - Tsunami Warning and Watch Timing and Areas
  - Tide Gage Data
- Field Survey
  - Survey Summary
  - Tabulated Results
  - Tabulated Reports
  - Team Reports
- Numerical Simulation
- Research Members -- total 37 from 13 organizations
- Others: 1) News Media Materials; 2) Tide Table; 3) Tsunami Magnitude; 4) GPS Tsunami Gage; 5) Local News Paper Articles; 6) Web Articles; 7) Digital Tide Gage Record
- Links

9/5 23:57, M 7.3 -- Tsunami warning was issued

- 9/6, 05:30 -- Call for the field survey (Akita U.)
- 9/6, 07:25 -- Preliminary numerical simulations were made and posted (DRI)
- 9/6, 11:30 -- The field survey team was formed with the distribution of assigned survey areas.
  - National Academy of Defense
  - Hokkaido U.
  - Akita U. & U. of Tokyo
  - Kyoto U. & DRI
  - Tokushima U.
- 9/6, 11:50 -- Tide table was posted (U. Tokyo)



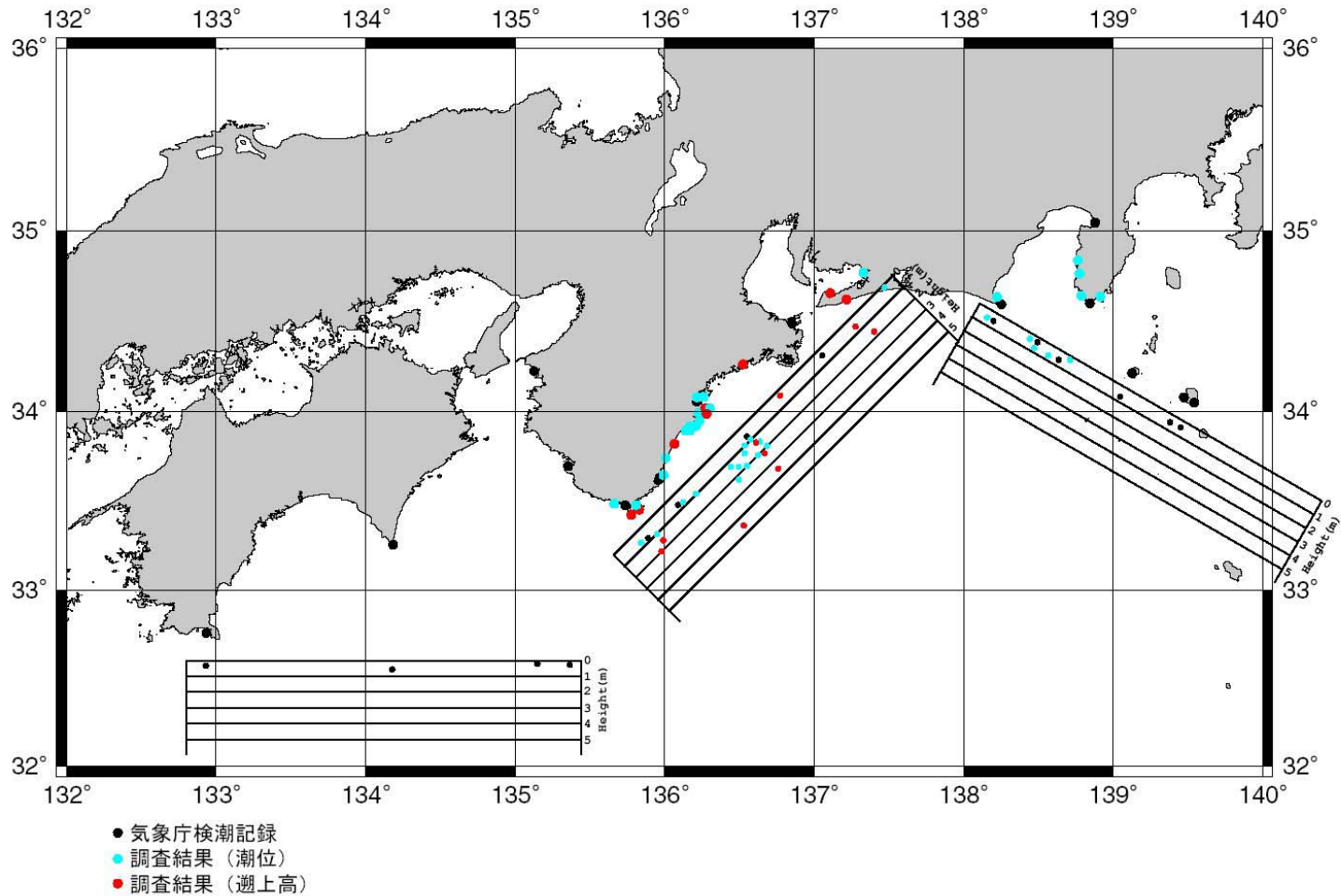
## 9/5 23:57, M 7.3 -- Tsunami warning was issued

- 9/6, 20:56 -- Revised numerical simulations were made and posted (DRI): Both low and high angle solutions provided by USGS and NIED
- 9/6, 10:40 -- Eyewitness accounts were posted (Tokushima U.)
- 9/7, 12:18 -- Tsunami magnitude was posted (U. Tokyo)
- 9/7, 22:06 -- Collection of news paper articles were posted (U. Tokyo)
- 9/8, 08:28 -- Field survey data were posted on the webpage (Wakayama C. and Akita U.)
- 9/8, 09:50 -- GPS tsunami gage data and simulated wave form were posted (DRI)
- 9/13, 15:10 -- All the relevant data sources (URL) (AIST)
- 9/15, 10:08 -- Comments on field survey

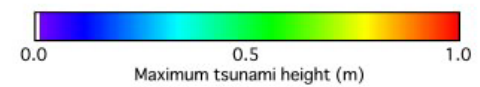
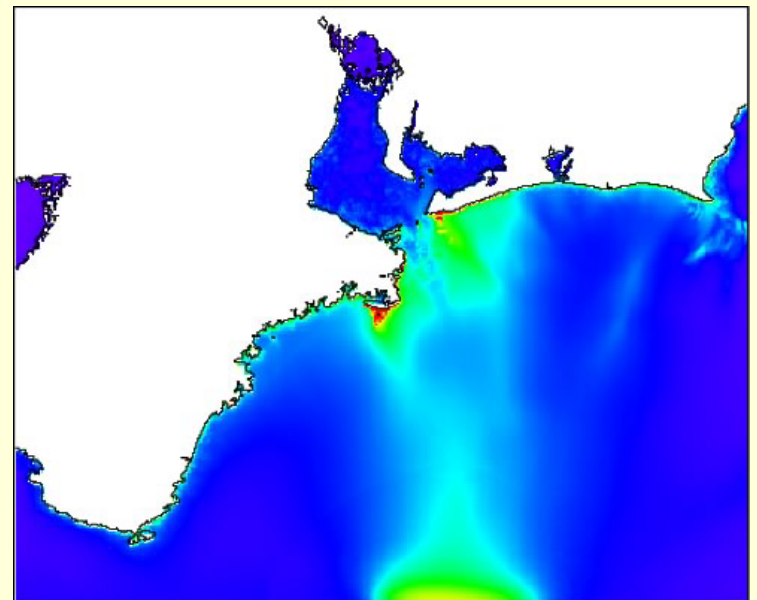
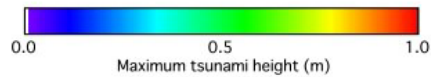
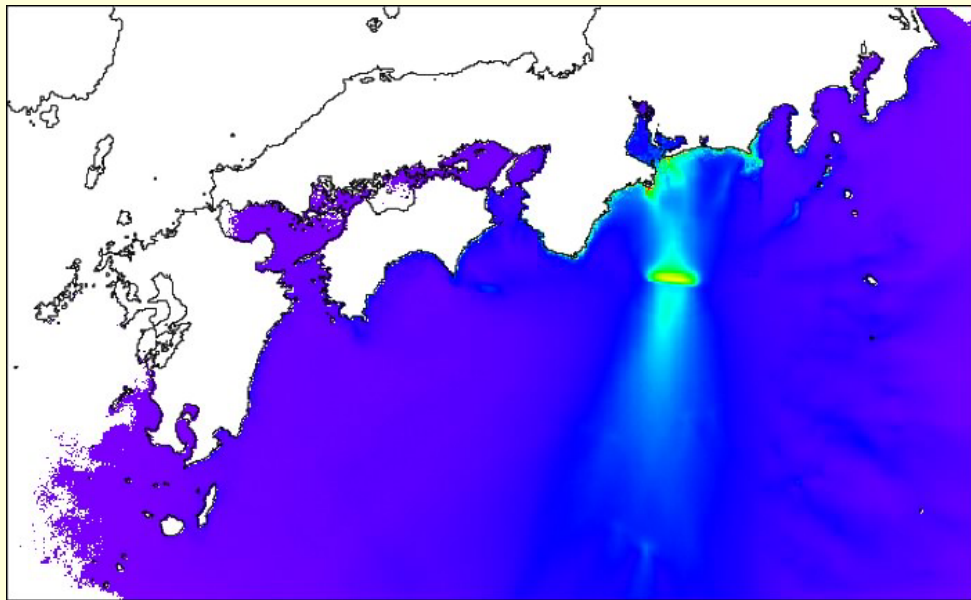
## **Extremely efficient and effective field survey**

- There was no international or national organization who led the survey.
- There was no special fund that was previously pooled for the survey.
- Each participant played a role in his/her specialized field with little duplication: no formal pre-assignment was made.
- They are well experienced by participating in previous surveys.
- Is it because of the Japanese culture?

# Measured Tsunami Data: 9/27



# Quick Numerical Simulation by DRI



9/8, 09:50 -- GPS tsunami gage data and simulated wave form

