

NEW GPS MEASUREMENTS, PLATE MOTIONS AND SEISMICITY OF HATAY



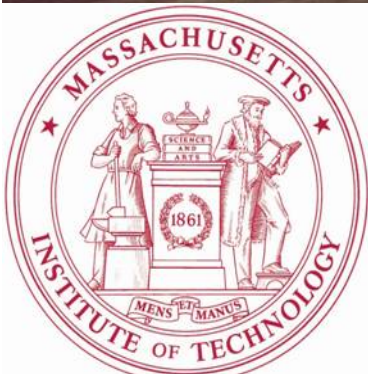
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with

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NEW GPS MEASUREMENTS, PLATE MOTIONS AND SEISMICITY OF HATAY

Outline

I. Earthquakes: A Global Natural Hazard

II. GPS Measurements, Plate Motions and Earthquakes

III. Tectonics and Seismicity of Hatay and Surrounding Areas

IV. Conclusions



I. Earthquakes: A Global Natural Hazard

- **EARTHQUAKES CONSTITUTE THE LARGEST NATURAL HAZARD IN THE WORLD**
- **MORE THAN HALF OF THE WORLD'S POPULATION LIVES IN REGIONS SUBJECT TO SIGNIFICANT EARTHQUAKE HAZARD**
- **SINCE 1900, EARTHQUAKES CAUSED MORE THAN TWO MILLION DEATHS, MILLIONS OF INJURIES AND MANY TRILLIONS OF DOLLARS IN ECONOMIC LOSSES**
- **AT PRESENT, THERE IS NO RELIABLE SCIENTIFIC METHOD OF PREDICTING THE TIME (OF OCCURRENCE) OF AN EARTHQUAKE**
- **IT IS POSSIBLE TO MITIGATE THE EFFECTS OF EARTHQUAKES AND TO PREVENT CASUALTIES BY EARTHQUAKE RESISTANT DESIGN AND CONSTRUCTION**

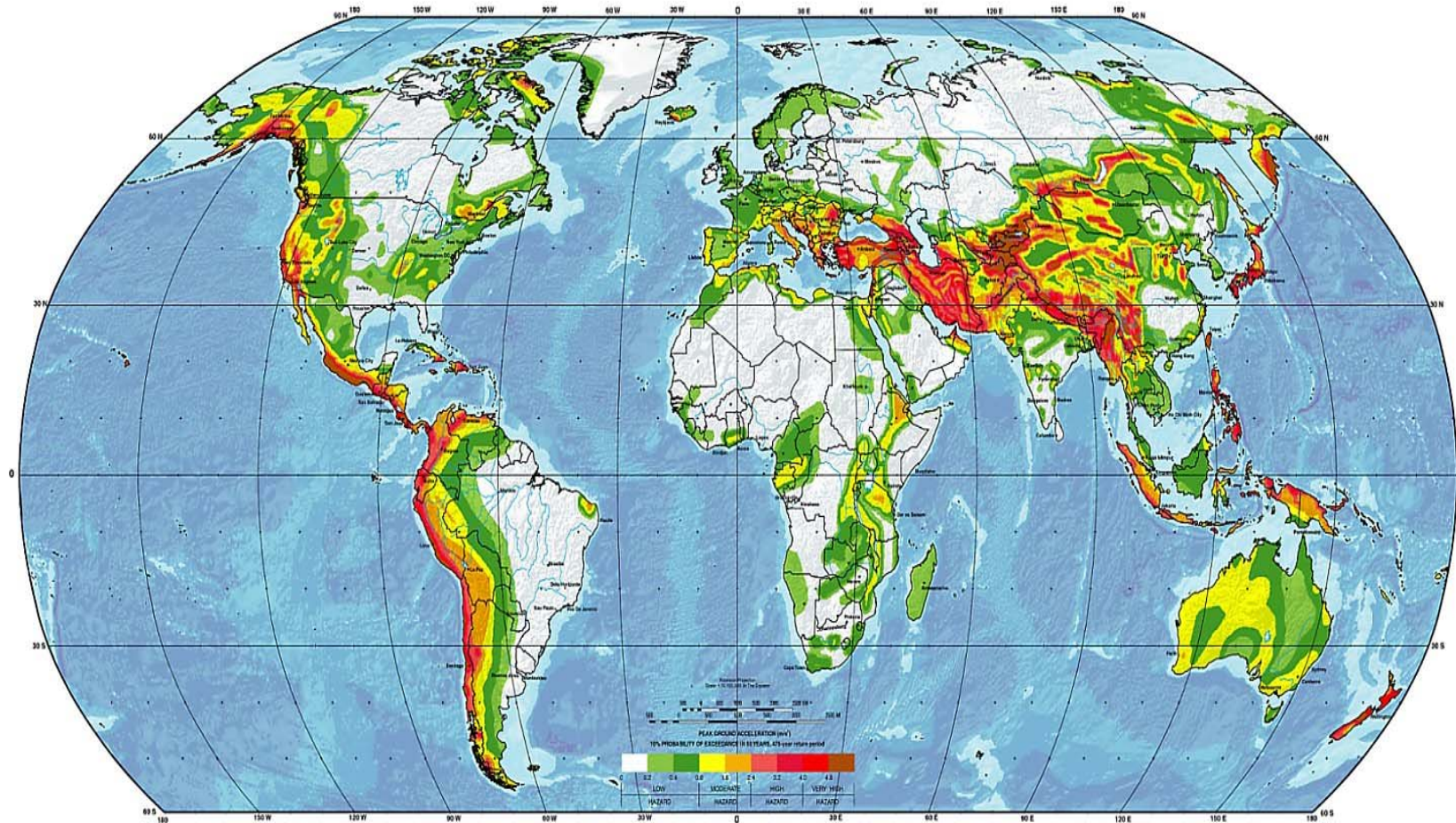


I. Earthquakes: A Global Natural Hazard

GLOBAL SEISMIC HAZARD MAP

Produced by the Global Seismic Hazard Assessment Program (GSHAP),
a demonstration project of the UN/International Decade of Natural Disaster Reduction, conducted by the International Lithosphere Program.

Global map assembled by D. Giardini, G. Grÿnthal, K. Shedlock, and P. Zhang
1999





I. Earthquakes: A Global Natural Hazard

PLACE	YEAR	MAGNITUDE	CASUALTIES
IZMIT	1999	7.6	17,000
CHINA	2008	7.9	68,000
HAITI	2010	7.0	230,000
CHILE	2010	8.8	521
NEW ZEALAND	2010	7.1	0



I. Earthquakes: A Global Natural Hazard





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USGS: www.usgs.gov



I. Earthquakes: A Global Natural Hazard

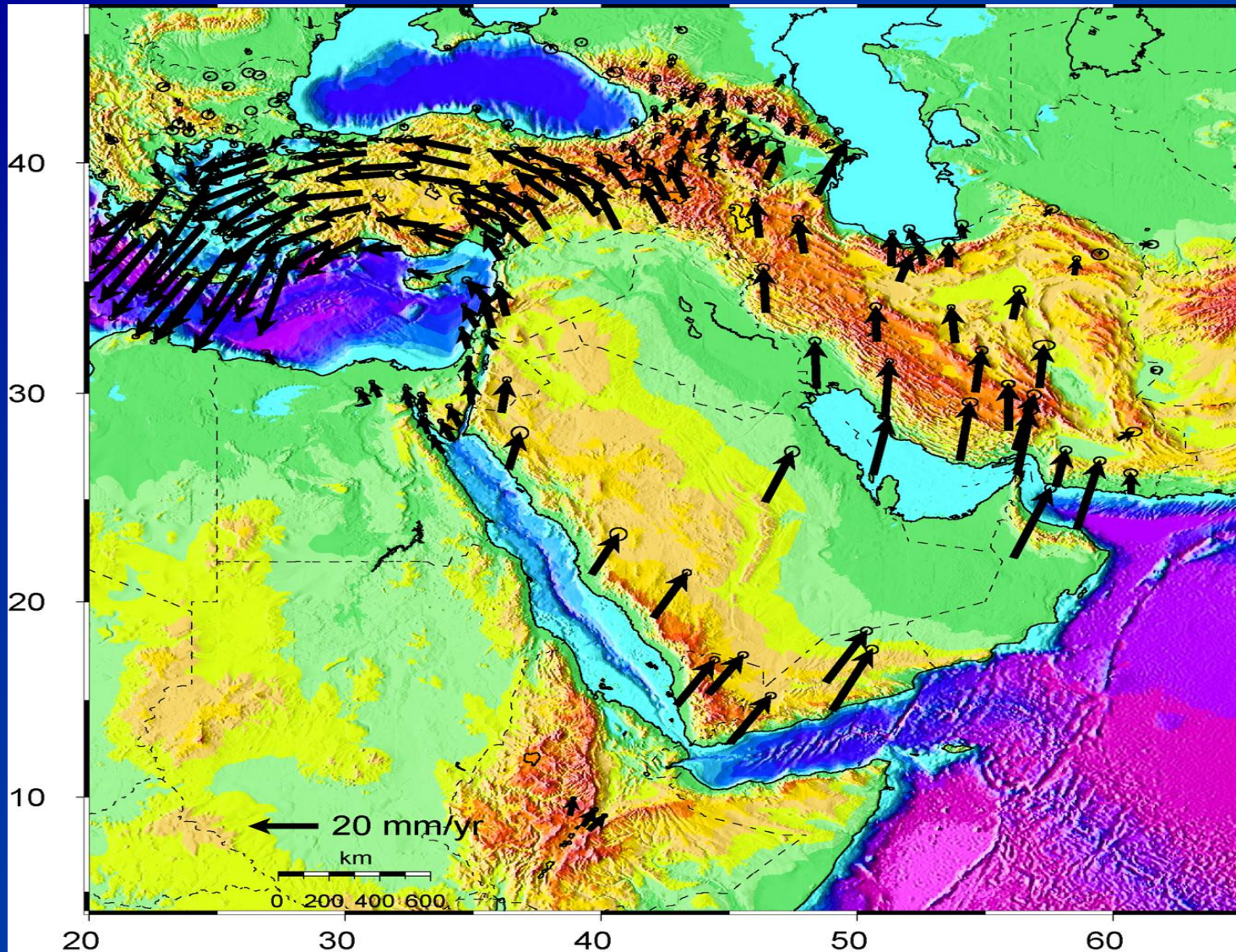


Turkey, 1999

Magnitude = 7.4



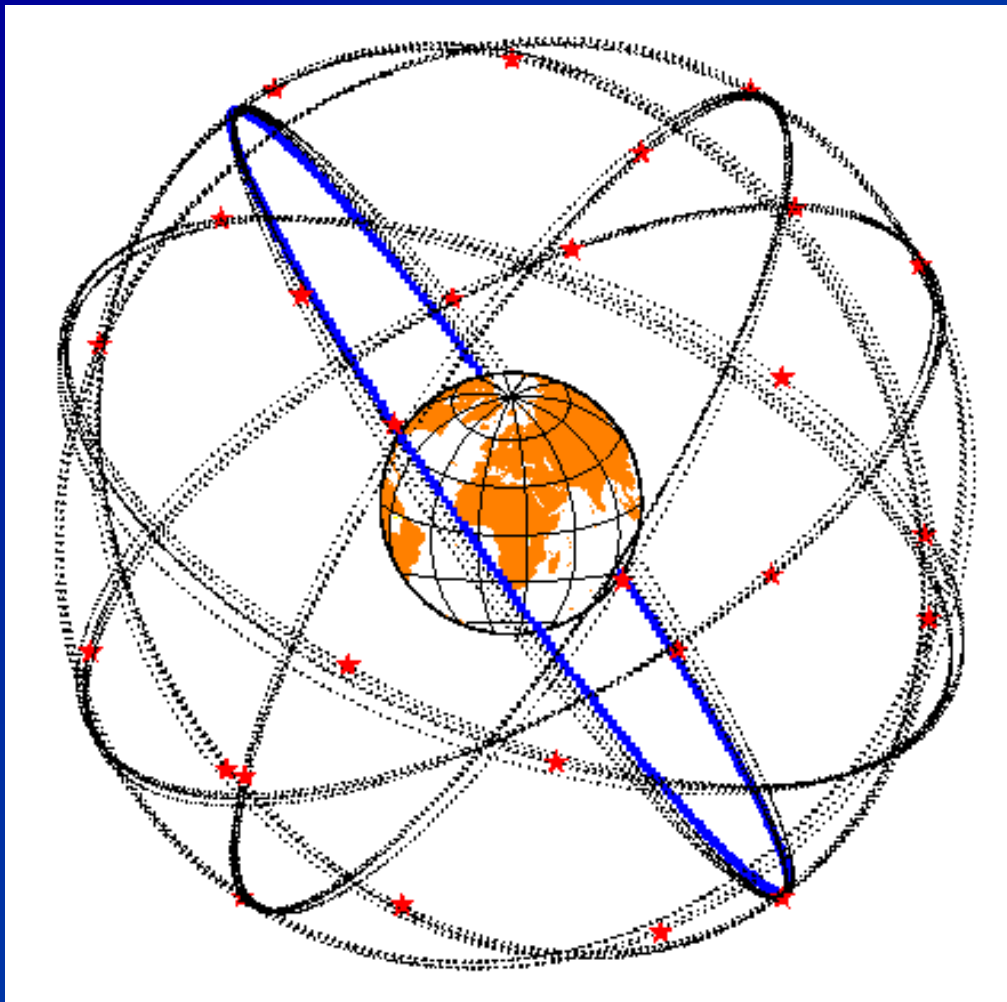
II. GPS Measurements, Plate Motions and Earthquakes





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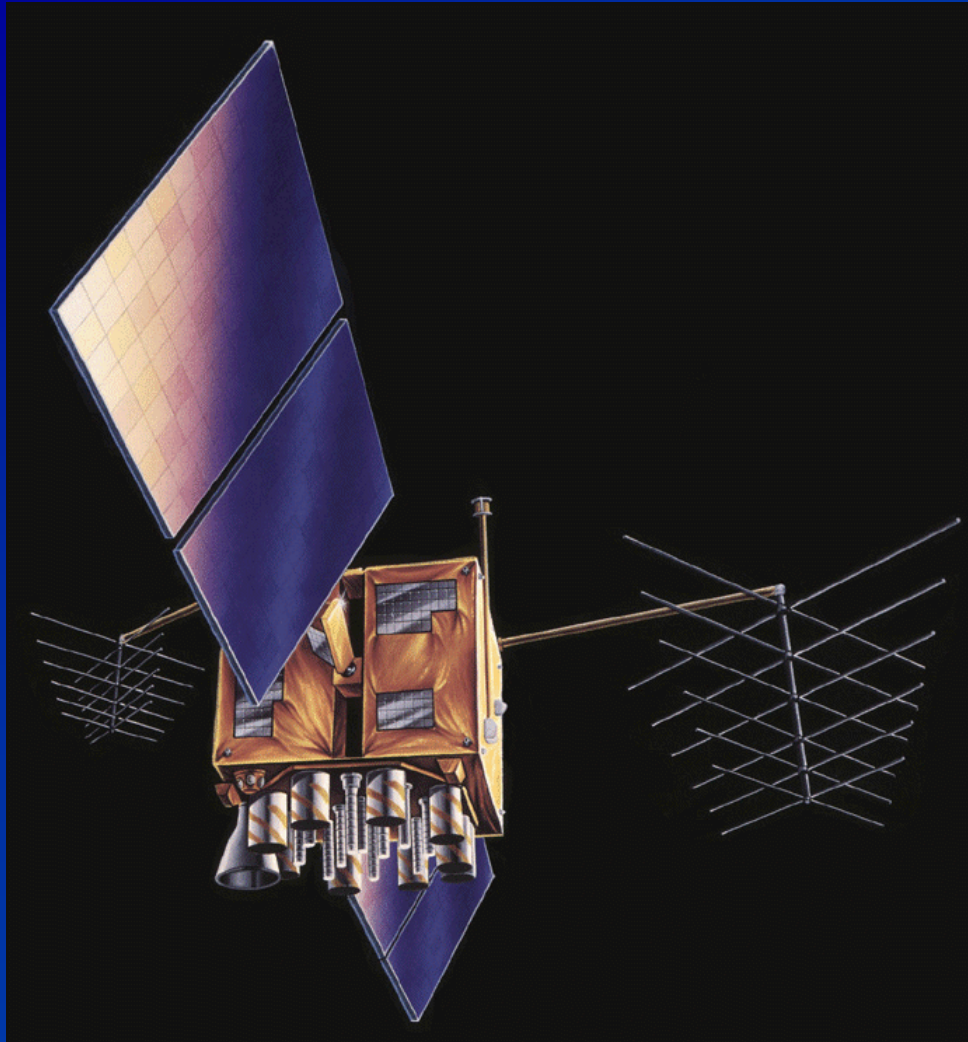
GPS Constellation (MEO at 20000km altitude)



- Relative sizes correct (inertial space view)
- “Fuzzy” lines not due to orbit perturbations, but due to satellites being in 6-planes at 55° inclination.
- Originally 21 satellites now 30-32 (Satellites have 5-year lifetimes but last 10-15 years). However, replacement satellites need to be built and these become “active spares”



II. GPS Measurements, Plate Motions and Earthquakes



GPS Satellite Block IIR
Mass 1100 kg

Limits to modeling orbits are non-gravitational accelerations due to solar and albedo radiation, unbalanced thrusts, and outgassing; and non-spherical antenna pattern

Orbit accuracy 3-5 cm



II. GPS Measurements, Plate Motions and Earthquakes

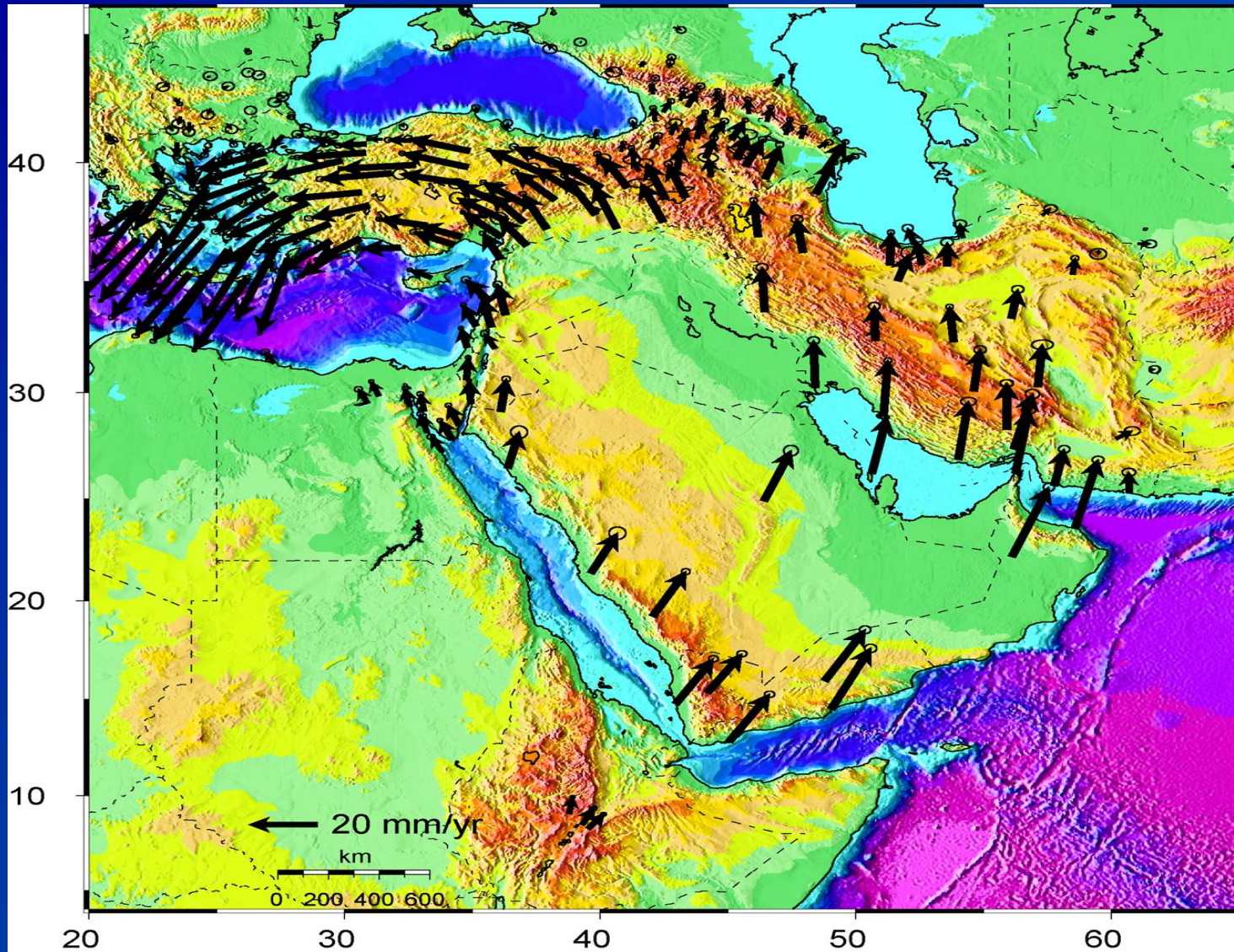
Styles of Monuments



Grey domes are radomes and protect the antenna (but also can cause problems with signal propagation delays).

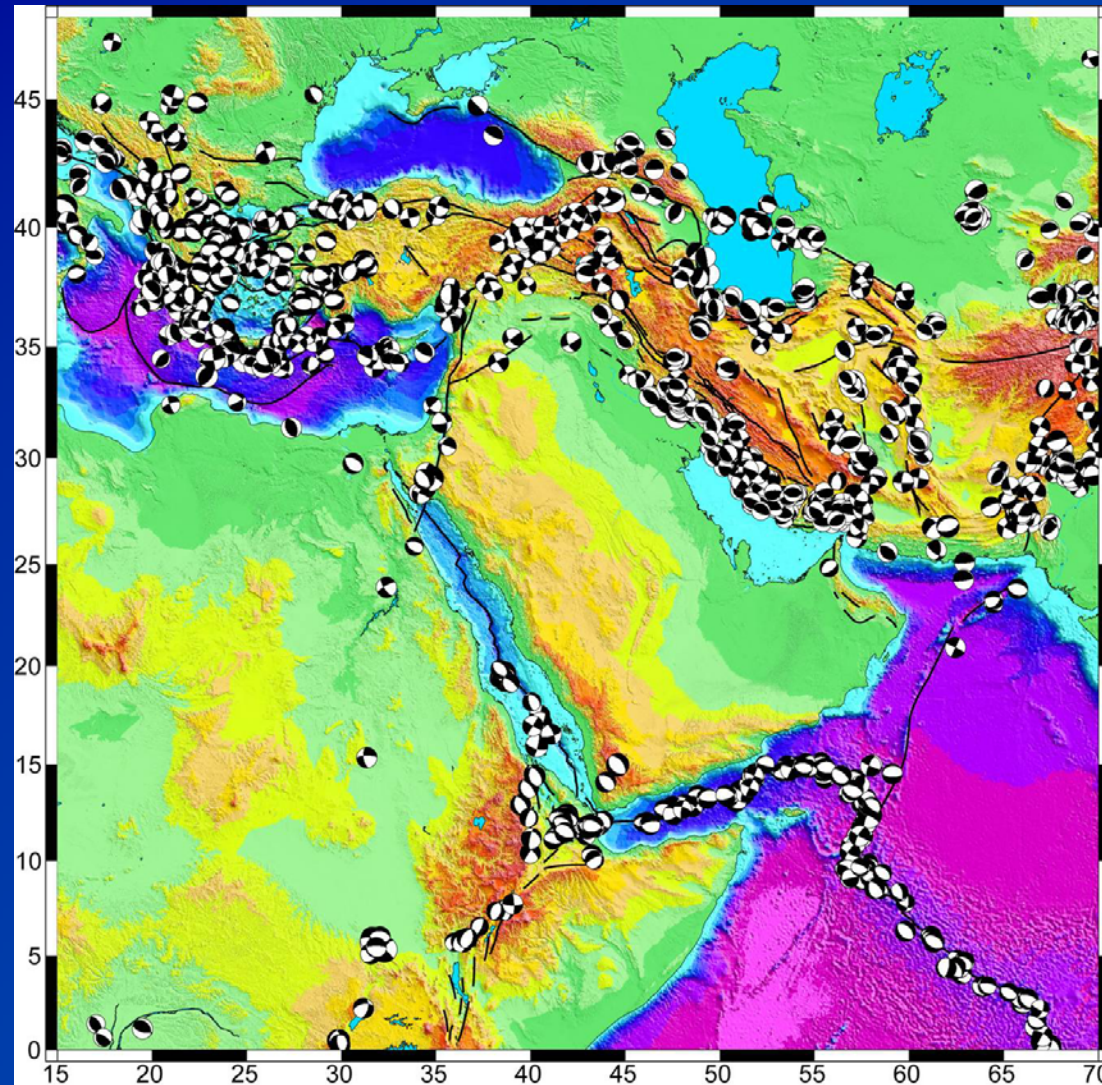


II. GPS Measurements, Plate Motions and Earthquakes





III. Tectonics and Seismicity of Hatay and Surrounding Areas





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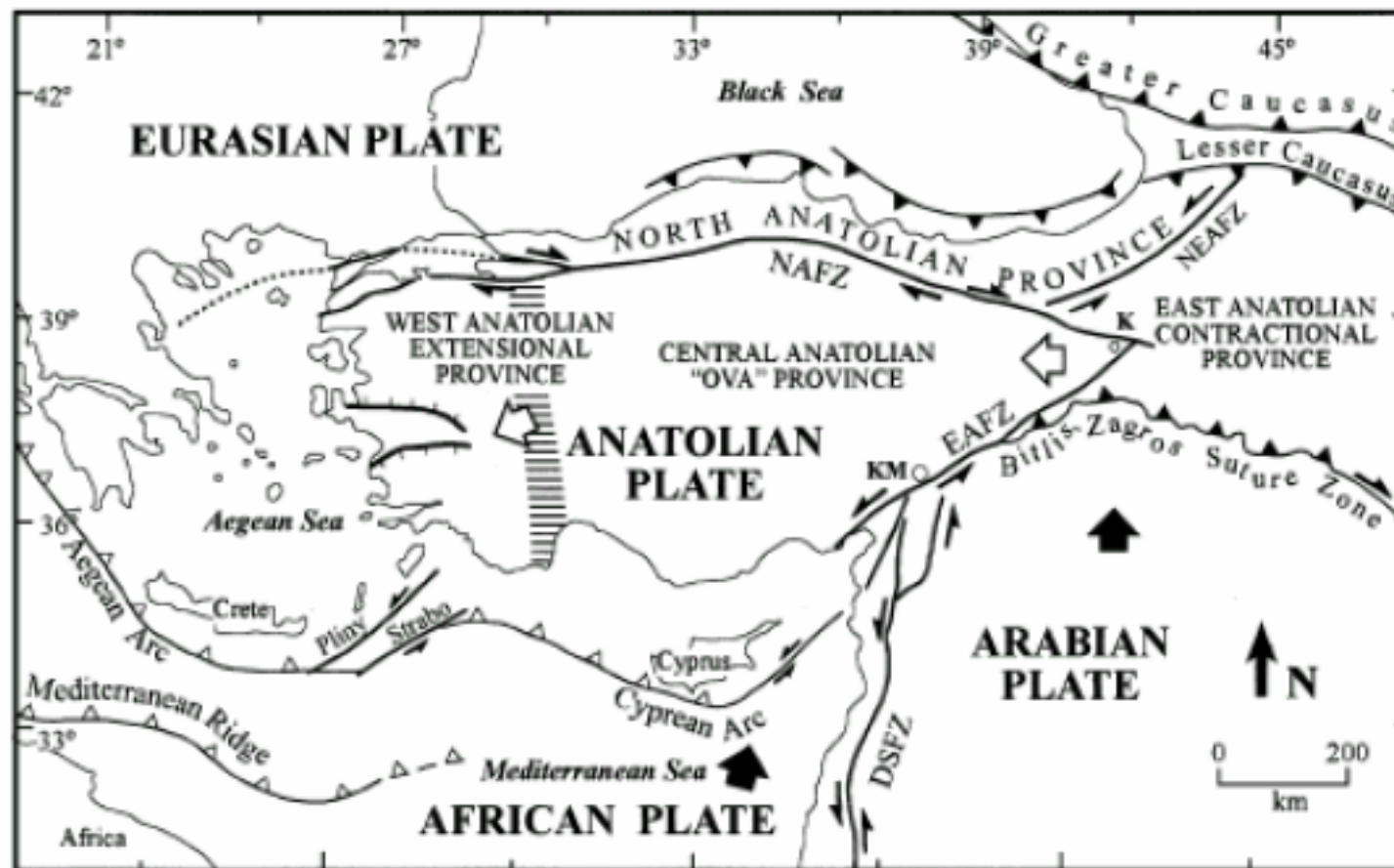


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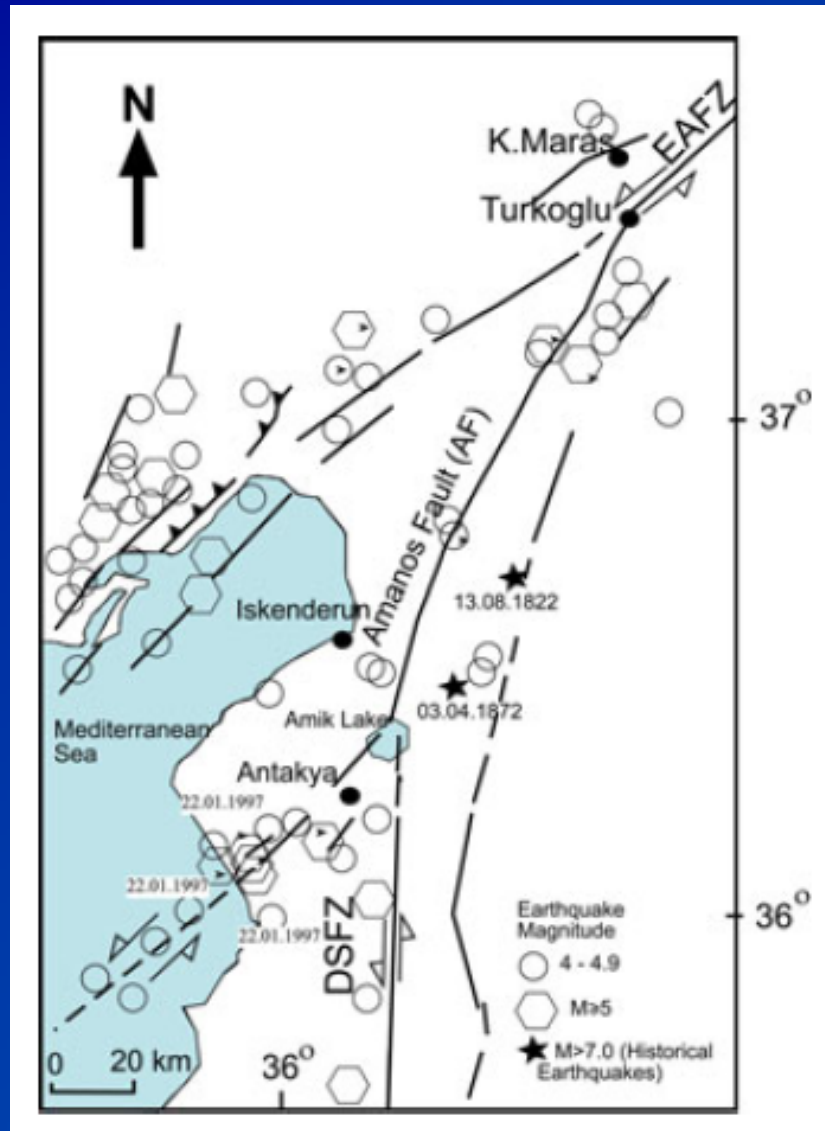


III. Tectonics and Seismicity of Hatay and Surrounding Areas





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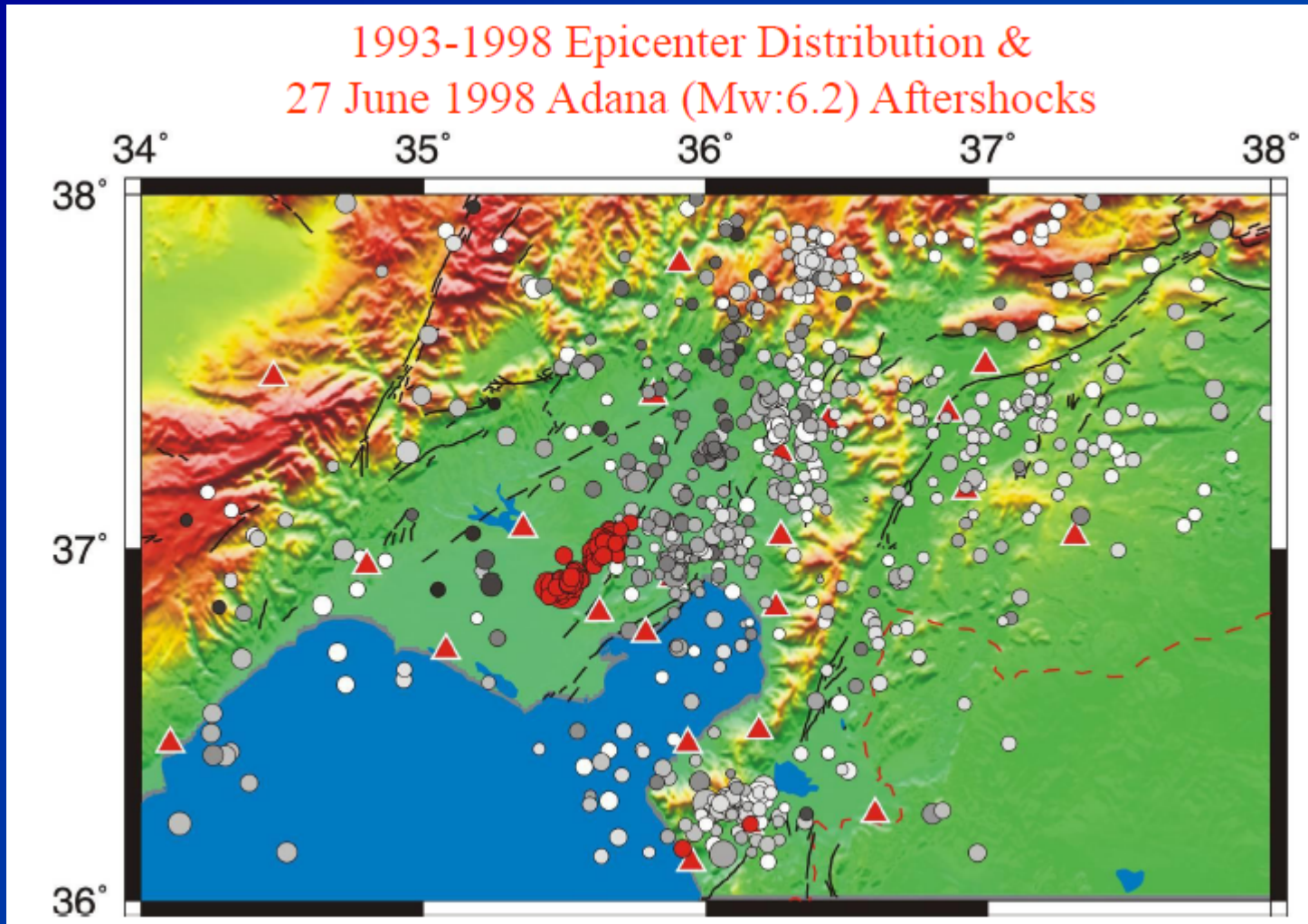
Over et al. (2002)

Over et al. (2010)



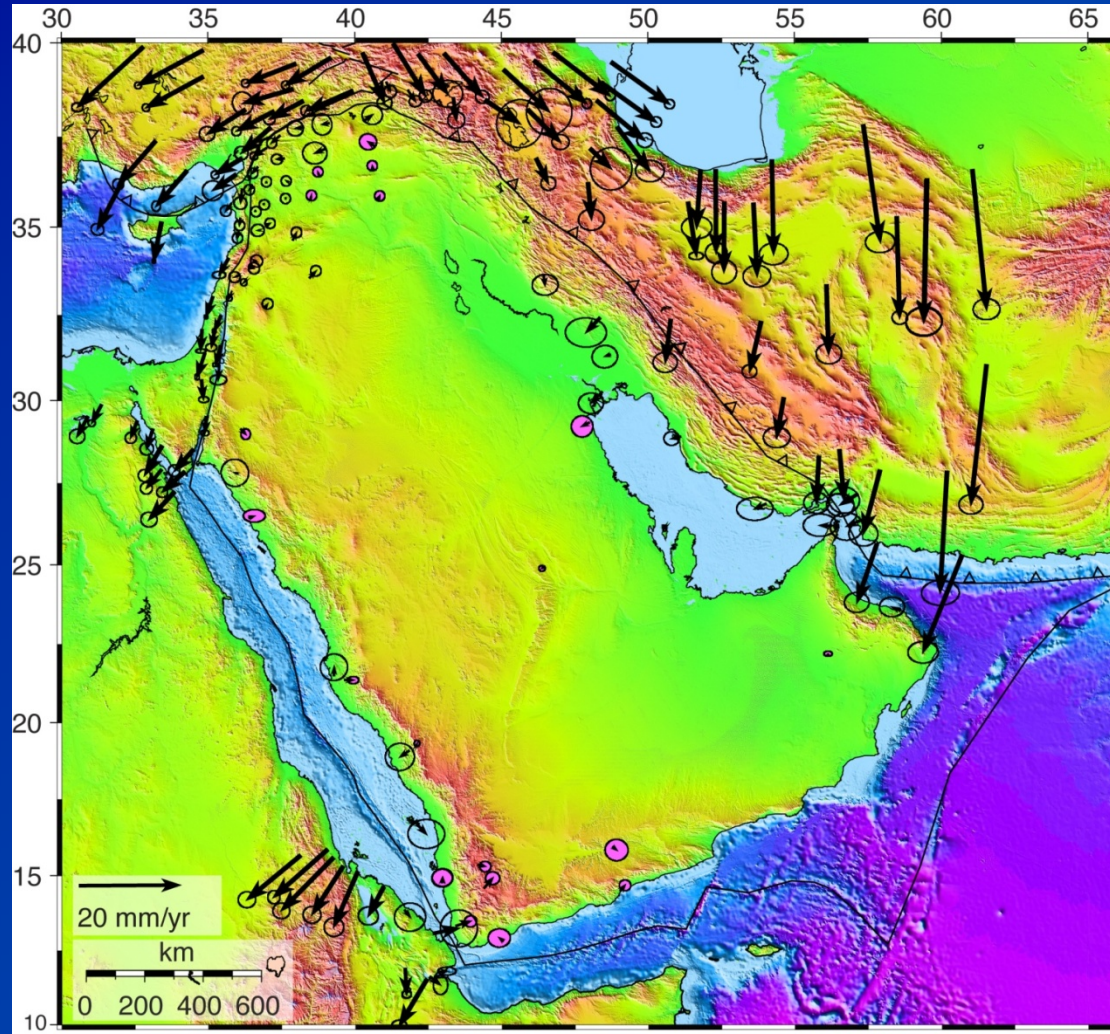
III. Tectonics and Seismicity of Hatay and Surrounding Areas

1993-1998 Epicenter Distribution &
27 June 1998 Adana (Mw:6.2) Aftershocks





III. Tectonics and Seismicity of Hatay and Surrounding Areas

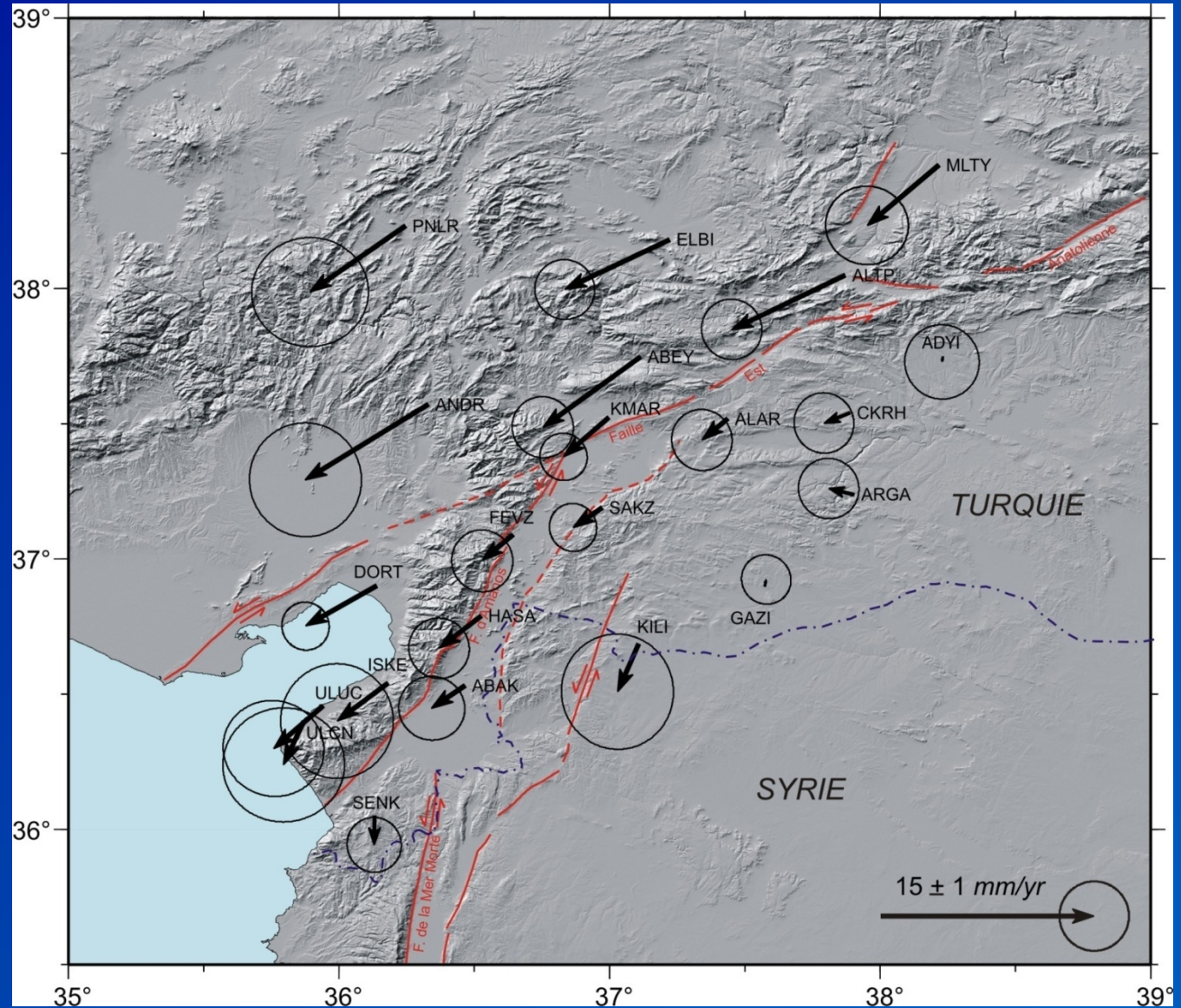




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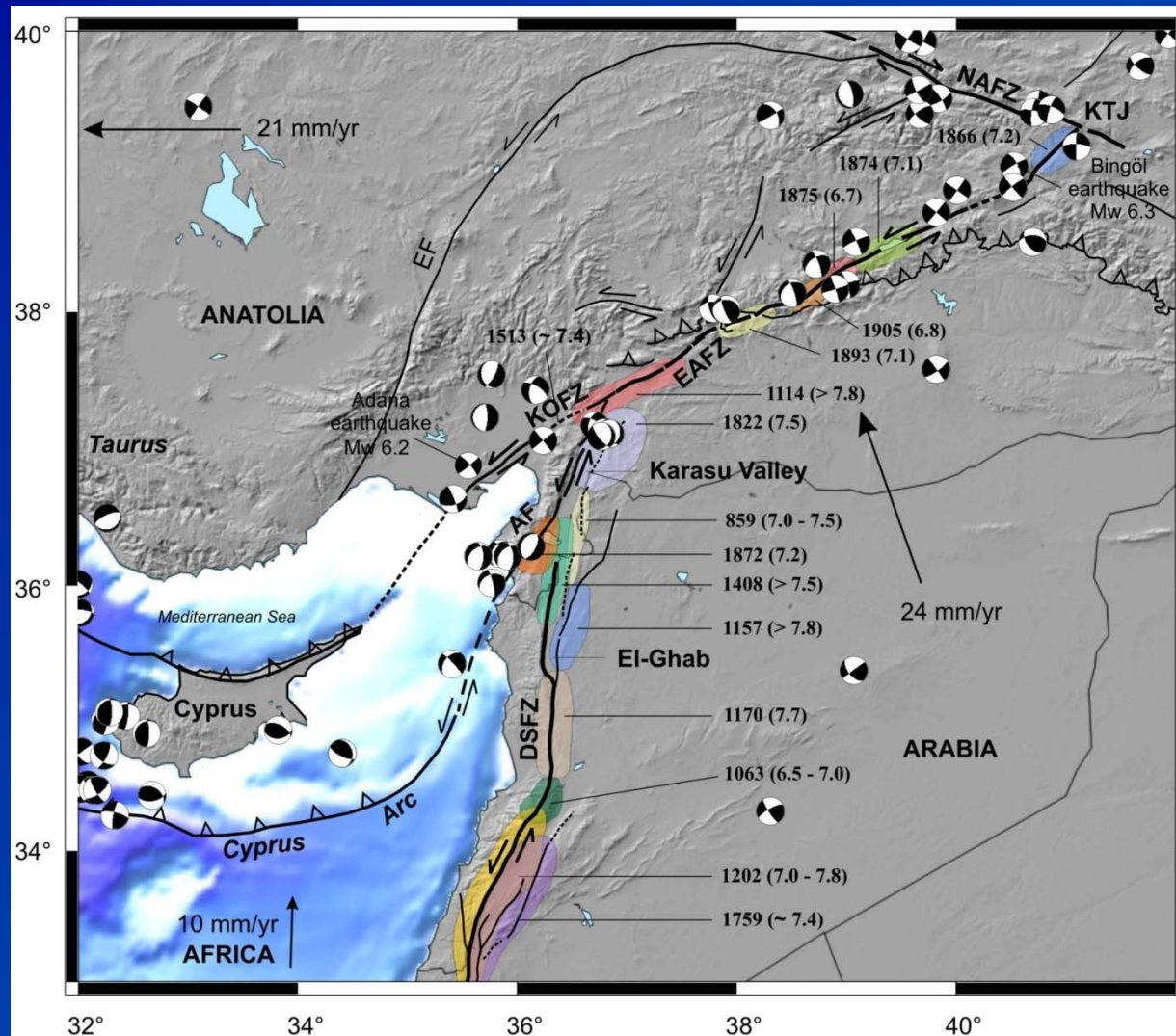
GPS velocities
with
fixed Arabia
(1991 – 2004)

GPS data are
from Reilinger et al.
(2006) and the
APAME Project.





III. Tectonics and Seismicity of Hatay and Surrounding Areas





IV. Conclusions

- **TECTONIC PLATES WILL CONTINUE TO MOVE AND BUILD UP STRESSES ON FAULTS IN AND AROUND HATAY RESULTING IN DAMAGING EARTHQUAKES**
- **SEISMICITY IS DISTRIBUTED OVER A NETWORK OF FAULTS AND NOT ON A SINGLE FAULT**
- **DEFORMATION RATES, BASED ON GPS, ACROSS THE DSF IS ABOUT 4 MM/YR (EAF 9 MM/YR, NAF 20 MM/YR)**
- **BASED ON DEFORMATION RATES AND THE ABSENCE OF LONG FAULTS, THE MAXIMUM MAGNITUDE OF A POTENTIAL EARTHQUAKE IS $M=6.5$ OR SMALLER. ON AVERAGE, SUCH AN EARTHQUAKE COULD OCCUR ONCE EVERY 250 YEARS. MORE STUDIES ARE NEEDED IN THIS AREA.**
- **AT PRESENT THERE IS NO RELIABLE SCIENTIFIC METHOD TO PREDICT WHEN AN EARTHQUAKE WILL OCCUR**
- **EFFECTS OF EARTHQUAKES CAN BE MITIGATED AND CASUALTIES PREVENTED BY EARTHQUAKE RESISTANT DESIGN AND CONSTRUCTION**



THANK YOU!