

Ground Acceleration Modeling for Istanbul Using Geographic Information Systems

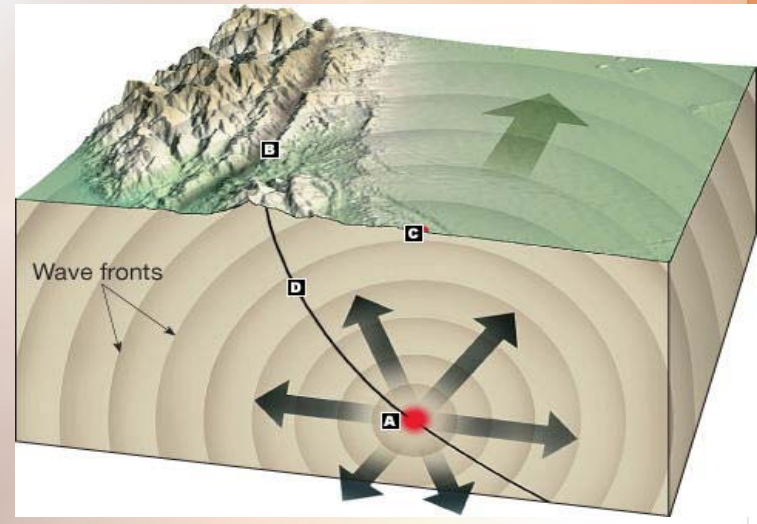


H. Can Unen
M. Zeki Coskun

Istanbul Technical University
Department Of Geodesy & Photogrammetry

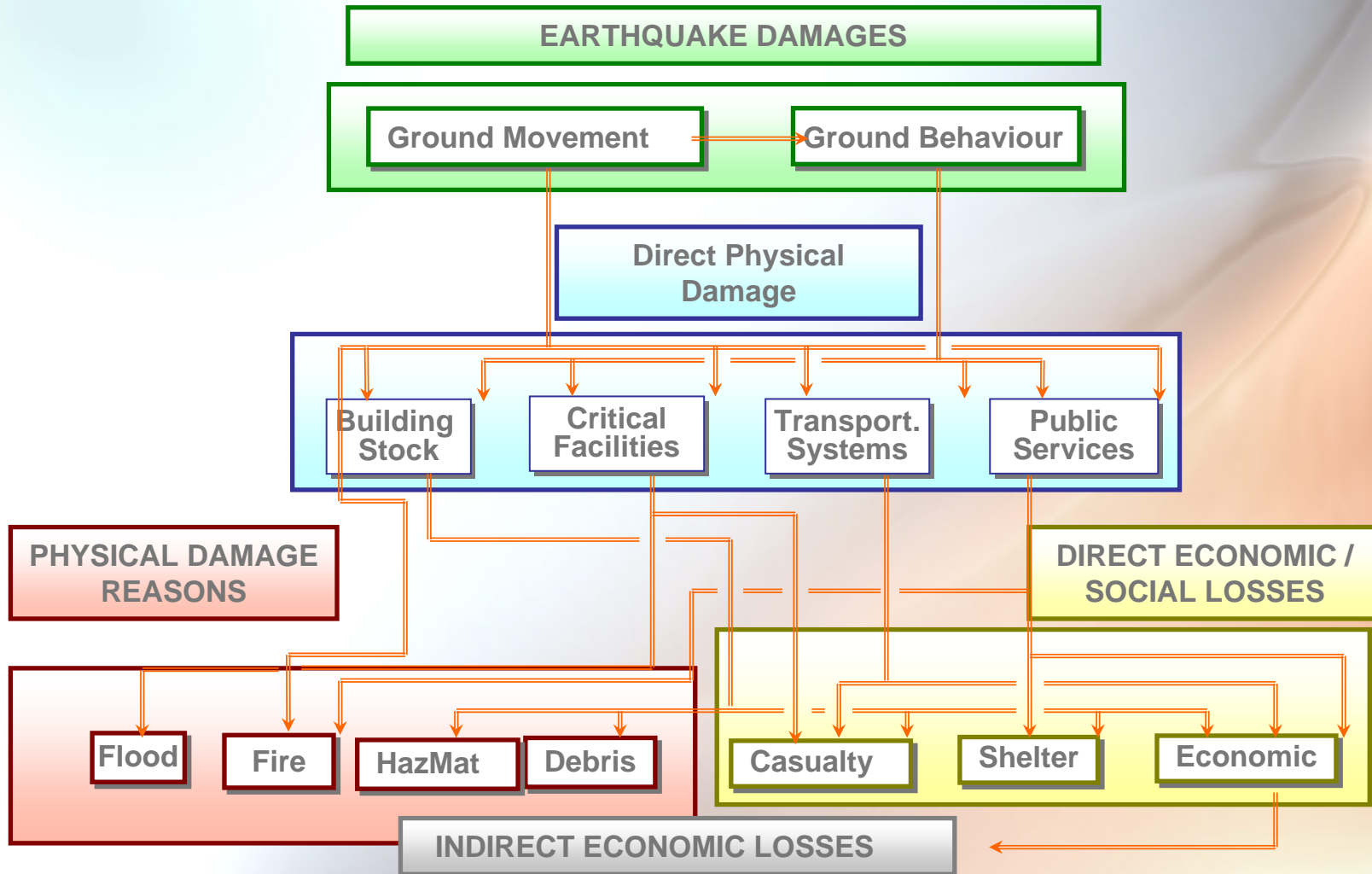
Objective

- Hazards have been taken seriously since the earthquakes on August 17 and November 12, 1999.
- It is necessary to implement disaster management systems in Turkey.
- A GIS based system for loss assessment and response planning will be developed.
- It is essential to know the seismic forces acting in order to make the analysis.



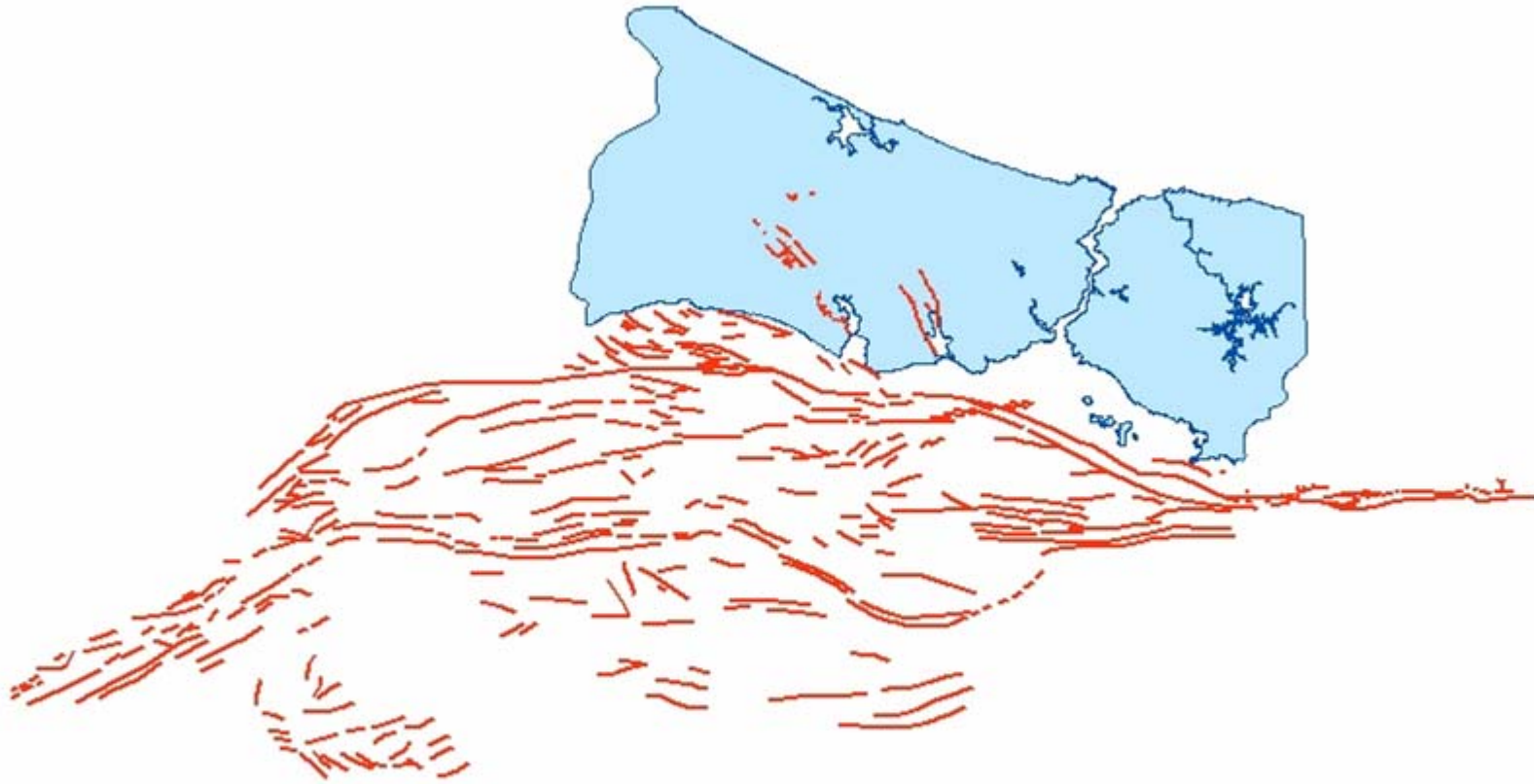
GIS Based Disaster Management Systems

HAZUS-MH Earthquake Model



(FEMA)

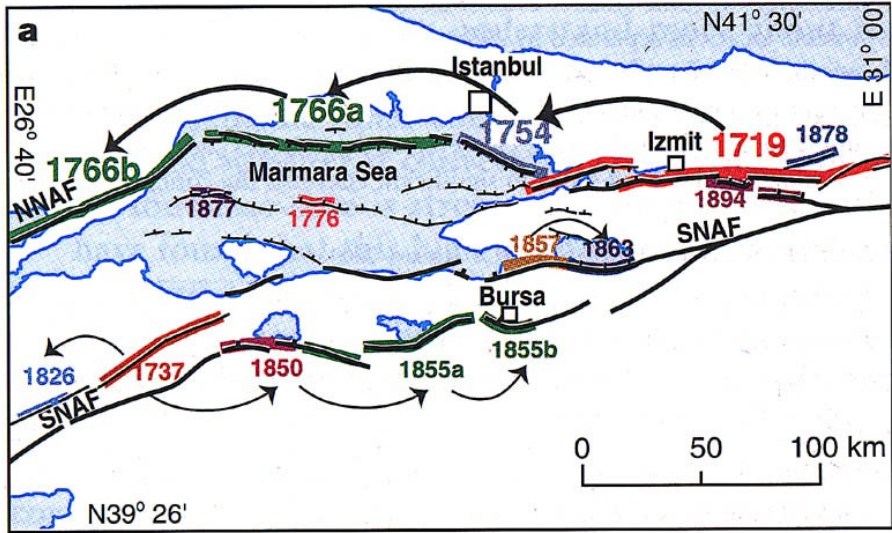
FAULT DATA



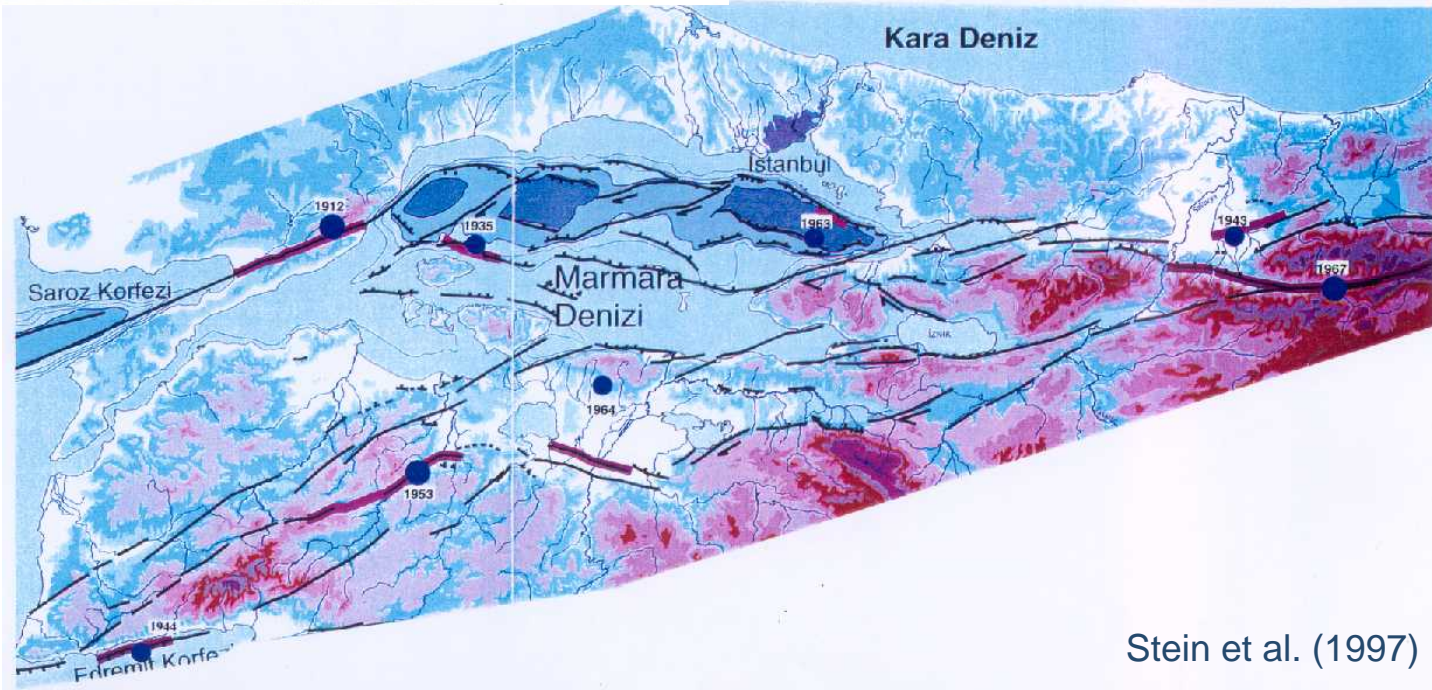
Fault Map of Marmara Sea

National Oil & Natural Gas Company of Turkey (TPAO), 1999

FAULT DATA

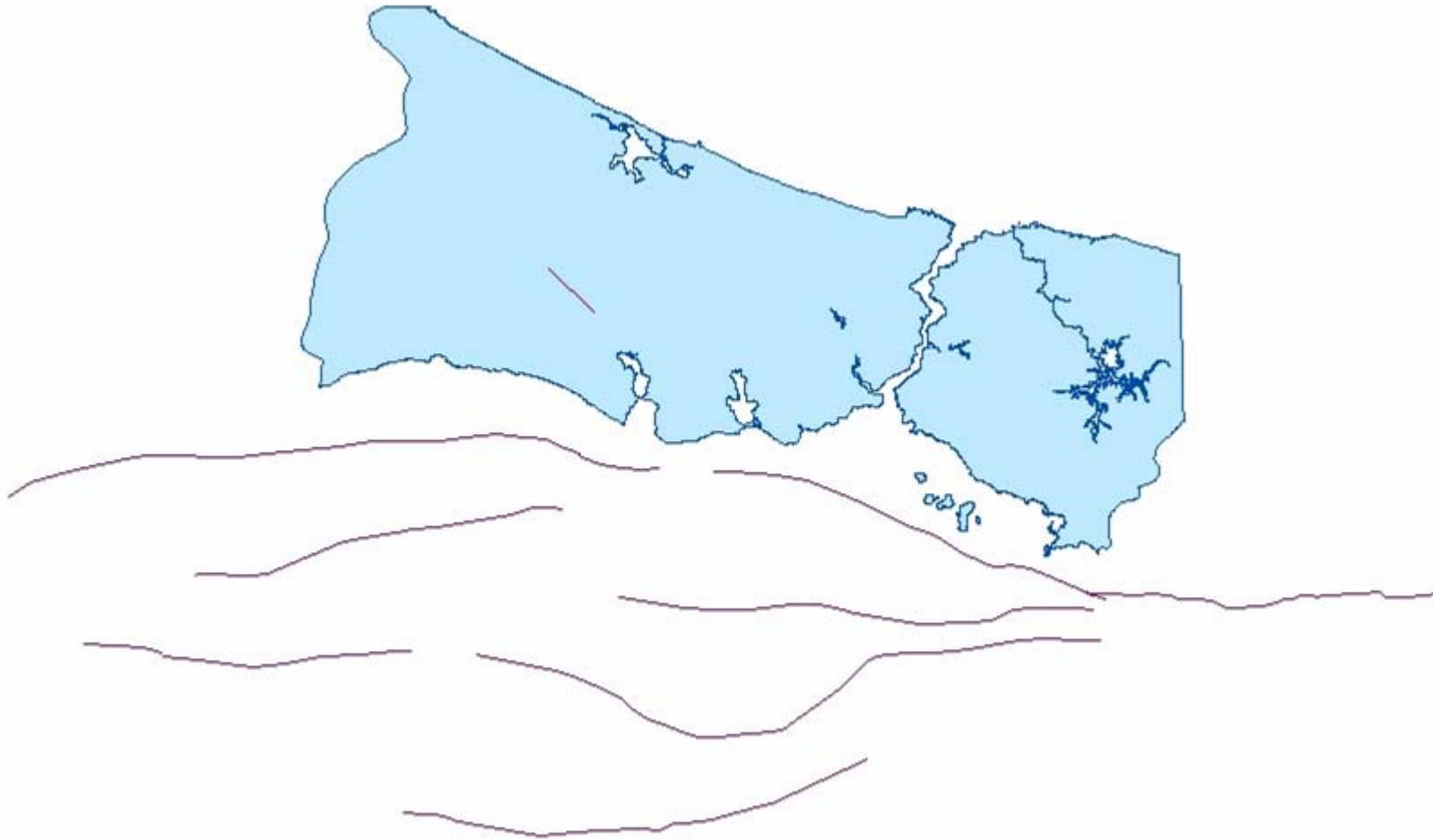


Hubert-Ferrari et al. (2000)

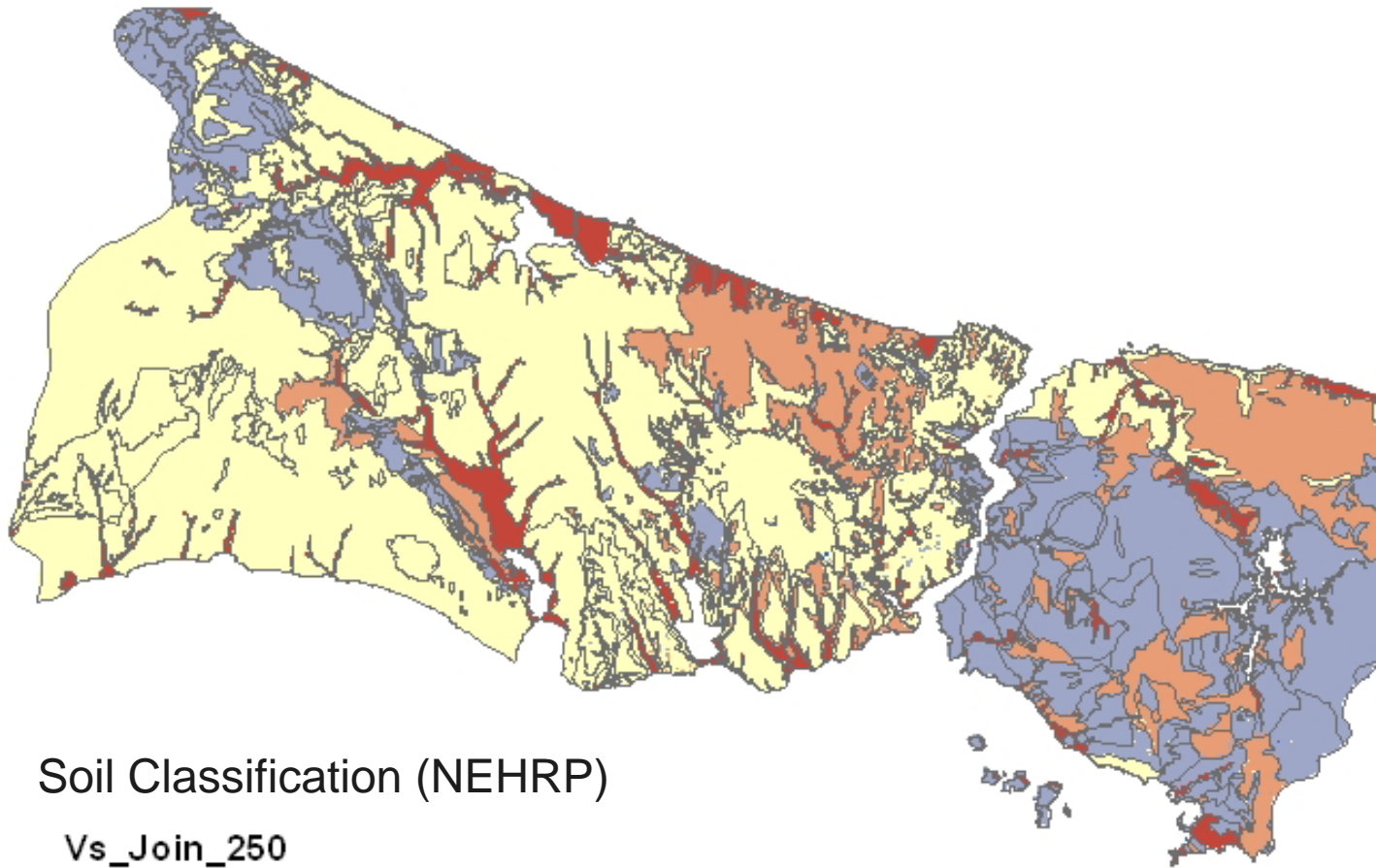


Stein et al. (1997)

FAULT DATA








GEOLOGICAL DATA

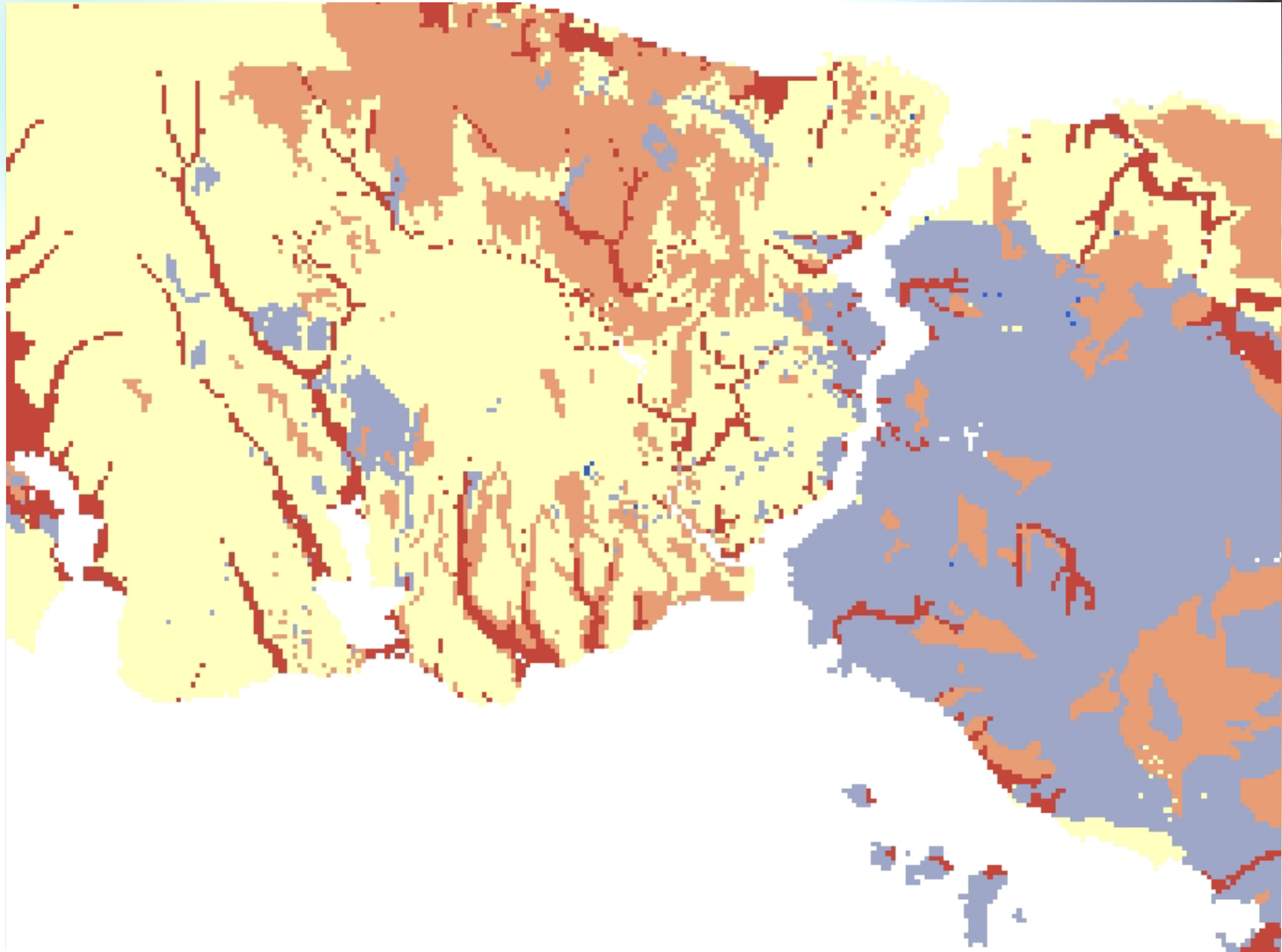


Soil Classification (NEHRP)

Vs_Join_250

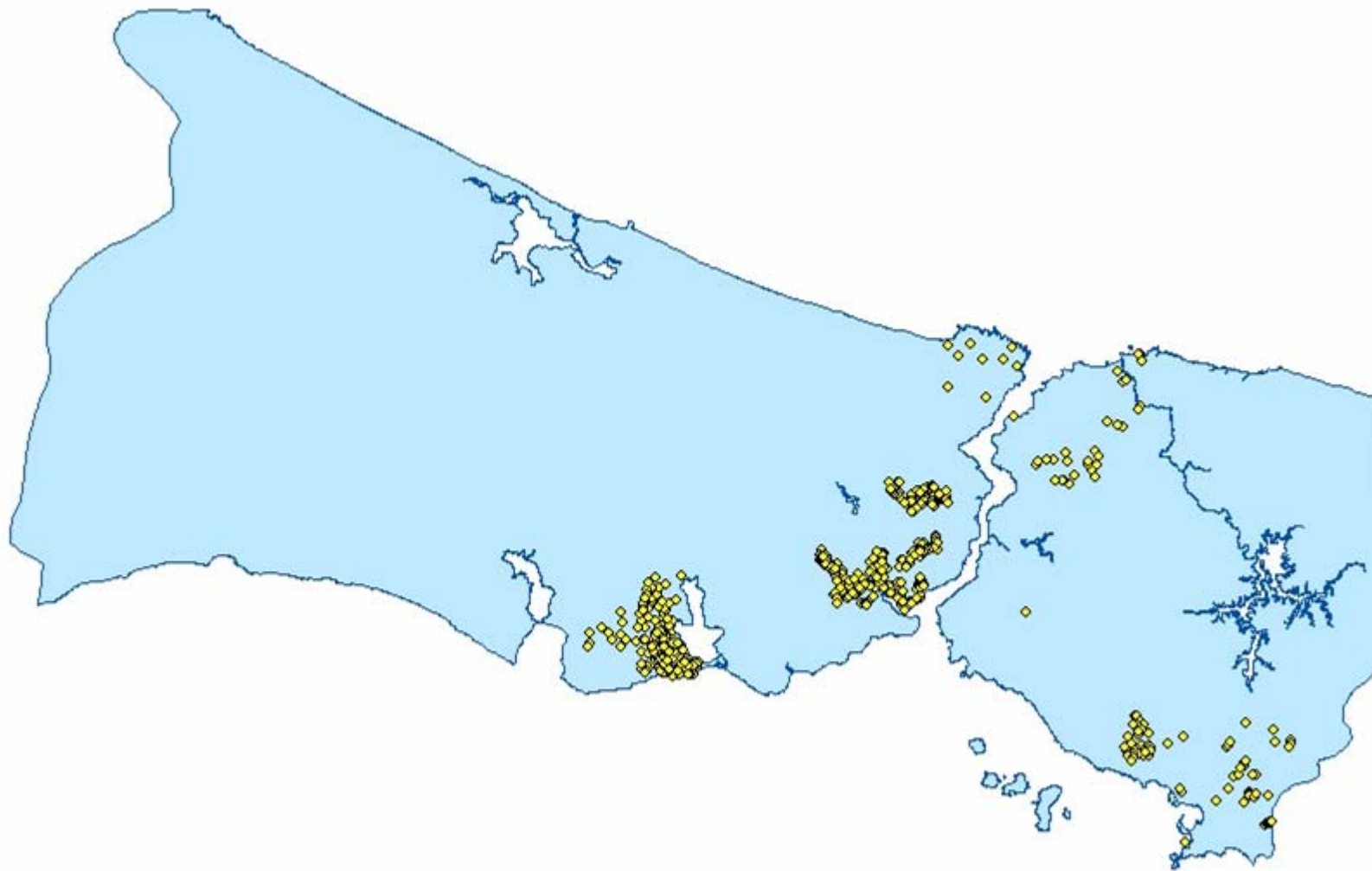
E		- 180
D		180,0000001 - 360
C		360,0000001 - 760
B		760,0000001 - 1.500
A		1.500,000001 -

GEOLOGICAL DATA



GEOLOGICAL DATA

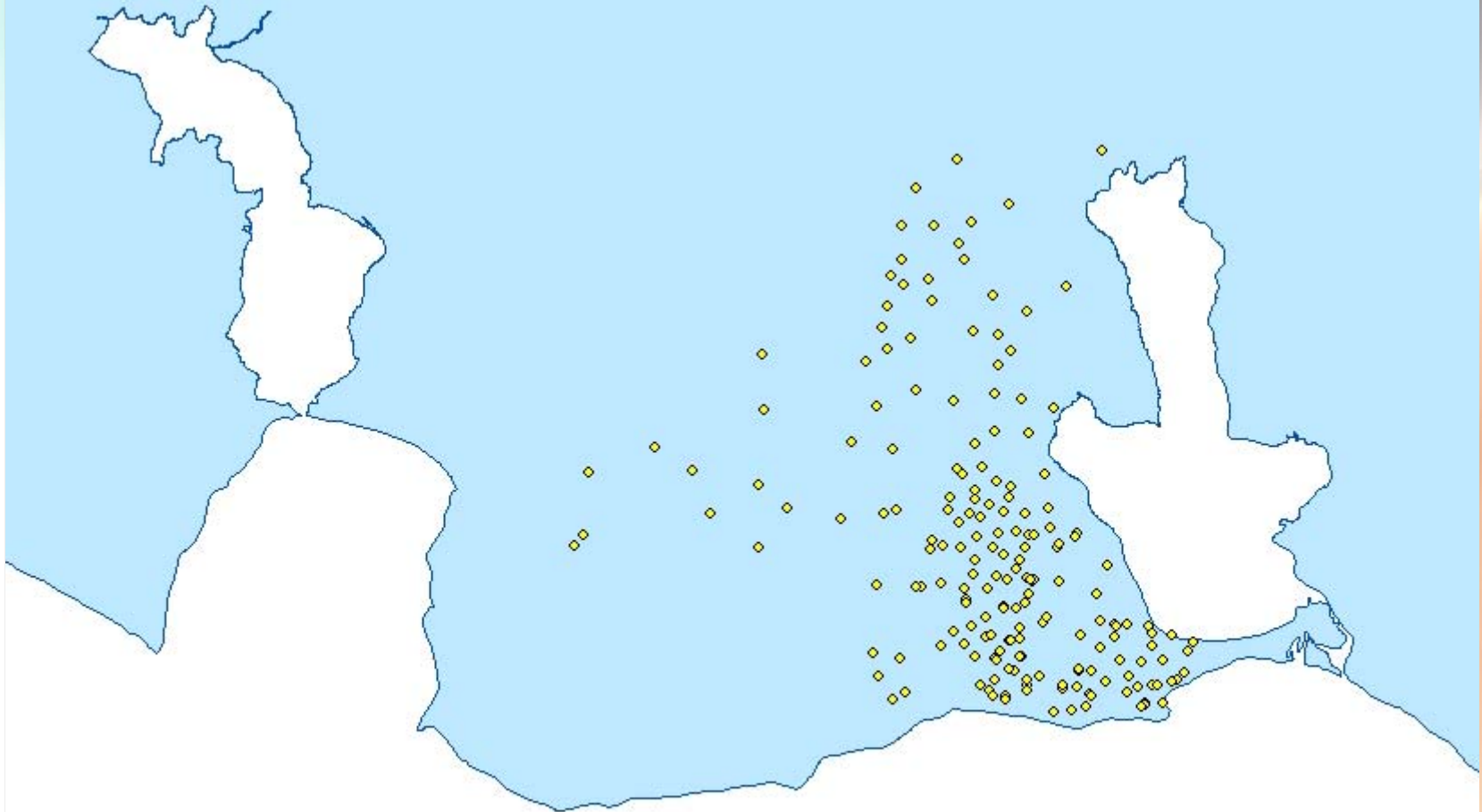
BOREHOLE LOCATIONS



JICA (2002)

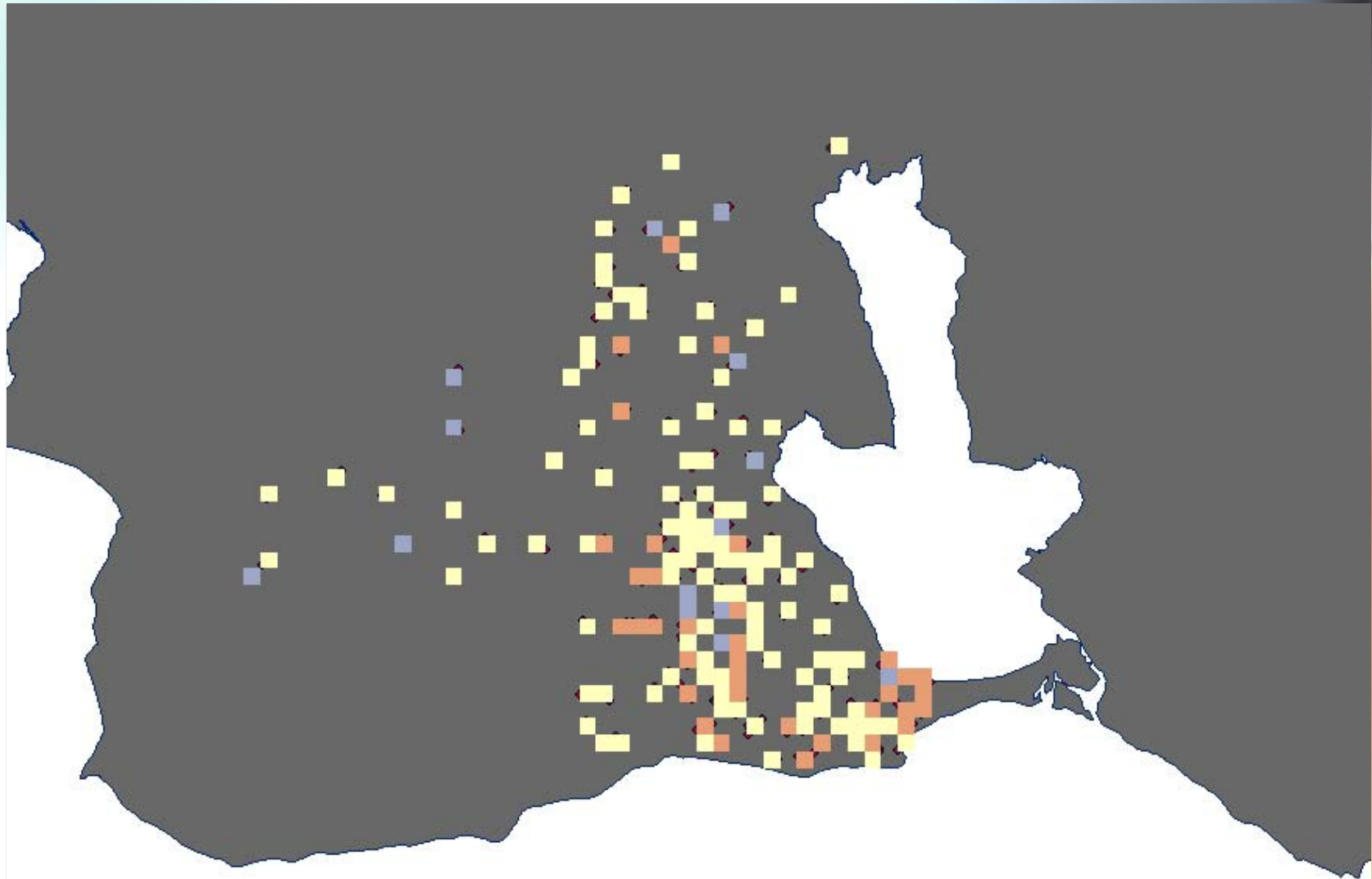
GEOLOGICAL DATA

BOREHOLE LOCATIONS

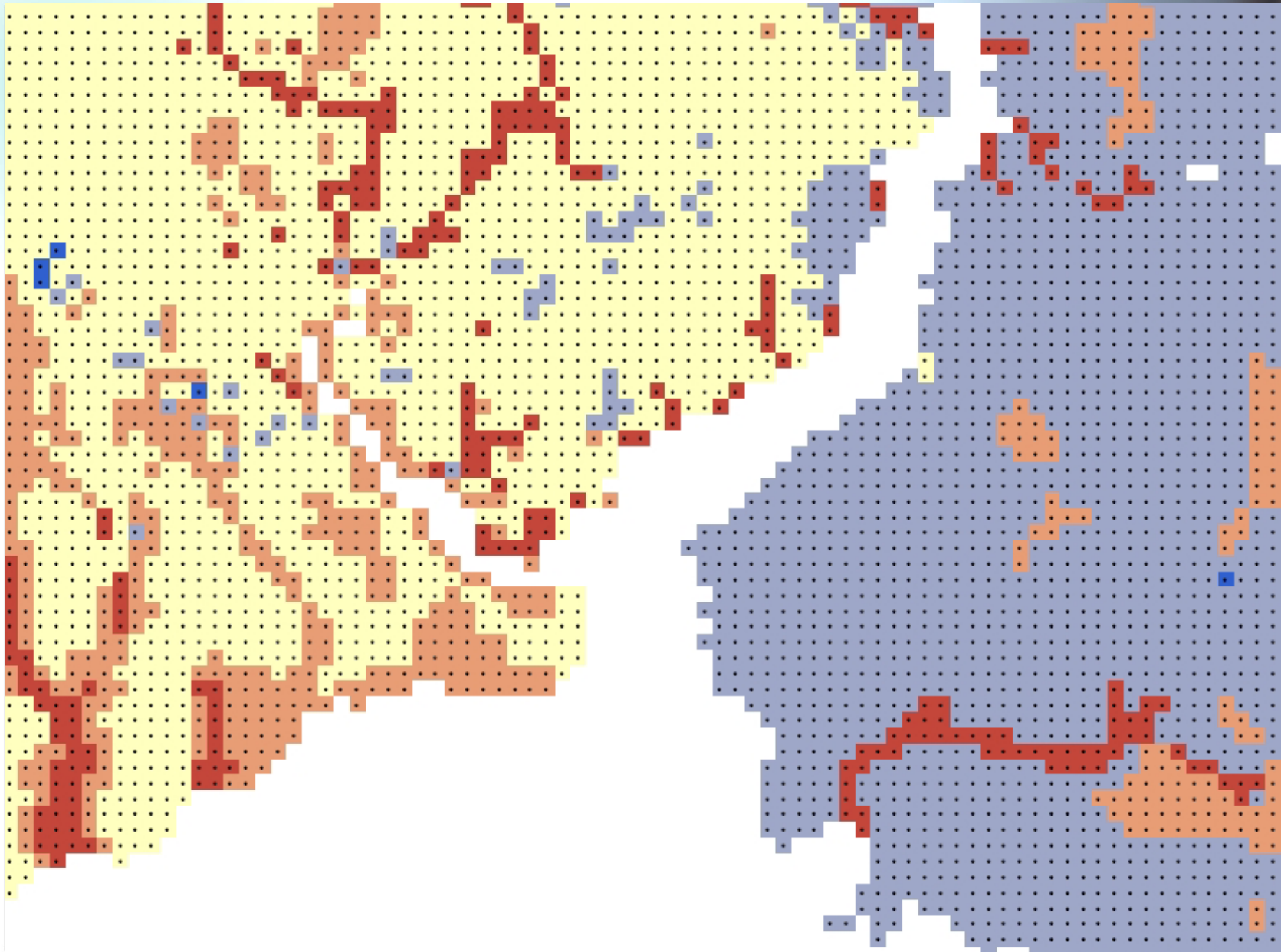


JICA (2002)

GEOLOGICAL DATA



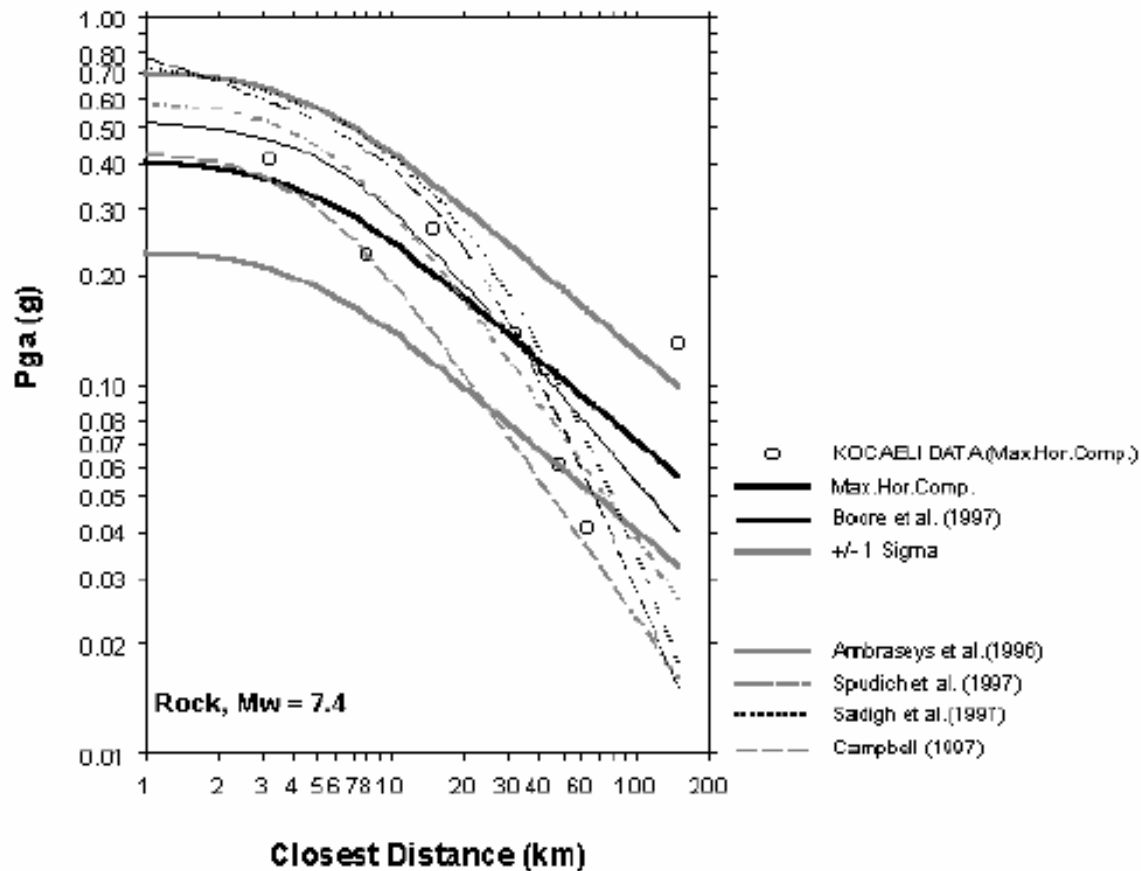
GEOLOGICAL DATA



ATTENUATION RELATIONS

Gülkan & Kalkan (2002)

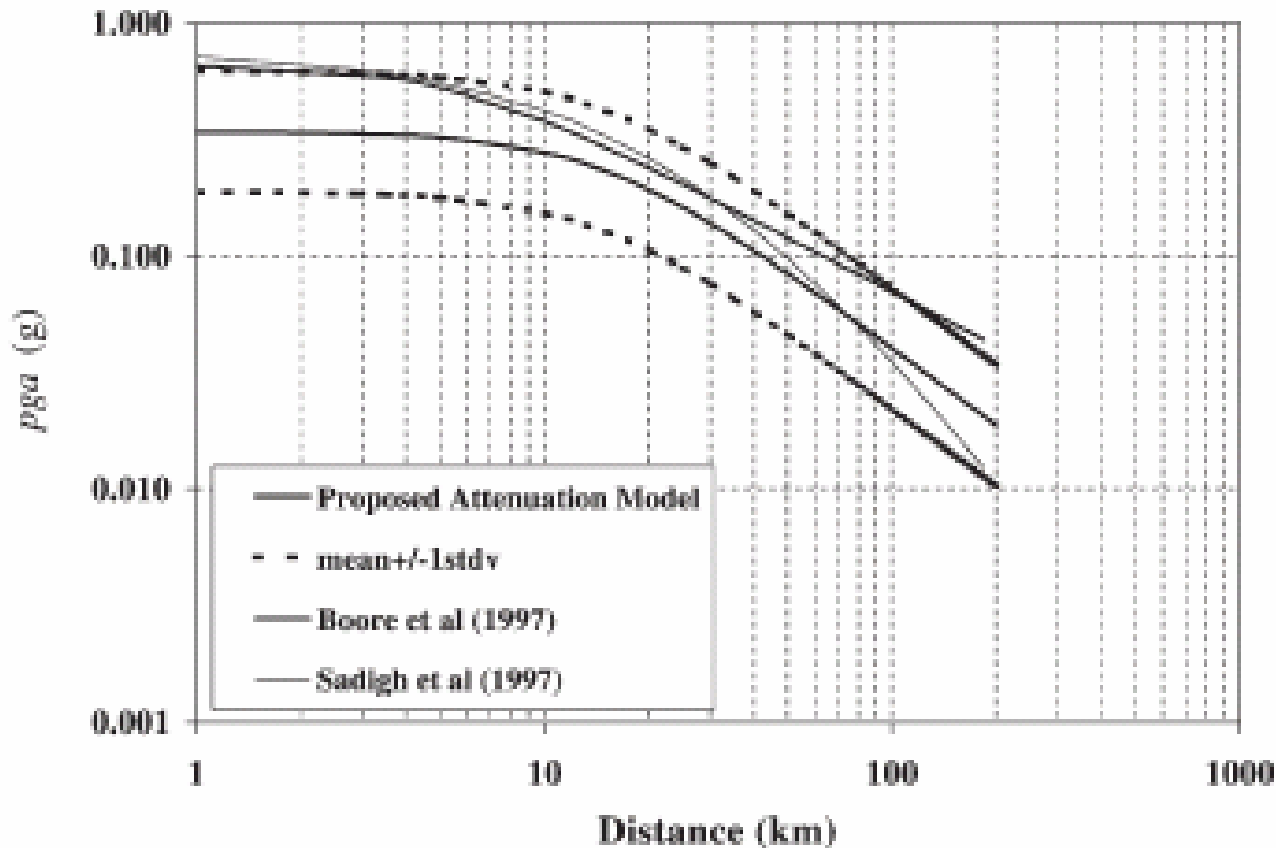
$$\ln(PGA) = -0.682 + 0.253(Mw - 6) + 0.036(Mw - 6)^2 - 0.562 \ln r - 0.297 \ln(VS/VA)$$
$$r = (rc^2 + d^2)^{1/2}$$



ATTENUATION RELATIONS

Ozbey et al. (2004)

$$\text{Log}(PGA) = 3.287 + 0.503(Mw - 6) - 0.079(Mw - 6)^2 - 1.1177 \log(r) + 0.141 G1 + 0.331 G2$$
$$r = (rc^2 + d^2)^{1/2}$$

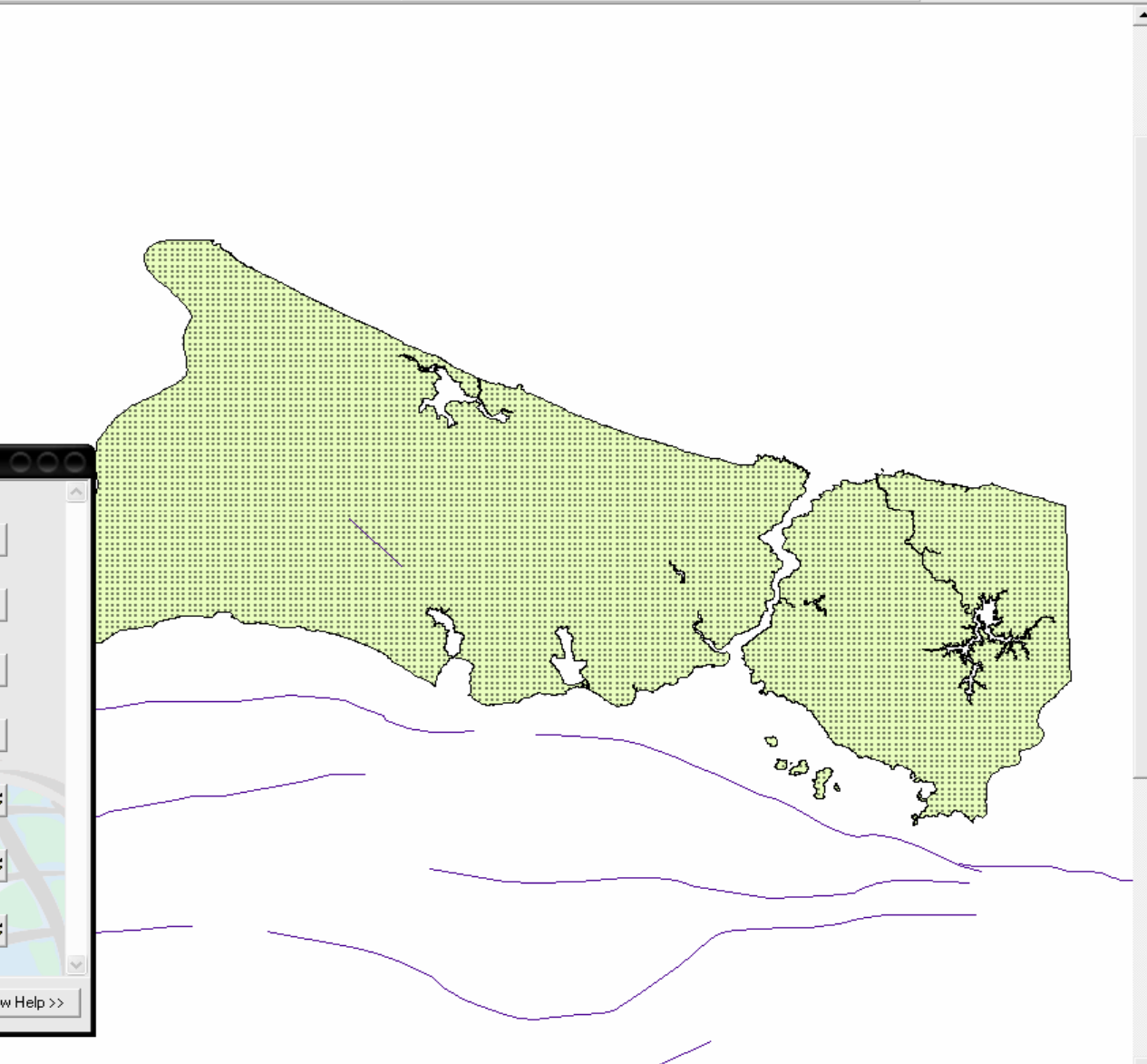


Layers

- Epicenter
- Point_Vs_Join_750
- Marmara_Fay
- Istanbul_Dissolve

ArcToolbox

- 3D Analyst Tools
- Analysis Tools
- Cartography Tools
- Conversion Tools
- Data Management Tools
- Geocoding Tools
- Geostatistical Analyst Tools
- I-REM
 - Attenuation
 - I-REM
 - Locate Point
 - zzzzzzzSelect_Fault
- Linear Referencing Tools
- Spatial Analyst Tools
- Spatial Statistics Tools
- Toolbox



Attenuation

Deprem Buyuklugu (Mw)
7.4

Deprem Derinligi (m)
6545

X Koordinati (UTM-35N)
662392

Y Koordinati (UTM-35N)
4524589

Buraya Kaydet
D:\=Docs=\=Y.L. Tez=\Veri\=004=\Model_Deneme_14.ly

Dagilim (Gulkan ve Kalkan, 2002)
D:\=Docs=\=Y.L. Tez=\Veri\=004=\vme_Model.mdb\Gul

Dagilim (Ozbey ve dig.,2004)
D:\=Docs=\=Y.L. Tez=\Veri\=004=\vme_Model.mdb\Oz

OK Cancel Environments... Show Help >>

Layers

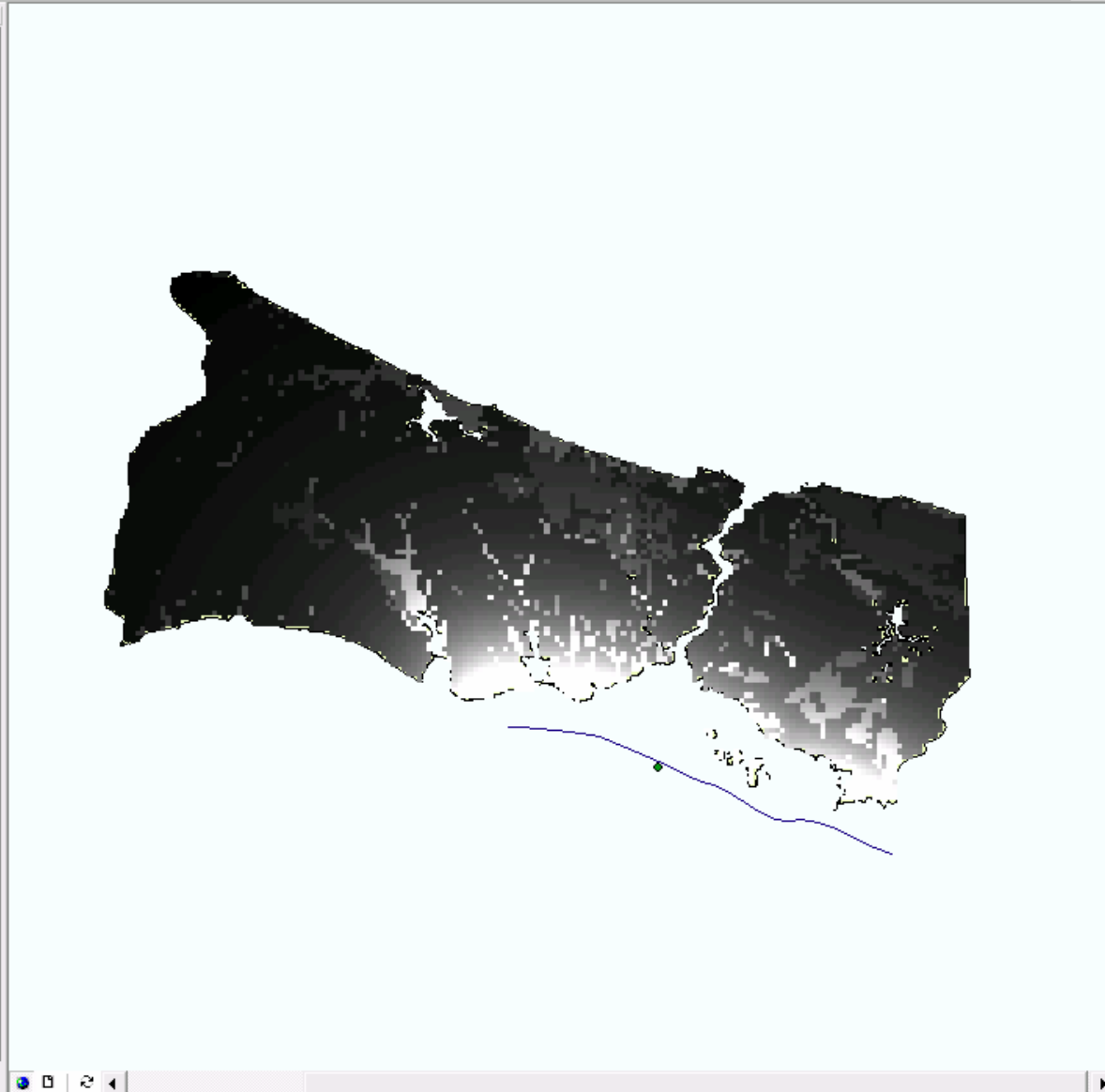
- Ozbey_Raster_Deneme_14
Value
High : 1,38461
Low : 0,0508438
- Gulkan_Raster_Deneme_14
Value
High : 0,451393
Low : 0,0677875
- Epicenter
◆
- Point_Vs_Join_750
.
- Marmara Fay
—
- Istanbul_Dissolve
■

Display Source Selection

ArcToolbox

- 3D Analyst Tools
- Analysis Tools
- Cartography Tools
- Conversion Tools
- Data Management Tools
- Geocoding Tools
- Geostatistical Analyst Tools
- I-REM
 - Attenuation
 - I-REM
 - Locate Point
 - zzzzzzzzSelect_Fault
- Linear Referencing Tools
- Spatial Analyst Tools
- Spatial Statistics Tools
- Toolbox

Favorites Index Search



Ground Acceleration Distribution Map (Gülkan & Kalkan, 2002)

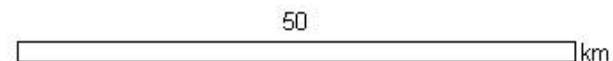
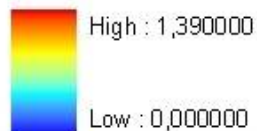


Mw = 7.4
Derinlik = 6545 m

PGA Values (x9.81 m/s)

Gulkan_Raster_Dene_09

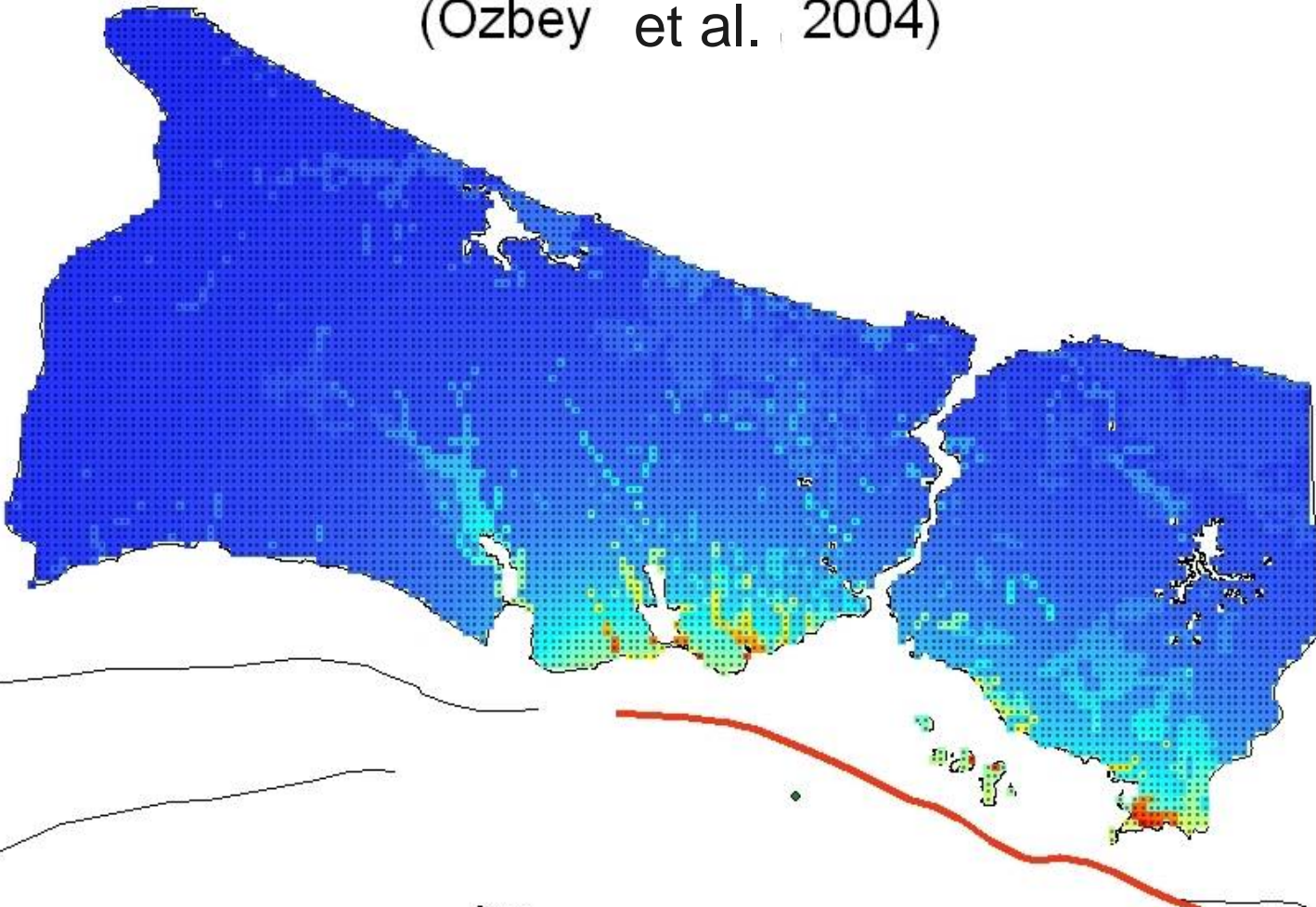
Value



Ground Acceleration Distribution Map (Ozbey et al. 2004)

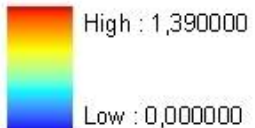


Mw = 7.4
Derinlik = 6545 m

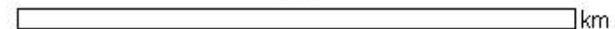


PGA Values (x9.81 m/s)

Ozbey_Raster_Dene_09
Value



50



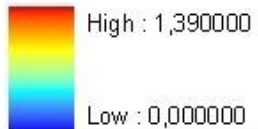
Ground Acceleration Distribution Map Gülkan & Kalkan (2002) - Ozbey ve diğ. (2004) Karşılaştırması



Mw = 7.4
Derinlik = 6545 m

PGA Values (x9.81 m/s)

PGA_MAX
Value



50

km

CONCLUSION

REFERENCES

- **Sahin et al.;** Turkey Disaster Information System: A Case Study For Istanbul, 2006.
- **Schneider & Schauer;** An Earthquake Risk Assessment Tool For Turkey, 2005.
- **Hubert-Ferrari et al.;** Seismic Hazard In The Marmara Sea Region Following the 17 August 1999 Izmit Earthquake, 2000.
- **Stein et al.;** Progressive Failure on the North Anatolian Fault Since 1939 By Earthquake Stress Triggering, 1997.
- **Gulkan & Kalkan;** Attenuation Modeling of Recent Earthquakes in Turkey, 2002.
- **Ozbey et. al.;** An Empirical Attenuation Relationship for Northwestern Turkey Ground Motion Using a Random Effects Approach, 2004.
- **JICA & IMM;** The Study On a Disaster Prevention / Mitigation Basic Plan In Istanbul Including Microzonation In The Republic Of Turkey, 2002.