May 12, 2008 Sichuan, China Earthquake Reconnaissance

Zhenming Wang
Kentucky Geological Survey
228 MMRB
University of Kentucky
Lexington, KY 40506
zmwang@uky.edu

KGS Brown Bag Seminar
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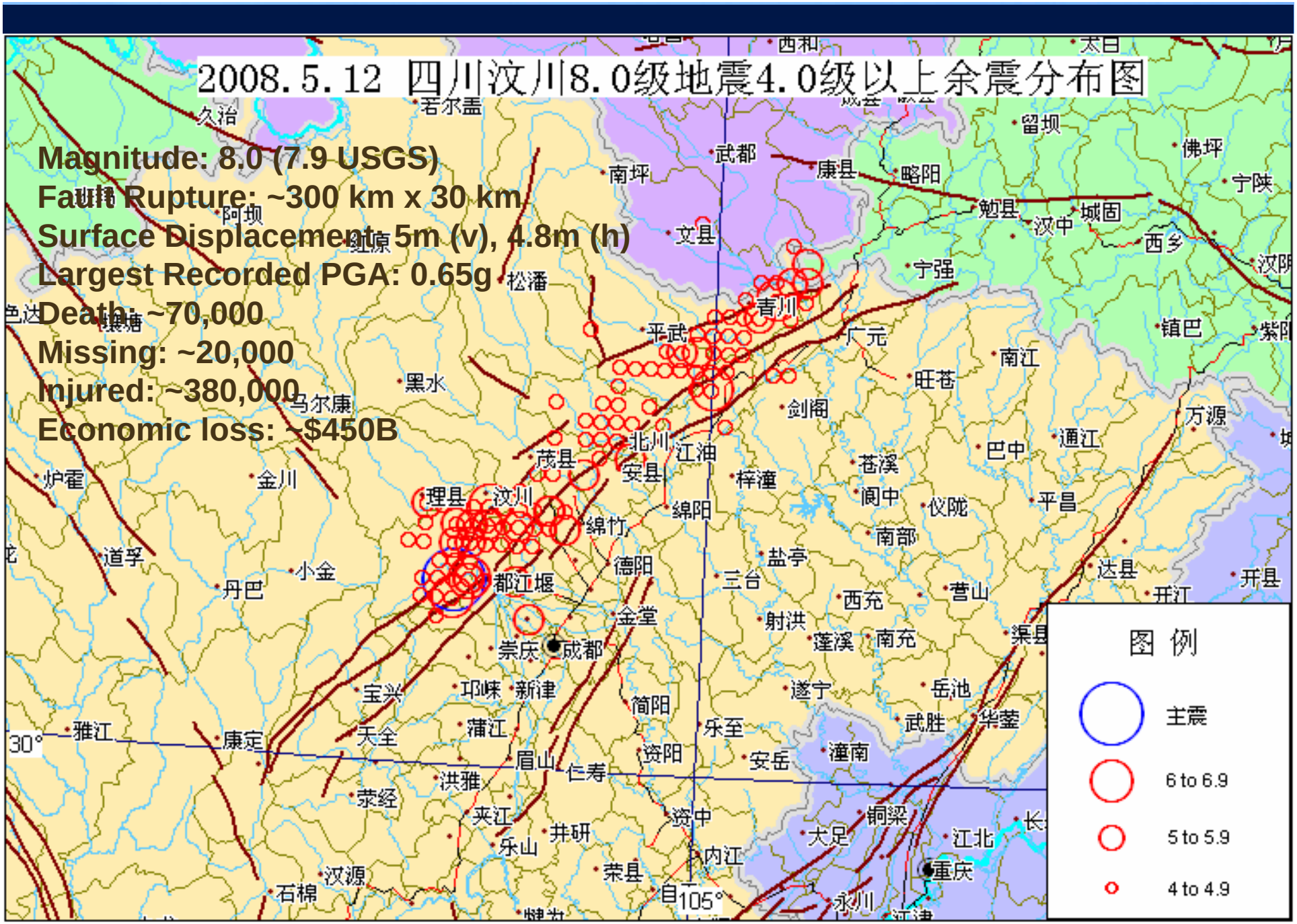
Acknowledgement

- Mr. Furen Xie (Deputy Director, Institute of Crustal Dynamics, CEA)
- Dr. Lanmin Wang (Director, Lanzhou Institute of Seismology, CEA)
- Mr. Yi Du (Institute of Crustal Dynamics, CEA) – in Sichuan
- Dr. Zijian Wu (Lanzhou Institute of Seismology, CEA) – in Gansu

Outline

- General Earthquake Information
- Some Observations
  - Chengdu
  - Dujiangyan
  - Xiaoyudong
  - Hanwang
  - Pintong
- Lesson Learned

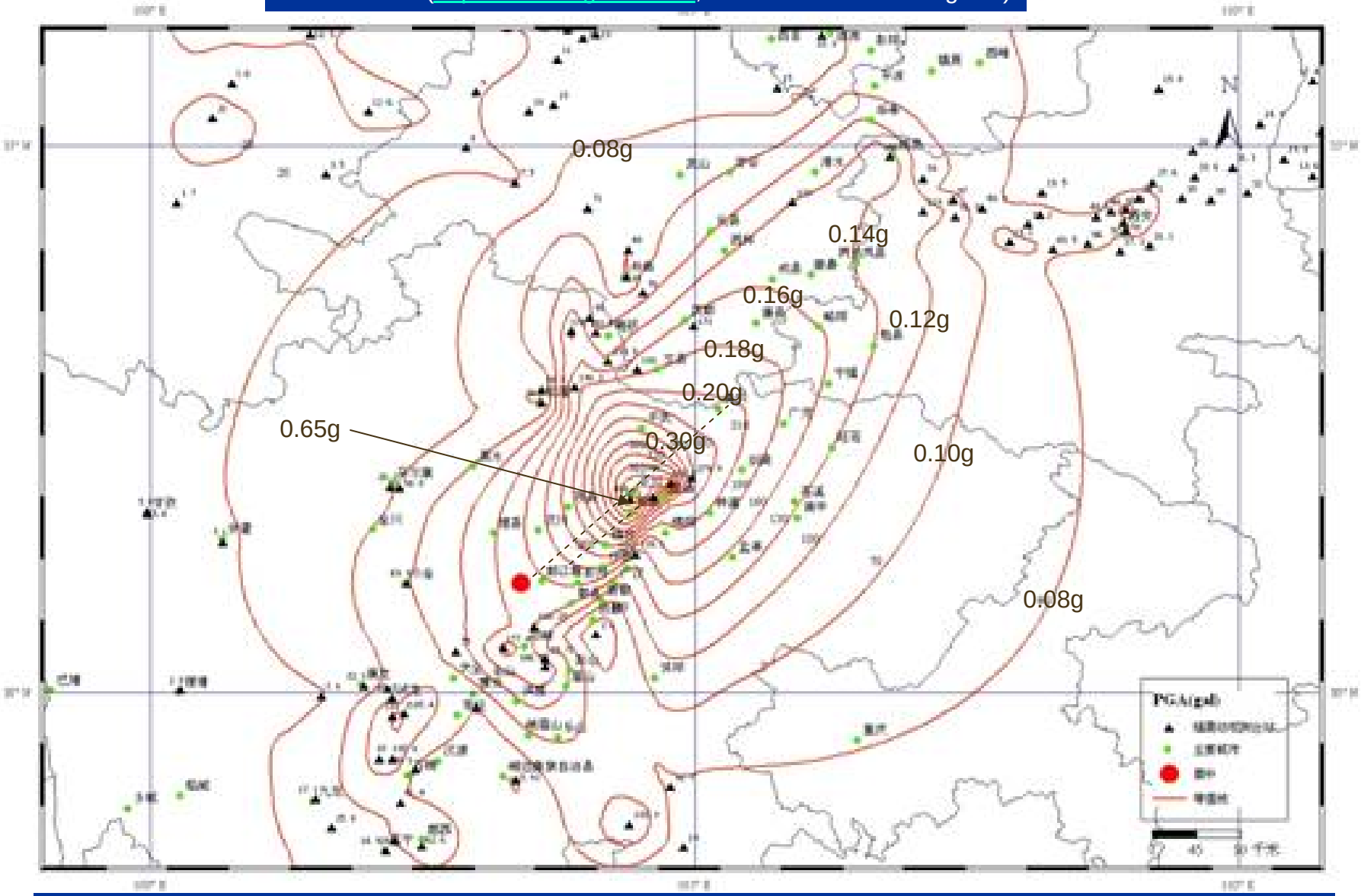


The map is from CEA website (http://ww.cea.gov.cn:99/)

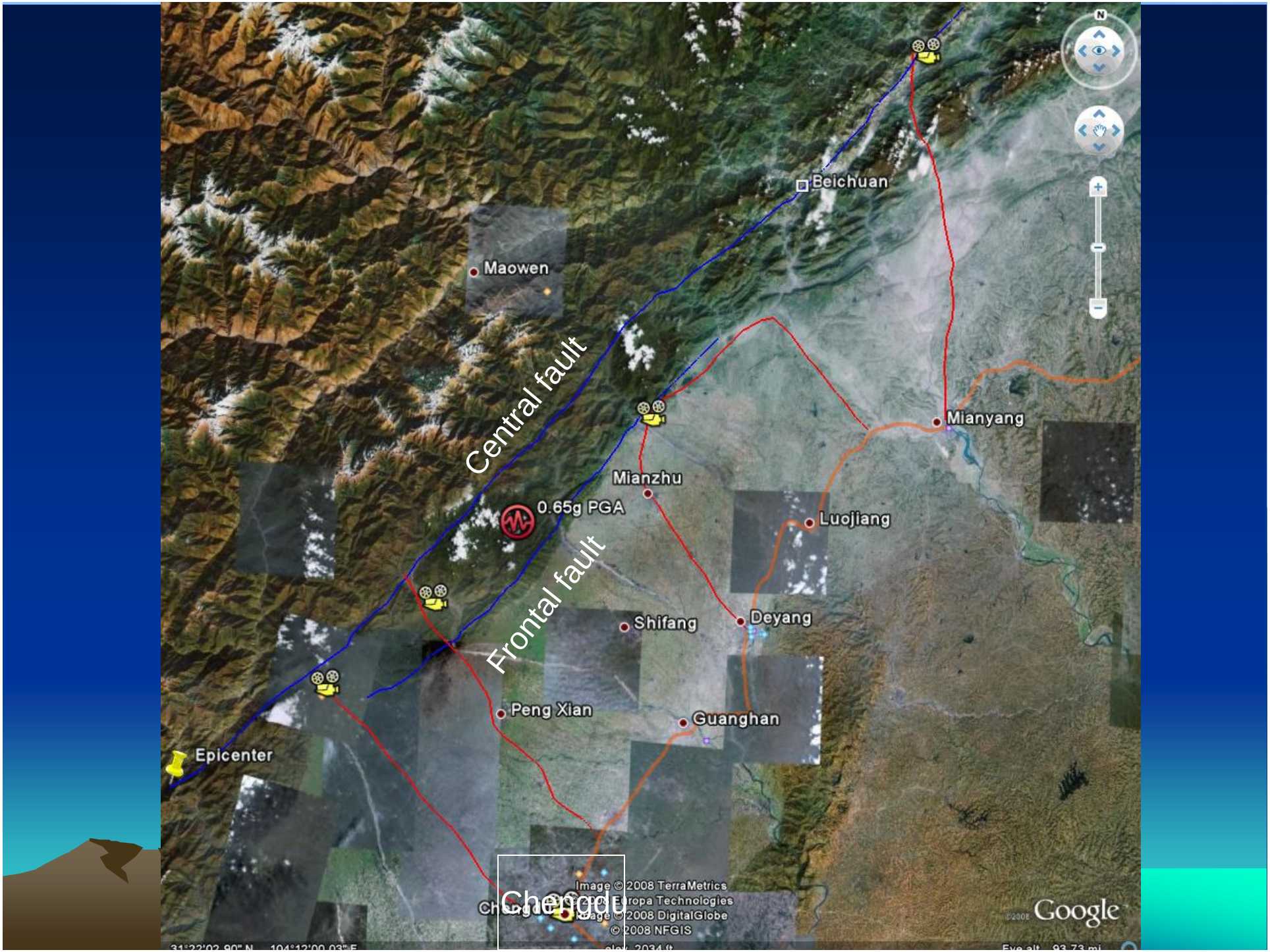
The Felt Areas of the Wenchuan M8.0 Earthquake

Peak Ground Acceleration (E-W component) of Wenchuan M8.0 Earthquake

CEA website (http://ww.cea.gov.cn:99/, no contour value was given)



* The contour values were estimated and may not be accurate.


Beichuan
Maowen
Central fault
Mianyang
Mianzhu
0.65g PGA
Luojiang
Frontal fault
Shifang
Deyang
Peng Xian
Guanghan
Epicenter
Chengdu
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Apartment building
City Center
Chengdu Airport
Chengdu
Yulin Hotel
Fault distance: 50~60 km, no damage
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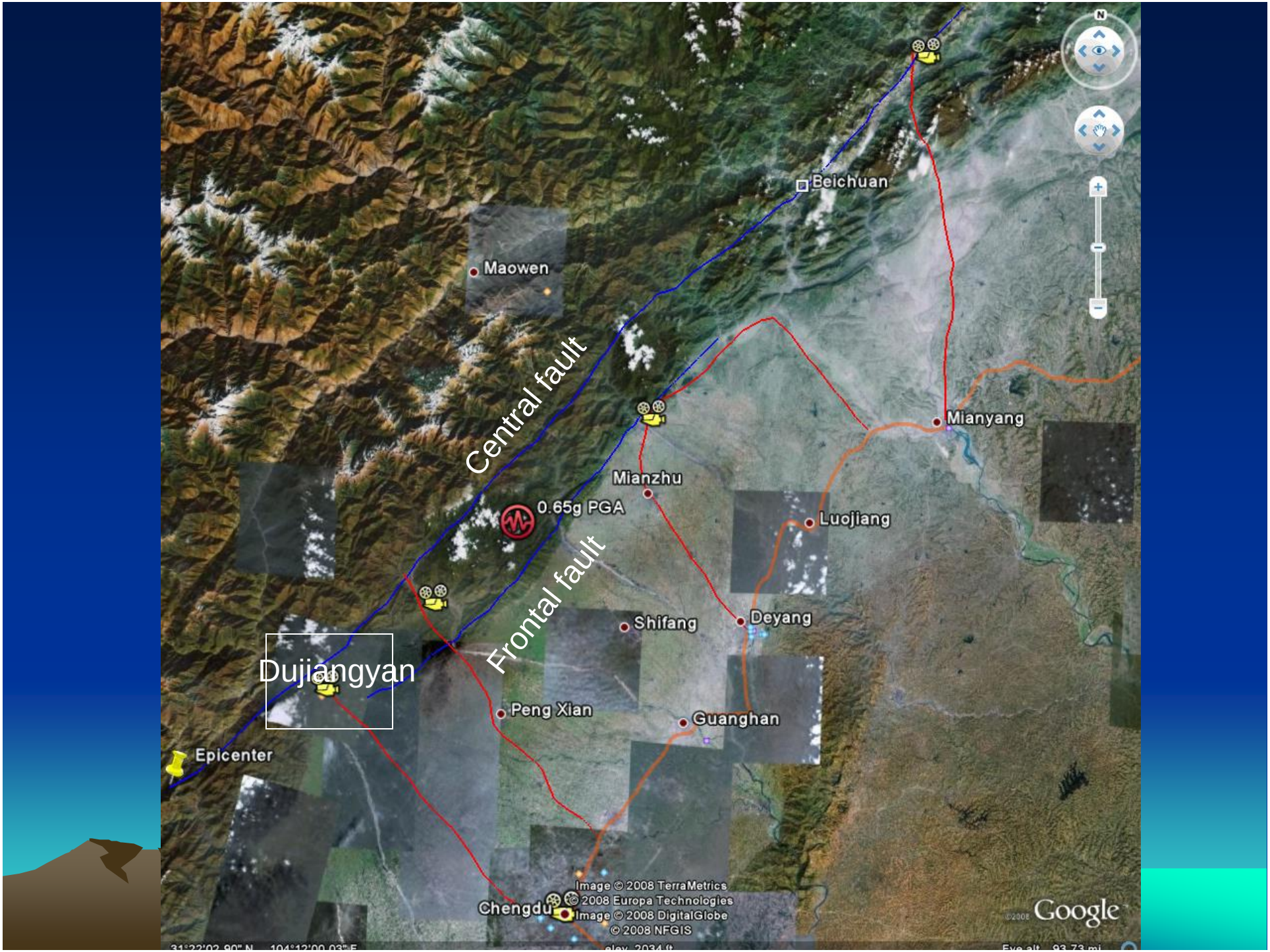
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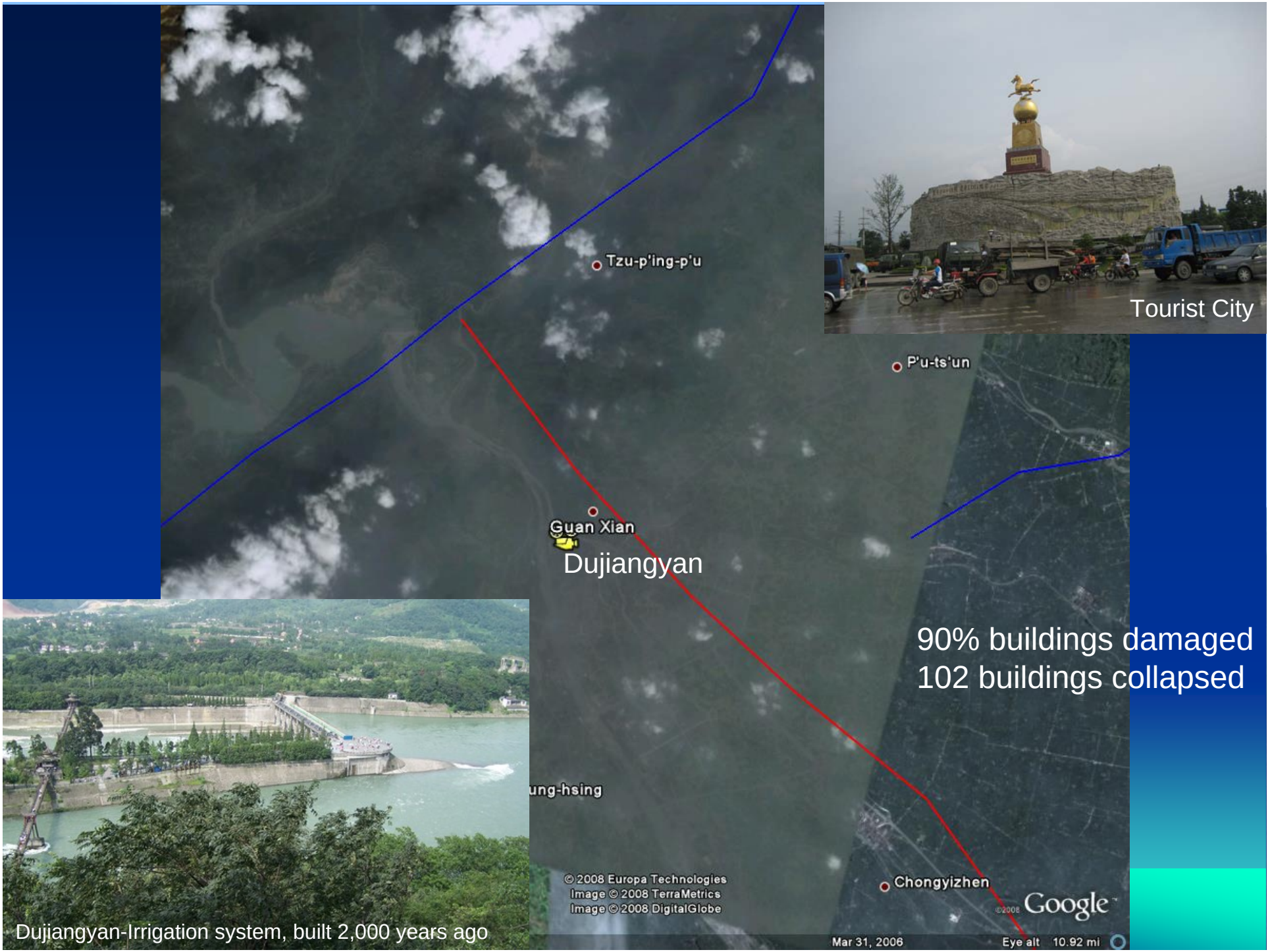
Tzu-p'ing-p'u
Tourist City
P'u-ts'un
Guan Xian
Dujiangyan
90% buildings damaged
102 buildings collapsed
ung-hsing
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Chongyizhen
Google
Mar 31, 2006
Eye alt 10.92 mi
Dujiangyan-Irrigation system, built 2,000 years ago

Collapsed building in Dujiangyan

Collapsed building in Dujiangyan

Damaged police station (new) in Dujiangyan

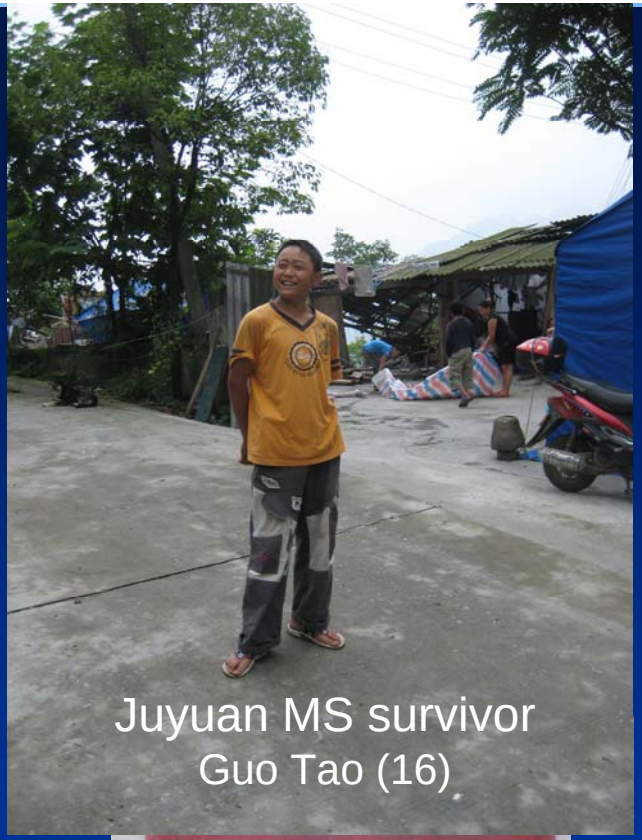
Damaged new hotel in Dujiangyan

Juyuan Middle School (300+ students were killed)

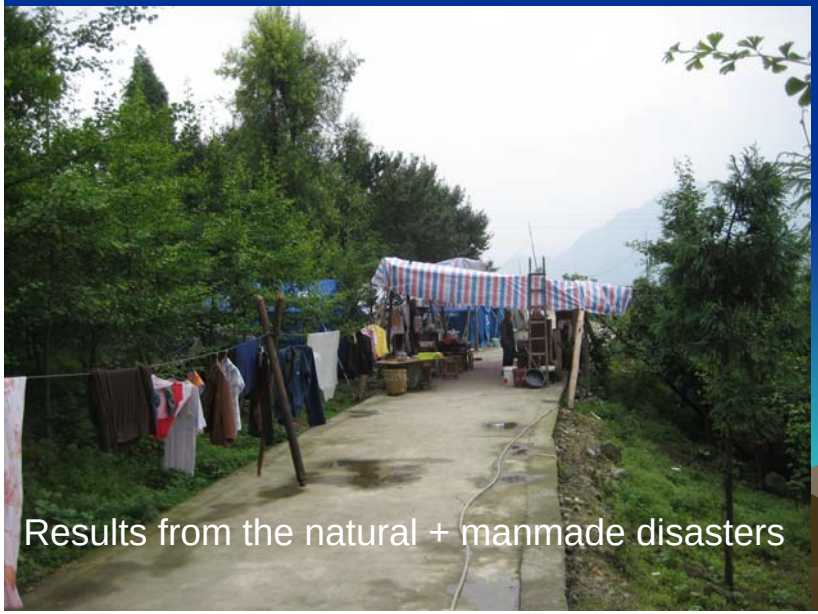

Zhipingpu Dam, built in 2005
Water level before earthquake

Damaged house

Luo Yu Zheng is crying for the losses of her son
(Tao Liang killed at Juyuan MS) and house.



Juyuan MS survivor
Guo Tao (16)



Results from the natural + manmade disasters

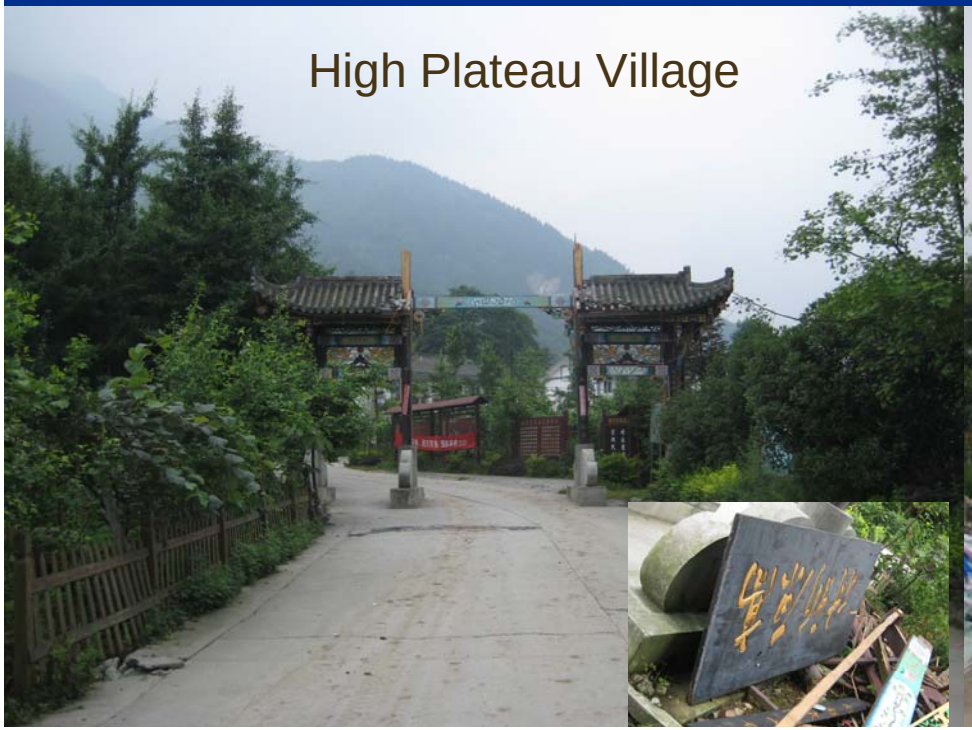
Juyuan MS victim
Tao Liang (16)

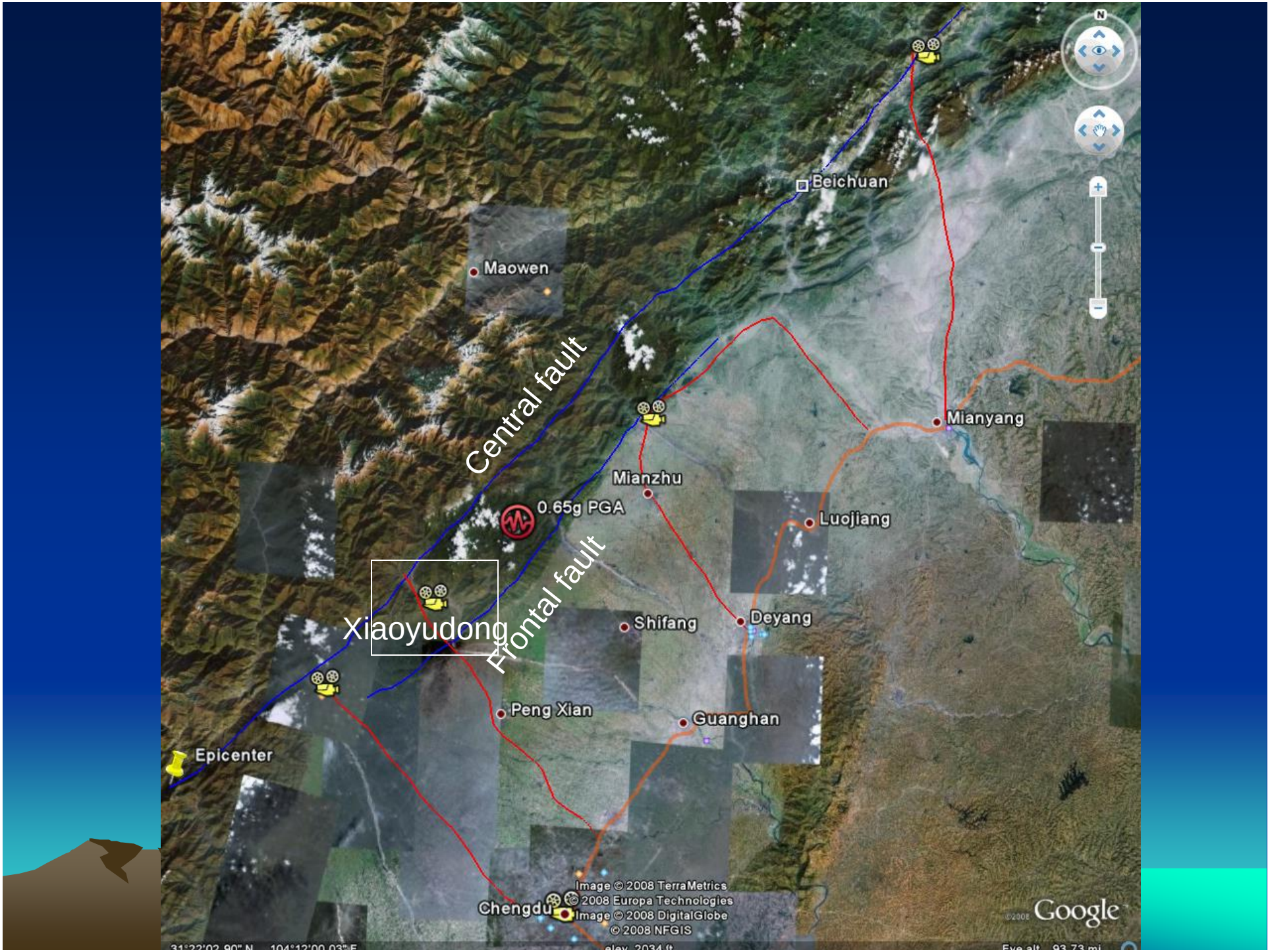

Dangerous road


Damaged bridge
Lateral spreading


Houses with minor damage
Collapsed house


“the best house – good construction quality”


High Plateau Village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Luojiang
Frontal fault
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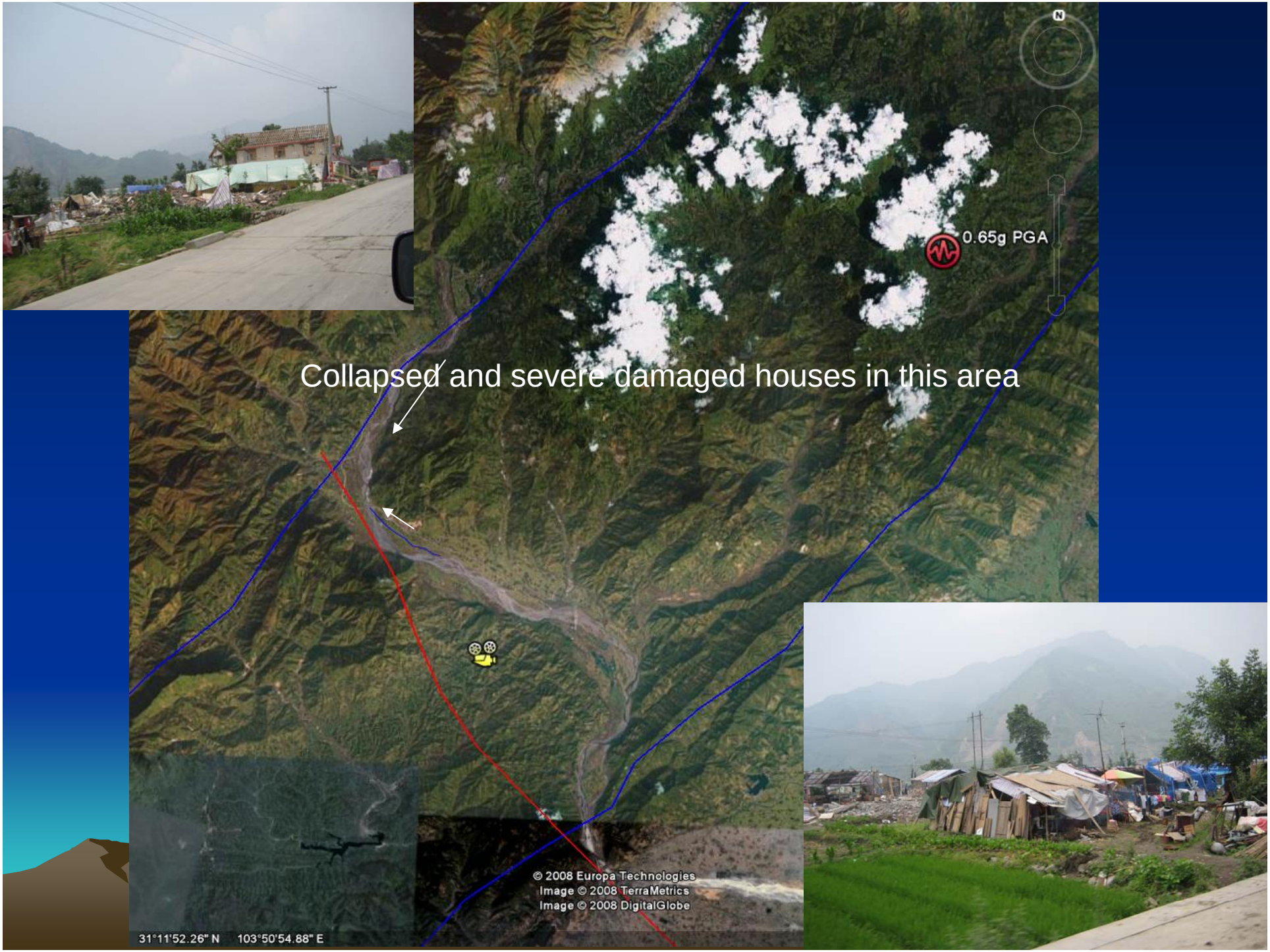
0.65g PGA
Collapsed and severe damaged houses in this area
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Image © 2008 TerraMetrics
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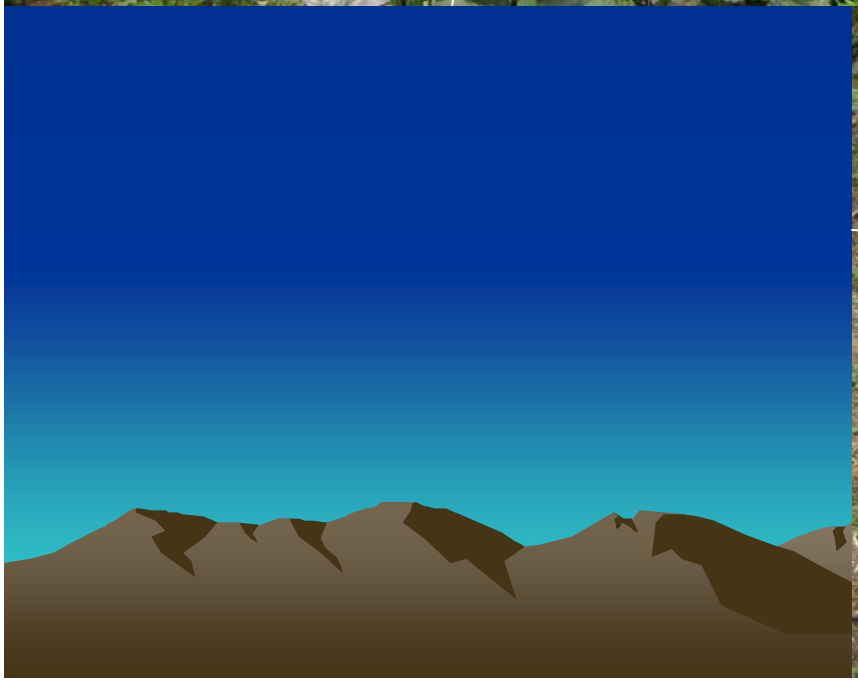
31°11'52.26" N 103°50'54.88" E

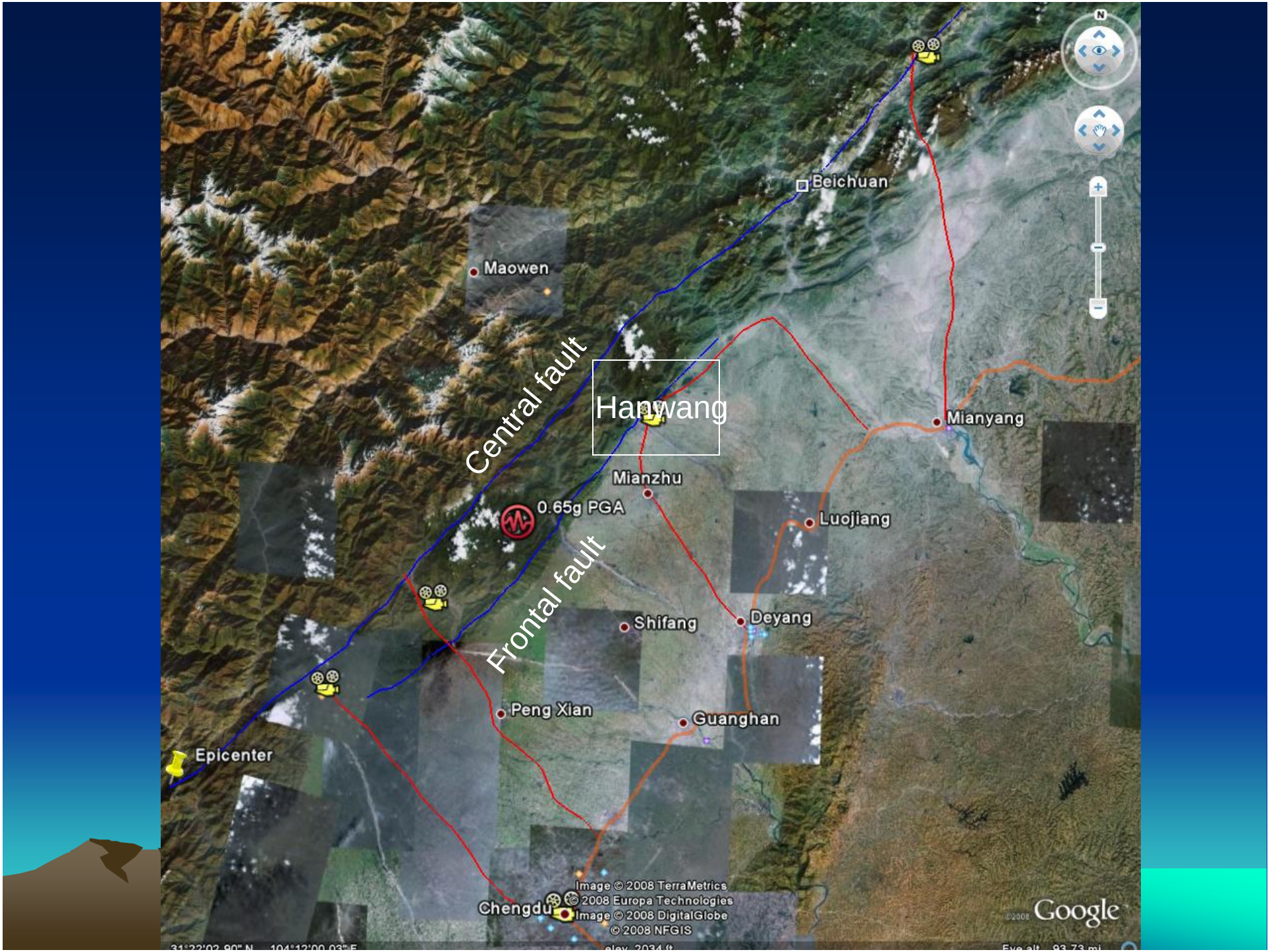

Surface rupture


Bridge collapsed




Rupture


House with some damage
Rupture
This may be the reason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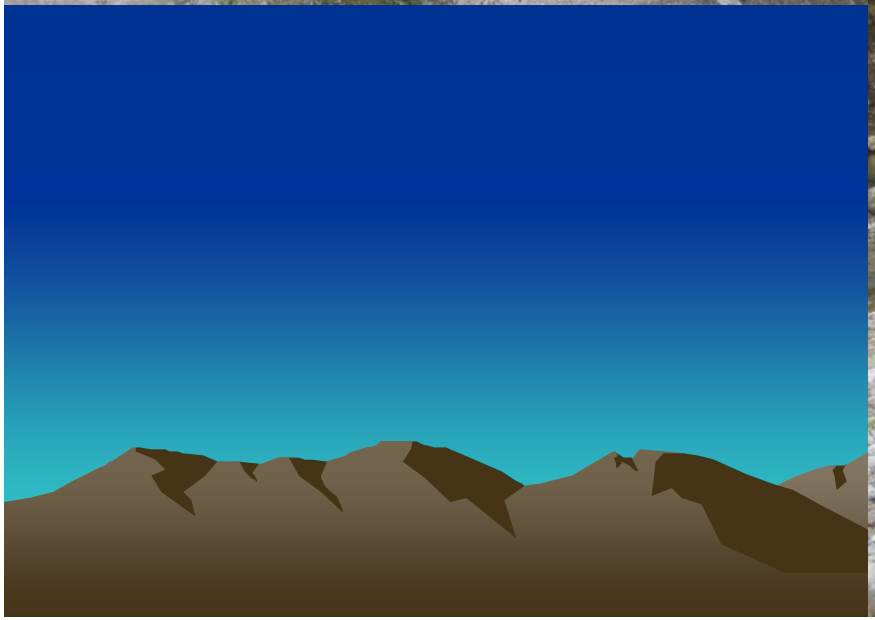
Clock stopped at 2:28pm on May 12, 2008

Collapsed school buildings

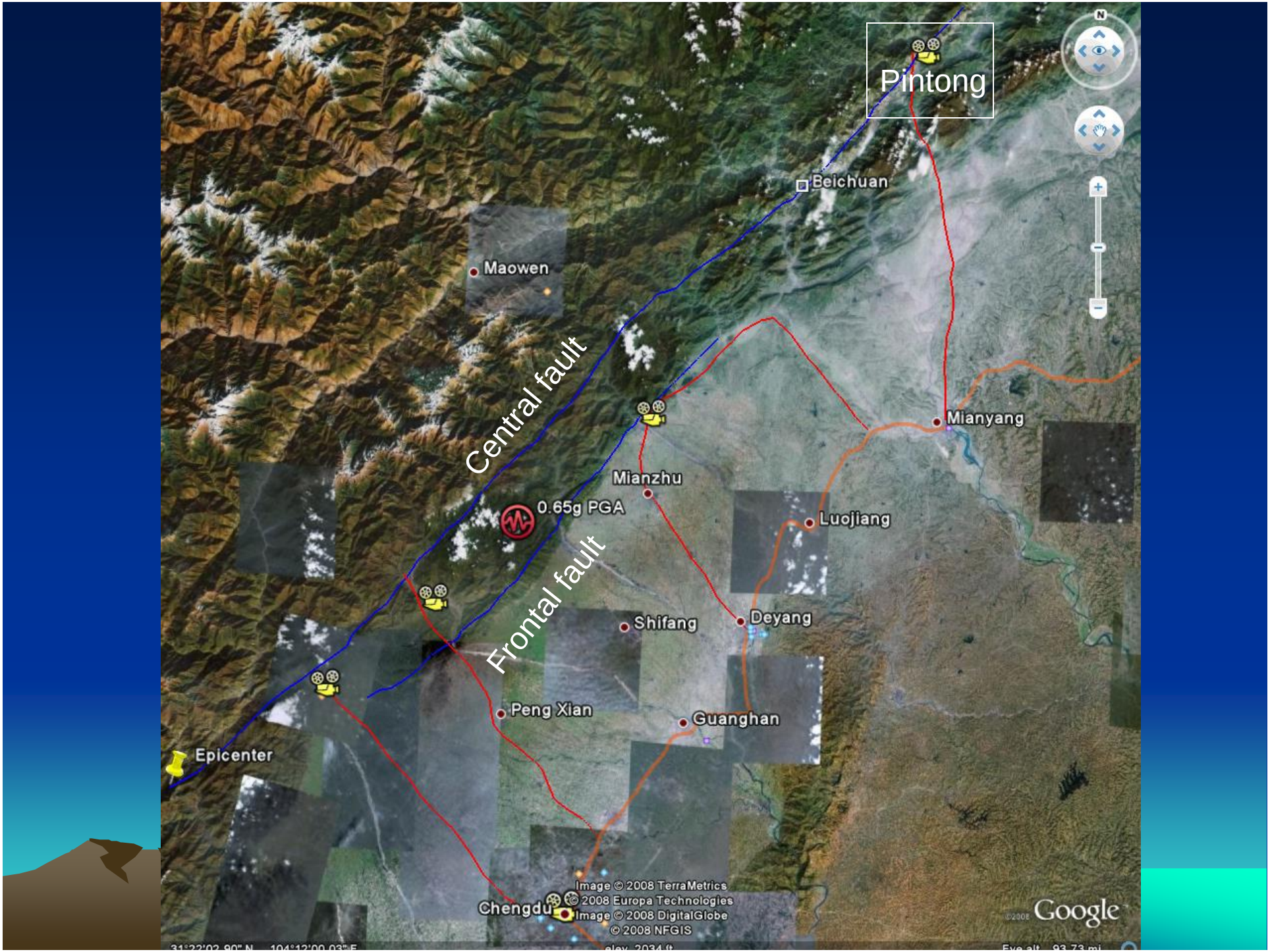
Collapsed school buildings

Collapsed school buildings


Cut though levy
Uplift
Water fall
Frontal fault rupture



Family lunch on top of ruptured fault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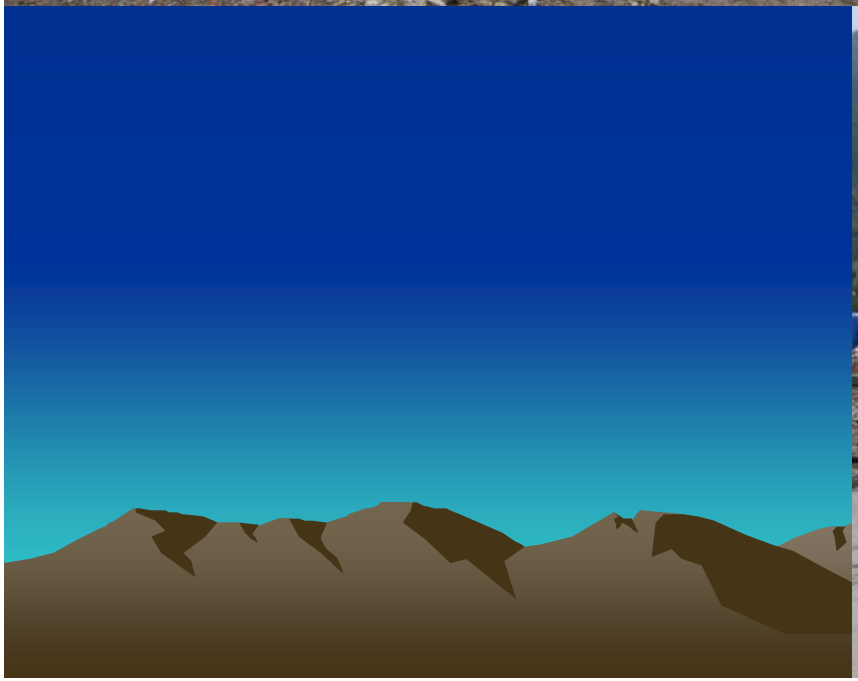
Pintong MS
Central Fault rupture
Pintong MS
Rupture

100+ students were killed

Collapsed school buildings


Fault


Pintong ES
40+ student were killed




Fault


Massive landslide
less damage
(lower plate)
More damage
(upper plate)
Fault rupture

No damage to this house
(about 50 m from the rupture)

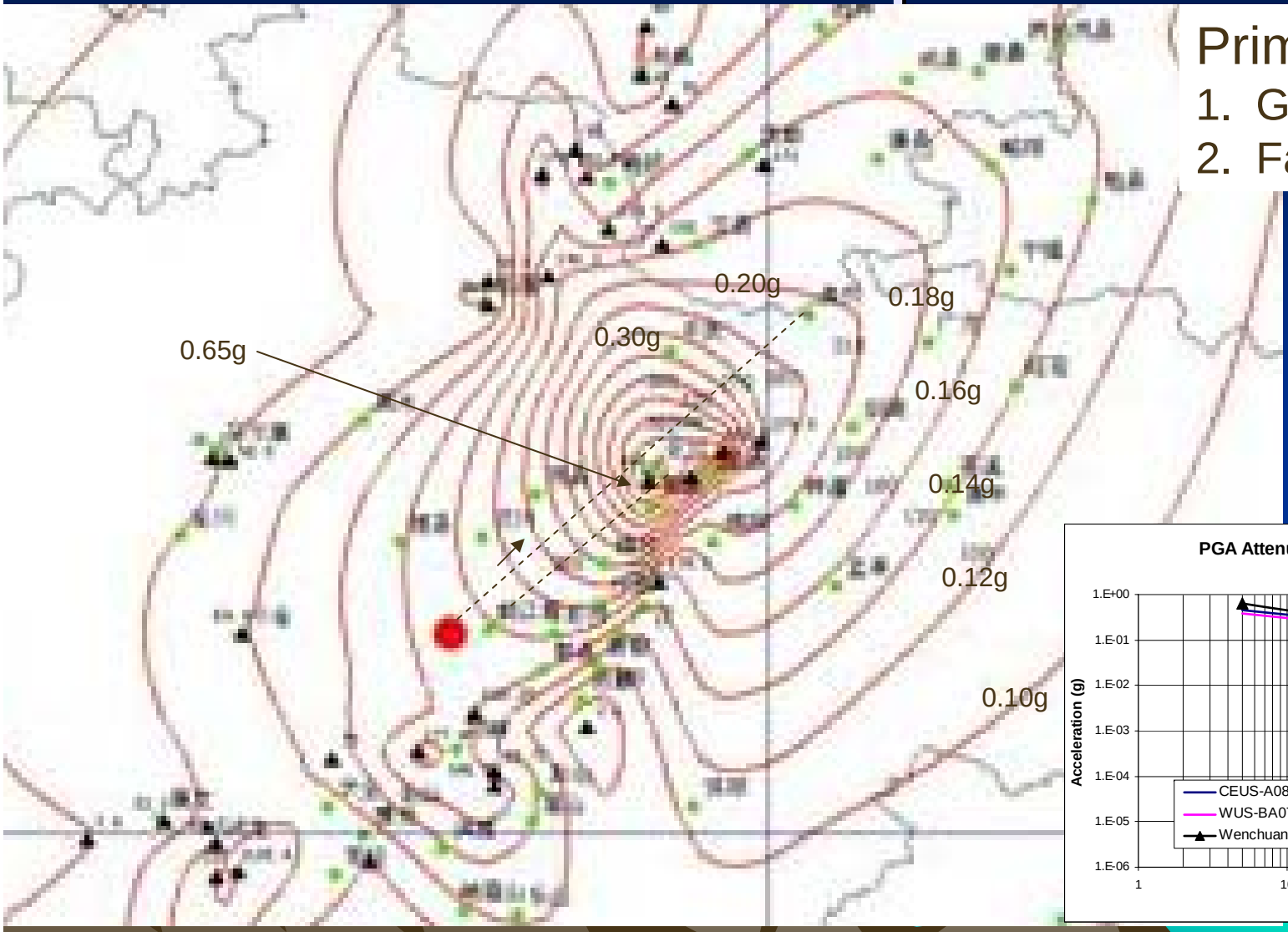
Large landslide

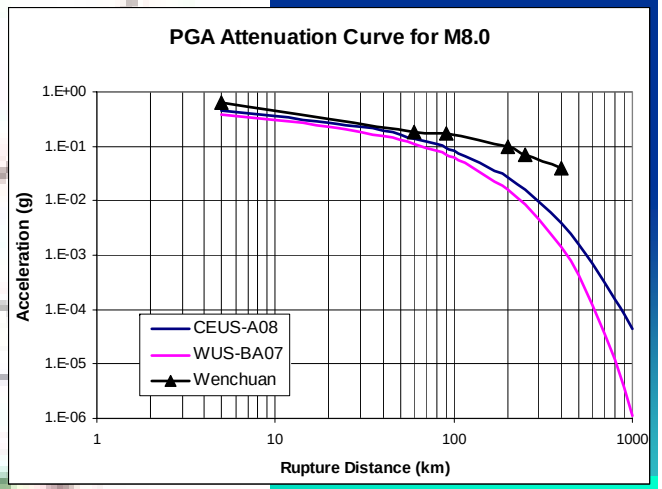
60+ people were buried

Lesson 1 – Earthquake Science

Primary Hazard

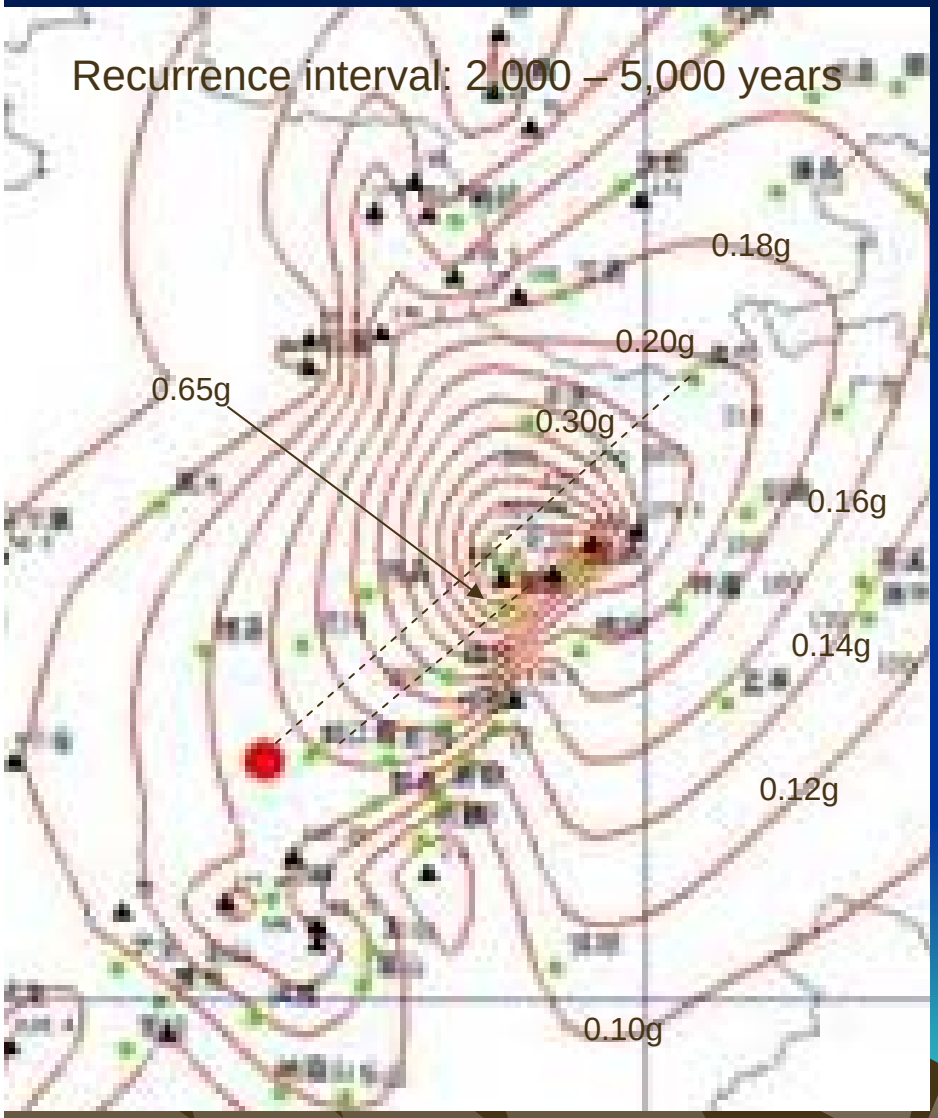
1. Ground Motion
2. Fault Rupture





Earthquake science is the base for seismic hazard assessment and mitigation

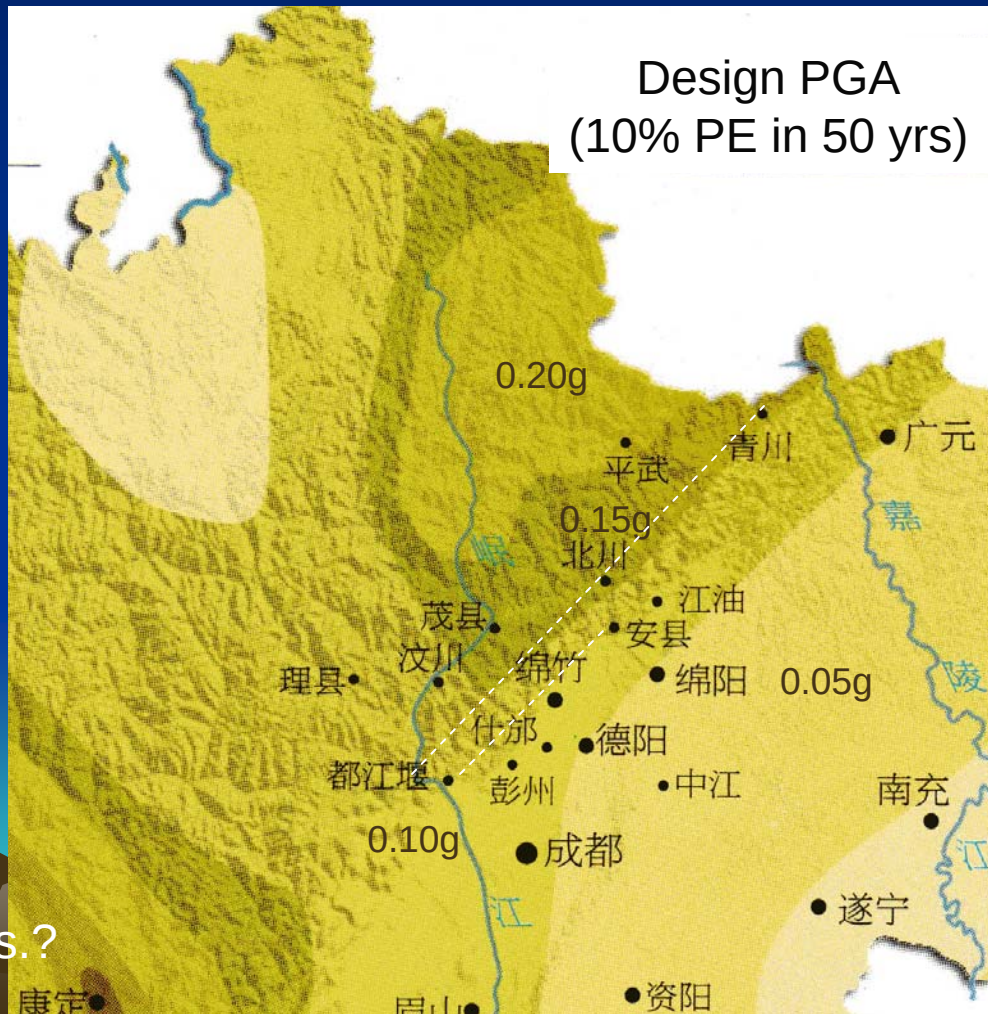
Lesson 2 – Design Ground Motion



How about PGA with 5 and 2% PE in 50 yrs.?

Building damage

1. Under design
2. Quality of construction



Lesson 3 – Induced (secondary) hazards

Secondary Hazard

1. Landslide/Rock fall
2. Ground Motion Amp.
3. Liquefaction (reported)

Lesson 4 – Mitigation Works

Not necessary expensive
Not design for 0.6g PGA or larger

Thank you!