



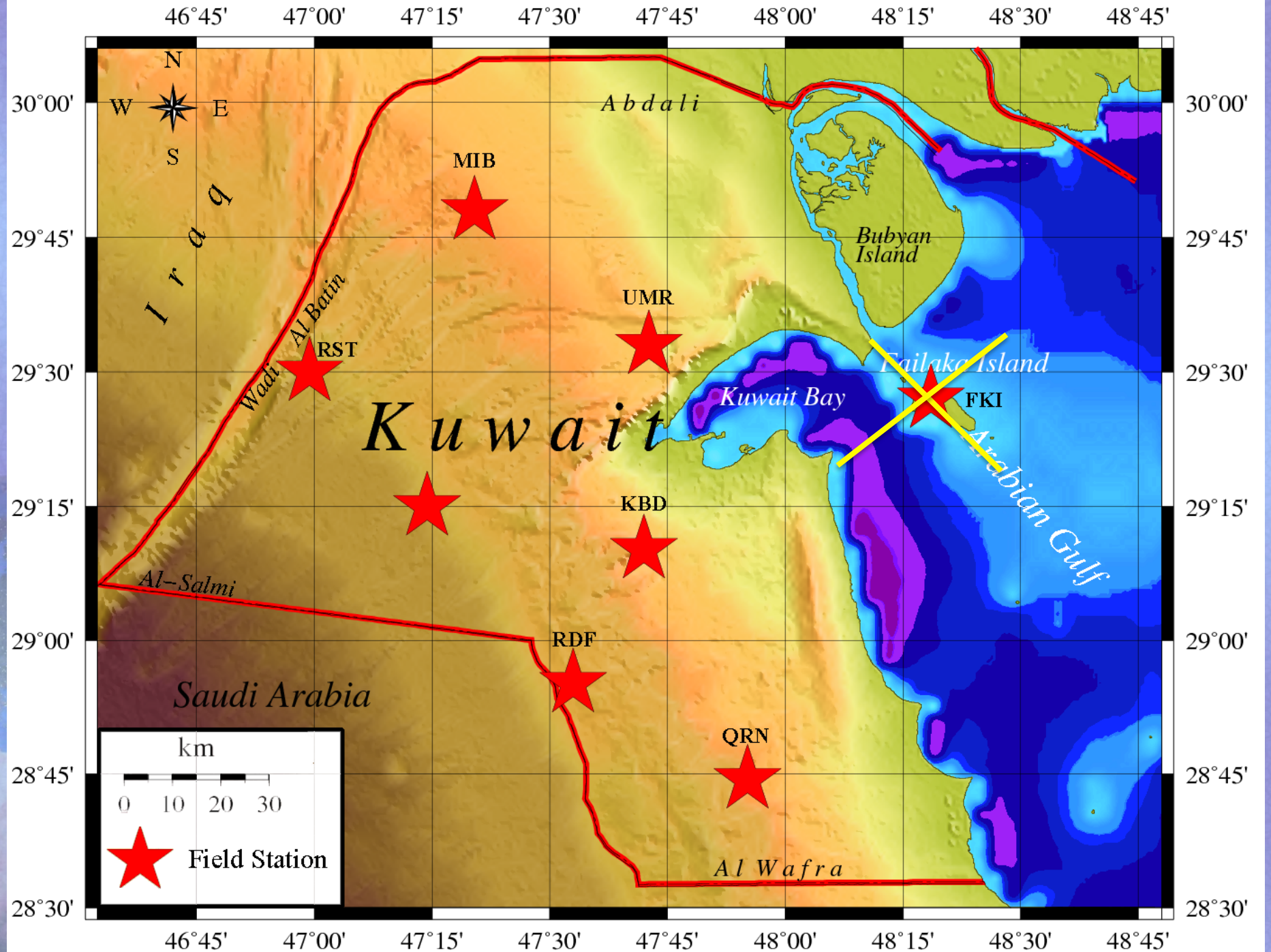
The Advancements and Future Applications of the Kuwait National Seismic Network

By

R. Abdel-Fattah, A. Al-Enezi, and F. Al-Jeri

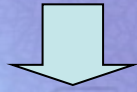
Kuwait Institute for Scientific Research (KISR)





Field Station View →

KNSN analytical Center





KNSN Real Time System Configuration

Radio



RefTek 72A



Server



Client 1



Client 2

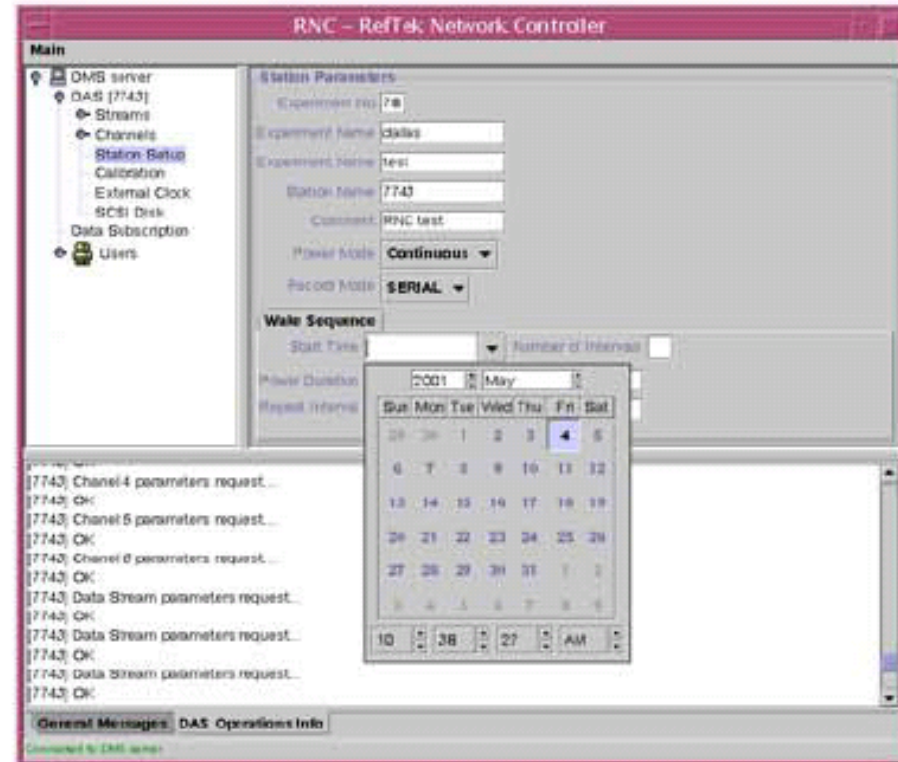
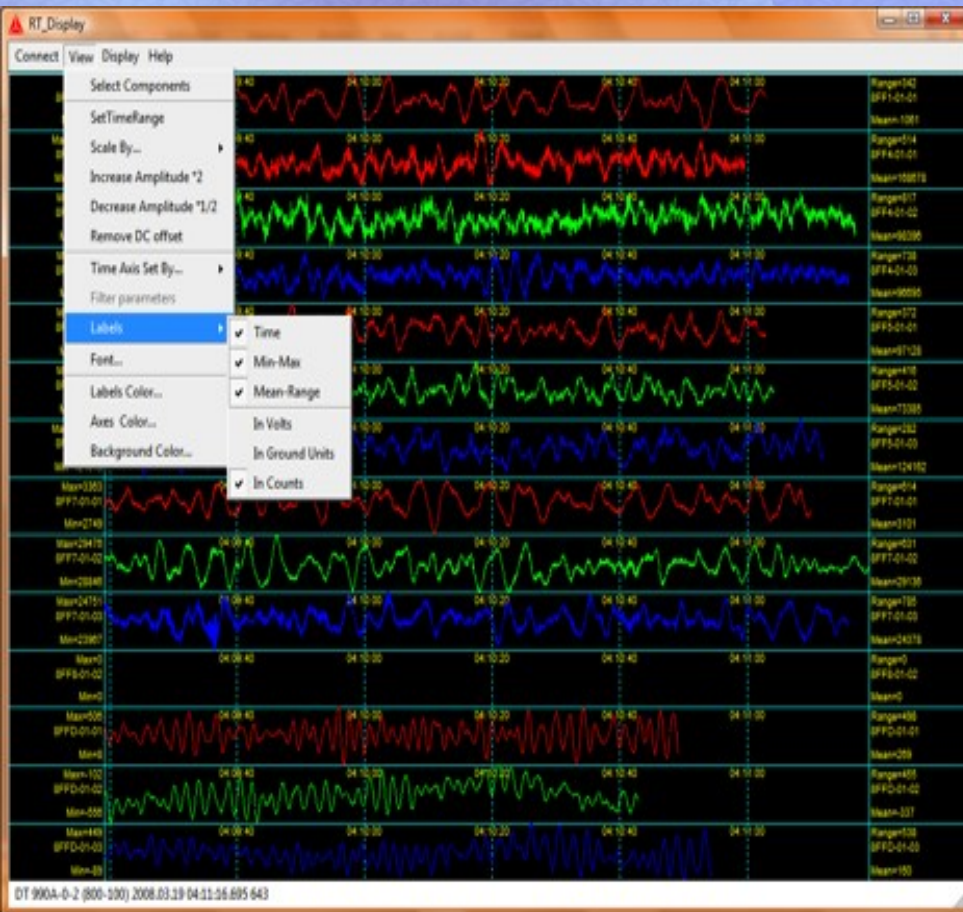
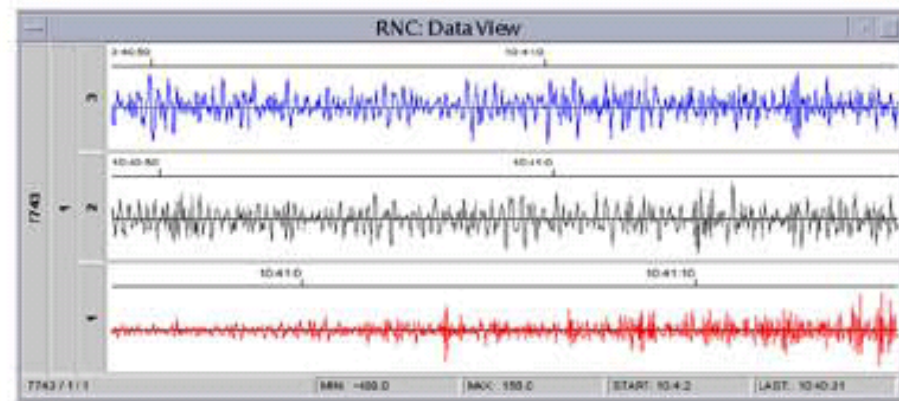


Client 3



Real-Time Display and Field Stations Control

RT_Display



KNSN Real Time System Configuration

Radio



RefTek 72A



Server



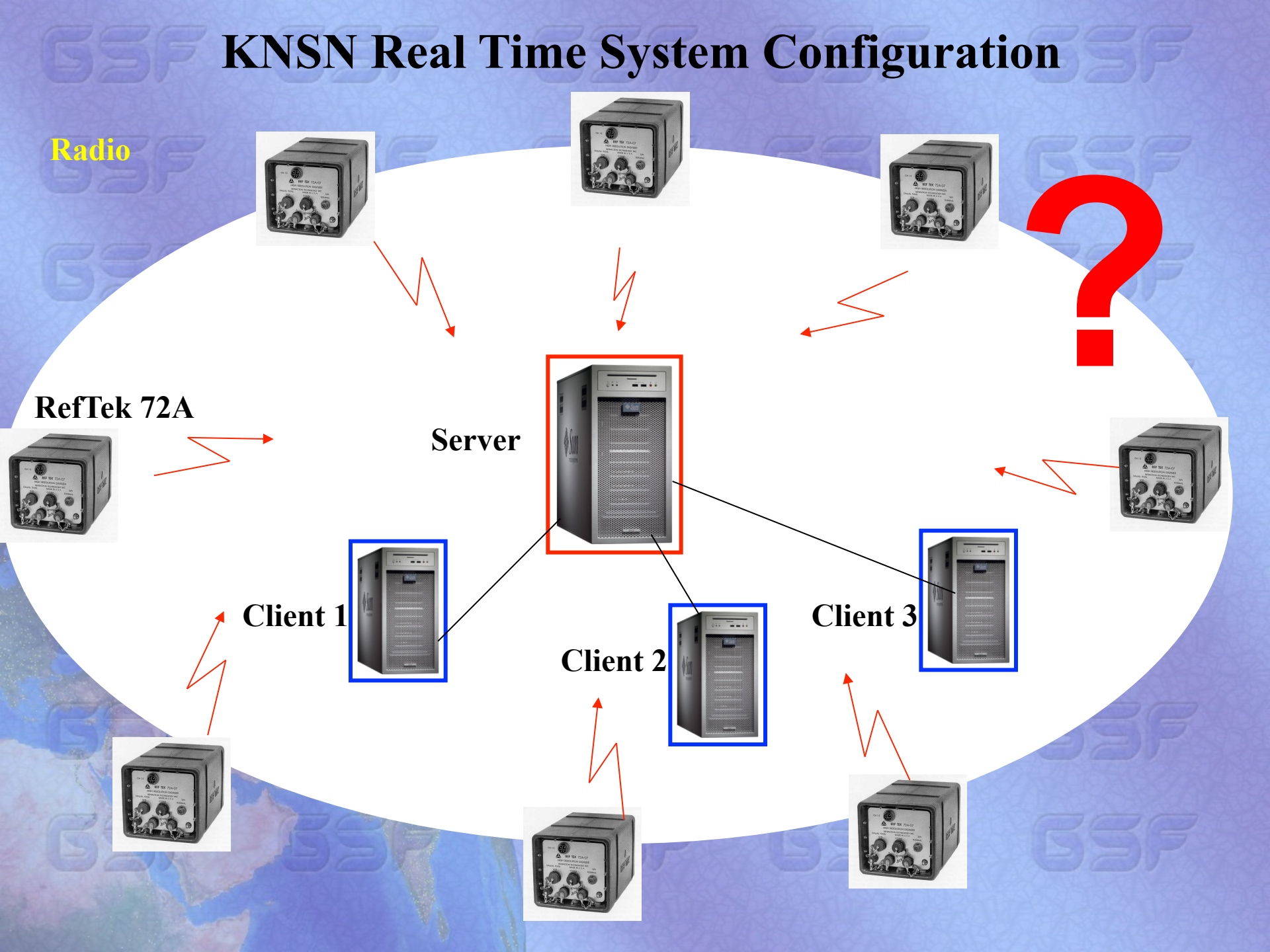
Client 1



Client 2



Client 3



Problems

- **The communication failed many times,**
- **Many data packages produced timing errors**
- **Some stations were not functioning** (Electronics Parts).
- **Database and data Storage.**





KNSN Real Time System Configuration

Open VPN
(3G/EDGE/GPRS, VPN)

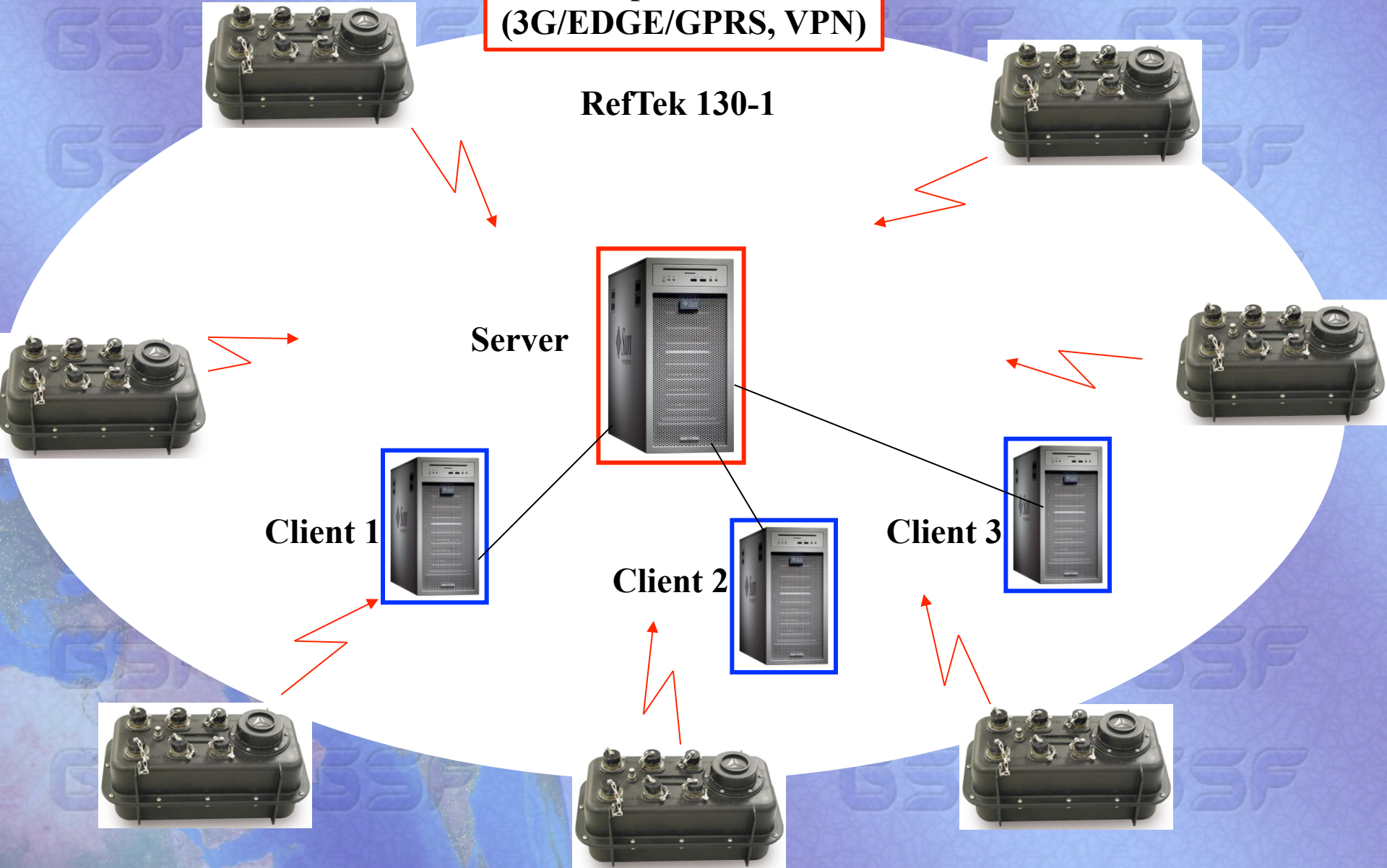
RefTek 130-1

Server

Client 1

Client 2

Client 3



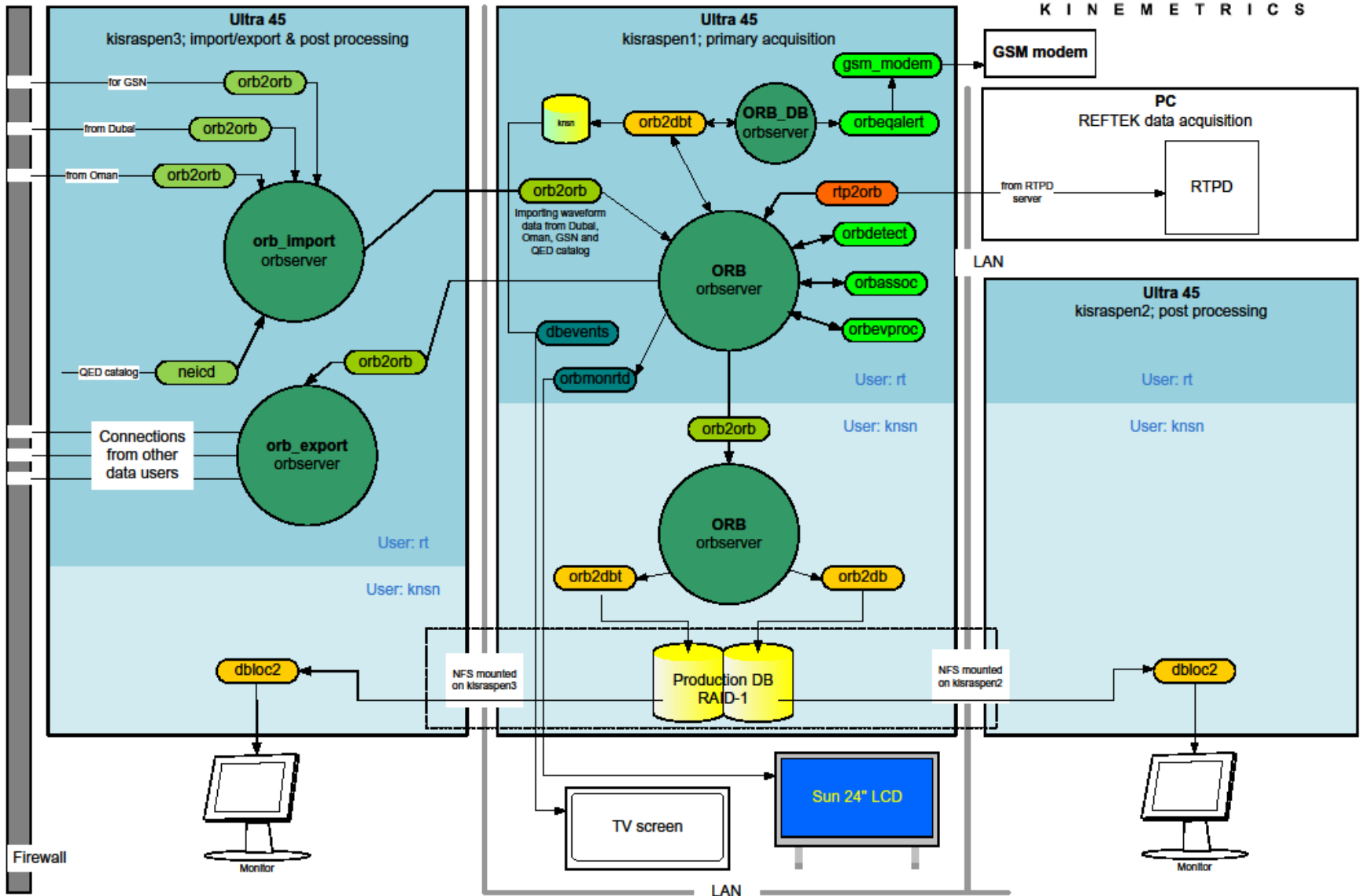
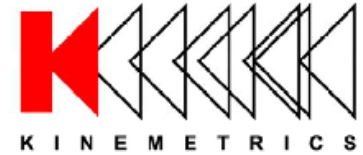
Portable Station

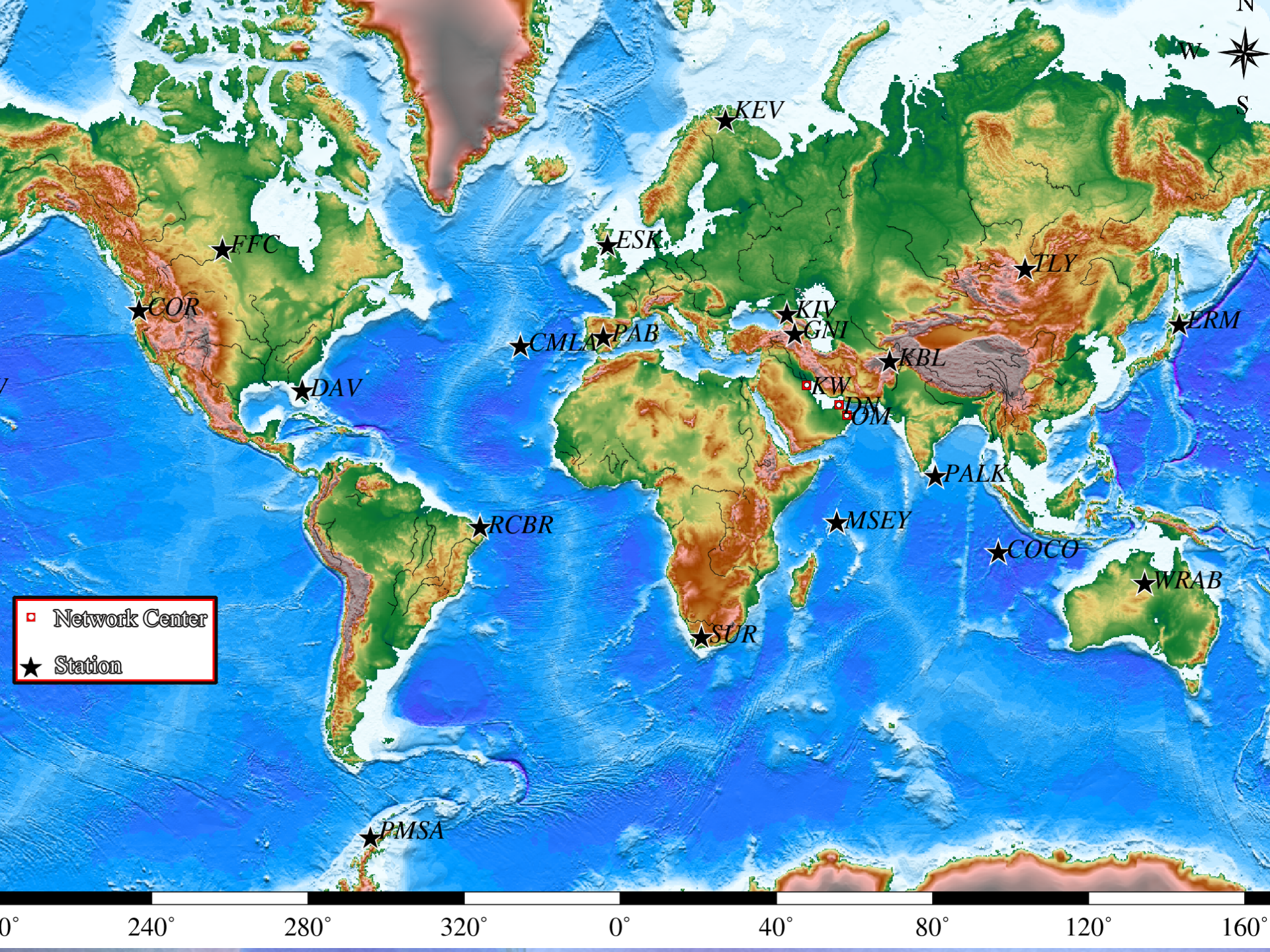
QUANTERRA



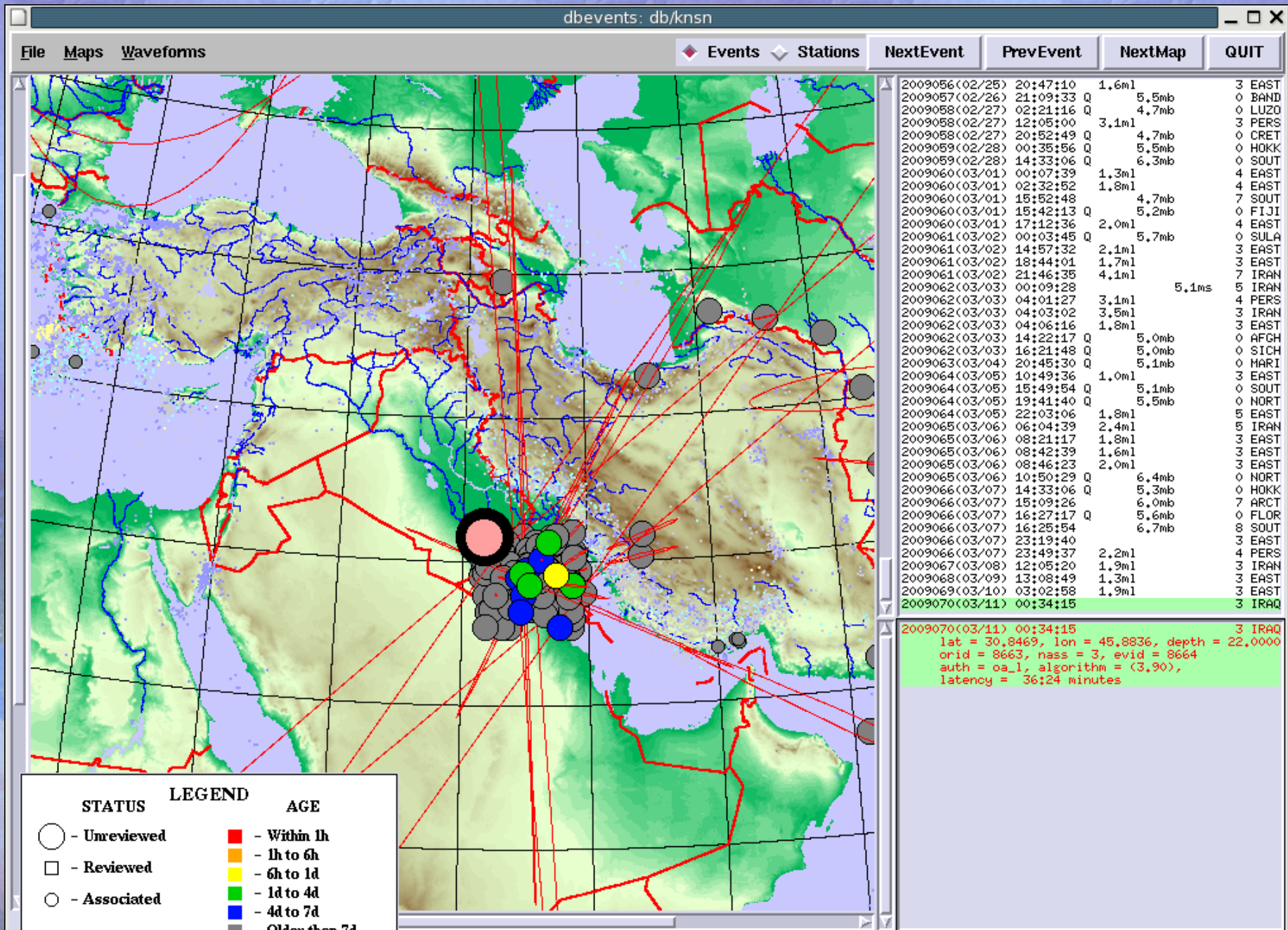
Antelope Installation for KISR

System drawing, N/C





Before

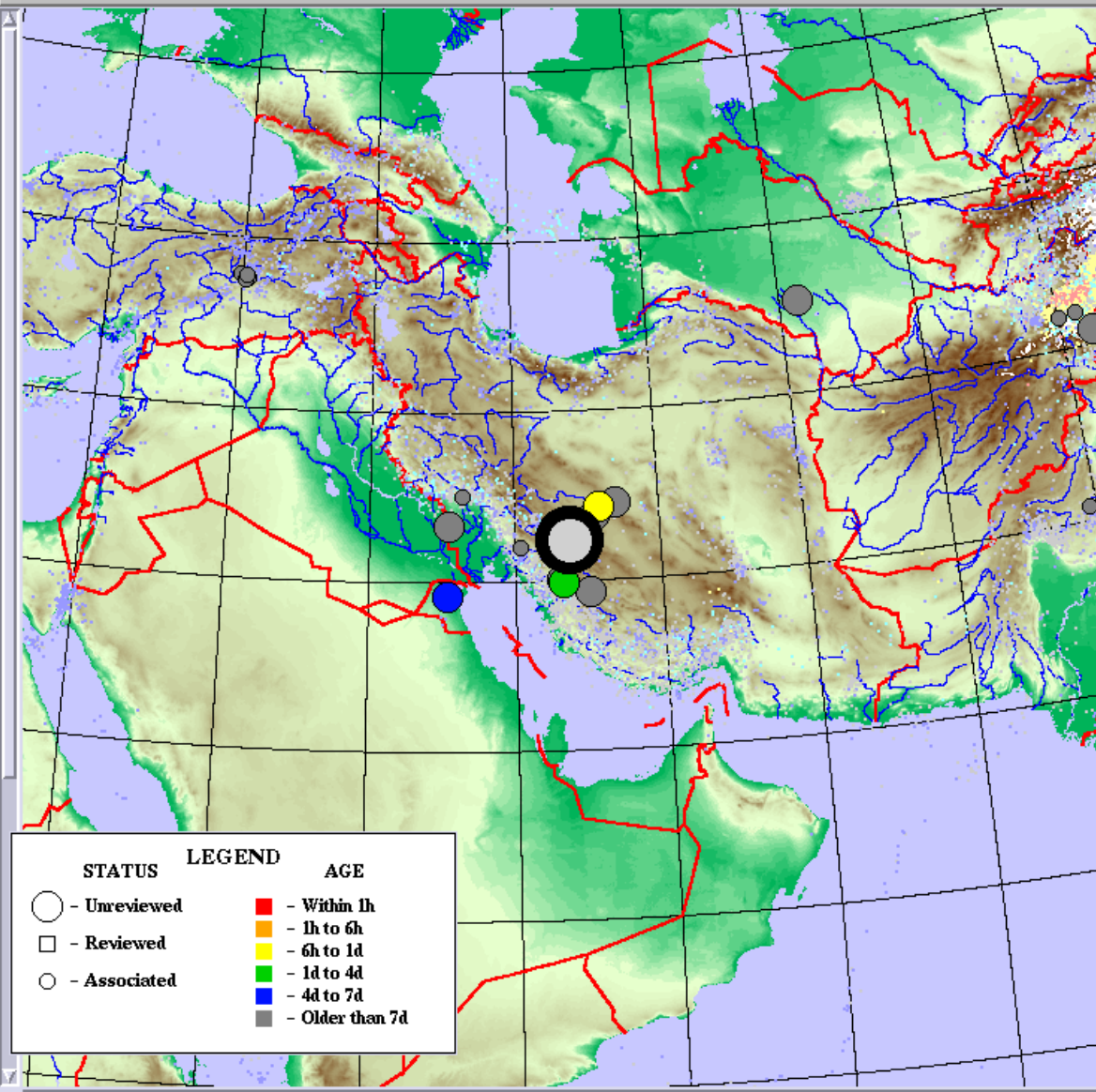


Now

dbevents: db/knsn

File Maps Waveforms

Events Stations NextEvent PrevEvent NextMap QUIT



| ID | Time | Mag | Location |
|----------------|------------|-------|-----------------------------|
| 2010047(02/16) | 19:59:31 Q | 5.0mb | 0 NEAR S. COAST OF HONSHU, |
| 2010048(02/17) | 02:52:41 Q | 5.1mb | 0 SOUTH OF HONSHU, JAPAN |
| 2010048(02/17) | 19:52:56 | | 8 TURKEY |
| 2010049(02/18) | 01:13:17 Q | 6.7mb | 0 E. USSR-N.E. CHINA BORDE |
| 2010049(02/18) | 21:08:15 Q | 4.8mb | 0 IRAN |
| 2010049(02/18) | 21:07:54 | | 8 IRAN |
| 2010049(02/18) | 23:49:44 Q | 5.1mb | 0 KURIL ISLANDS |
| 2010050(02/19) | 02:15:23 Q | 5.0mb | 0 ANDAMAN ISLANDS REGION |
| 2010051(02/20) | 07:46:51 | | 8 TURKMEN SSR |
| 2010051(02/20) | 09:22:46 | | 7 SULAWESI |
| 2010051(02/20) | 09:33:15 | | 7 IRAN |
| 2010051(02/20) | 21:07:27 Q | 4.7mb | 0 BURMA-INDIA BORDER REGION |
| 2010052(02/21) | 00:56:58 Q | 4.9mb | 0 NEAR EAST COAST OF HONSH |
| 2010052(02/21) | 07:29:08 Q | 4.5mb | 0 E. USSR-N.E. CHINA BORDE |
| 2010053(02/22) | 01:03:37 Q | 4.5mb | 0 PAKISTAN |
| 2010053(02/22) | 01:51:38 Q | 4.7mb | 0 HINDU KUSH REGION |
| 2010053(02/22) | 05:21:04 Q | 5.4mb | 0 TAIWAN REGION |
| 2010053(02/22) | 16:55:02 Q | 4.9mb | 0 JAN HAYEN ISLAND REGION |
| 2010054(02/23) | 07:28:04 Q | 4.5mb | 0 WESTERN IRAN |
| 2010054(02/23) | 10:43:10 Q | 5.3mb | 0 KURIL ISLANDS |
| 2010056(02/25) | 03:51:49 Q | 4.8mb | 0 ANDAMAN ISLANDS REGION |
| 2010056(02/25) | 15:41:37 | | 5 SOUTHERN IRAN |
| 2010057(02/26) | 20:31:26 | | 16 RYUKYU ISLANDS |
| 2010057(02/26) | 01:14:25 | | 6 PAKISTAN |
| 2010058(02/27) | 19:54:29 Q | 5.4mb | 0 NORTH ATLANTIC RIDGE |
| 2010058(02/27) | 23:14:29 | | 6 NORTHWEST AFRICA |
| 2010058(02/27) | 23:21:13 Q | 5.7mb | 0 HINDU KUSH REGION |
| 2010059(02/28) | 01:20:35 Q | 5.3mb | 0 RYUKYU ISLANDS |
| 2010059(02/28) | 03:33:49 Q | 5.2mb | 0 RYUKYU ISLANDS |
| 2010059(02/28) | 08:17:49 Q | 5.4mb | 0 OFF EAST COAST OF HONSHU |
| 2010059(02/28) | 11:25:35 Q | 6.2mb | 0 CHILE-ARGENTINA BORDER R |
| 2010059(02/28) | 11:25:34 Q | 6.1mb | 0 NEAR COAST OF CENTRAL CH |
| 2010059(02/28) | 12:13:27 Q | 5.1mb | 0 NORTHERN SUMATERA |
| 2010059(02/28) | 22:07:47 Q | 5.1mb | 0 HONSHU, JAPAN |
| 2010061(03/02) | 01:55:39 Q | 5.0mb | 0 ALMA-ATA REGION |
| 2010061(03/02) | 02:51:23 Q | 5.8mb | 0 LUZON, PHILIPPINE ISLAND |
| 2010061(03/02) | 09:35:19 Q | 4.8mb | 0 RYUKYU ISLANDS |
| 2010061(03/02) | 22:18:42 Q | 5.2mb | 0 TALAUD ISLANDS |
| 2010061(03/02) | 23:42:01 Q | 4.7mb | 0 TALAUD ISLANDS |
| 2010062(03/03) | 11:13:57 Q | 5.0mb | 0 TALAUD ISLANDS |
| 2010062(03/03) | 22:54:12 Q | 4.7mb | 0 TALAUD ISLANDS |
| 2010063(03/04) | 00:18:53 Q | 6.4mb | 0 TAIWAN |
| 2010063(03/04) | 14:16:27 | | 8 LIBYA |
| 2010063(03/04) | 20:22:25 | | 5 IRAN-IRAQ BORDER REGION |
| 2010063(03/04) | 22:09:46 | | 7 IRAN |
| 2010063(03/04) | 22:39:25 Q | 6.3mb | 0 NORTHERN CHILE |
| 2010063(03/04) | 22:54:41 | | 7 IRAN |
| 2010064(03/05) | 01:43:43 Q | 4.9mb | 0 PHILIPPINE ISLANDS REGIO |
| 2010064(03/05) | 16:07:04 Q | 5.0mb | 0 SOUTHERN SUMATERA |

2010049(02/18) 21:07:54 8 IRAN
 lat = 31.1766, lon = 51.9023, depth = 0.0247
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 latency = 4:28 minutes

STATUS LEGEND AGE

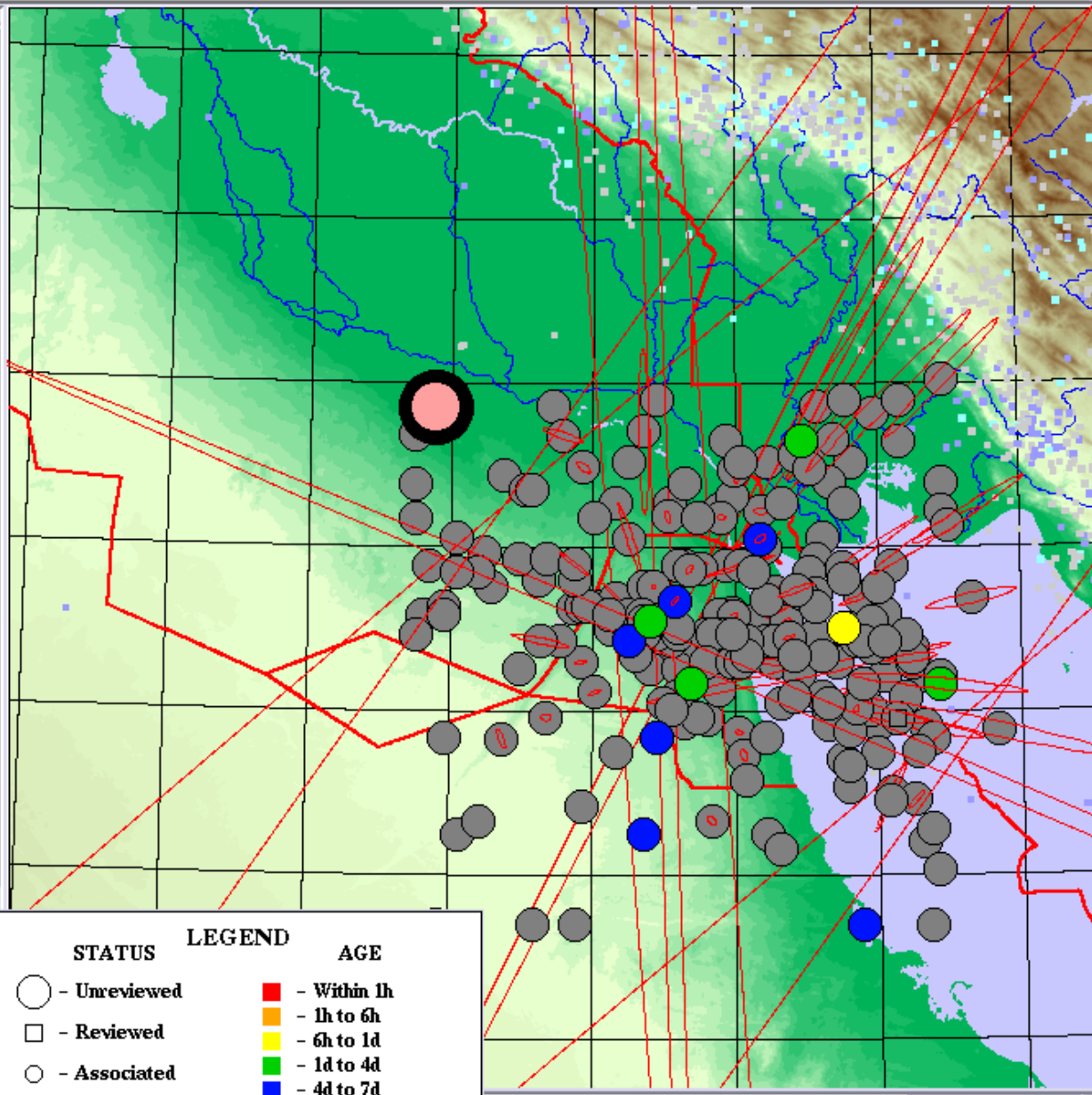
- - Unreviewed
- - Reviewed
- - Associated
- - Within 1h
- - 1h to 6h
- - 6h to 1d
- - 1d to 4d
- - 4d to 7d
- - Older than 7d

Before

dbevents: db/knsn

File Maps Waveforms

Events Stations NextEvent PrevEvent NextMap QUIT



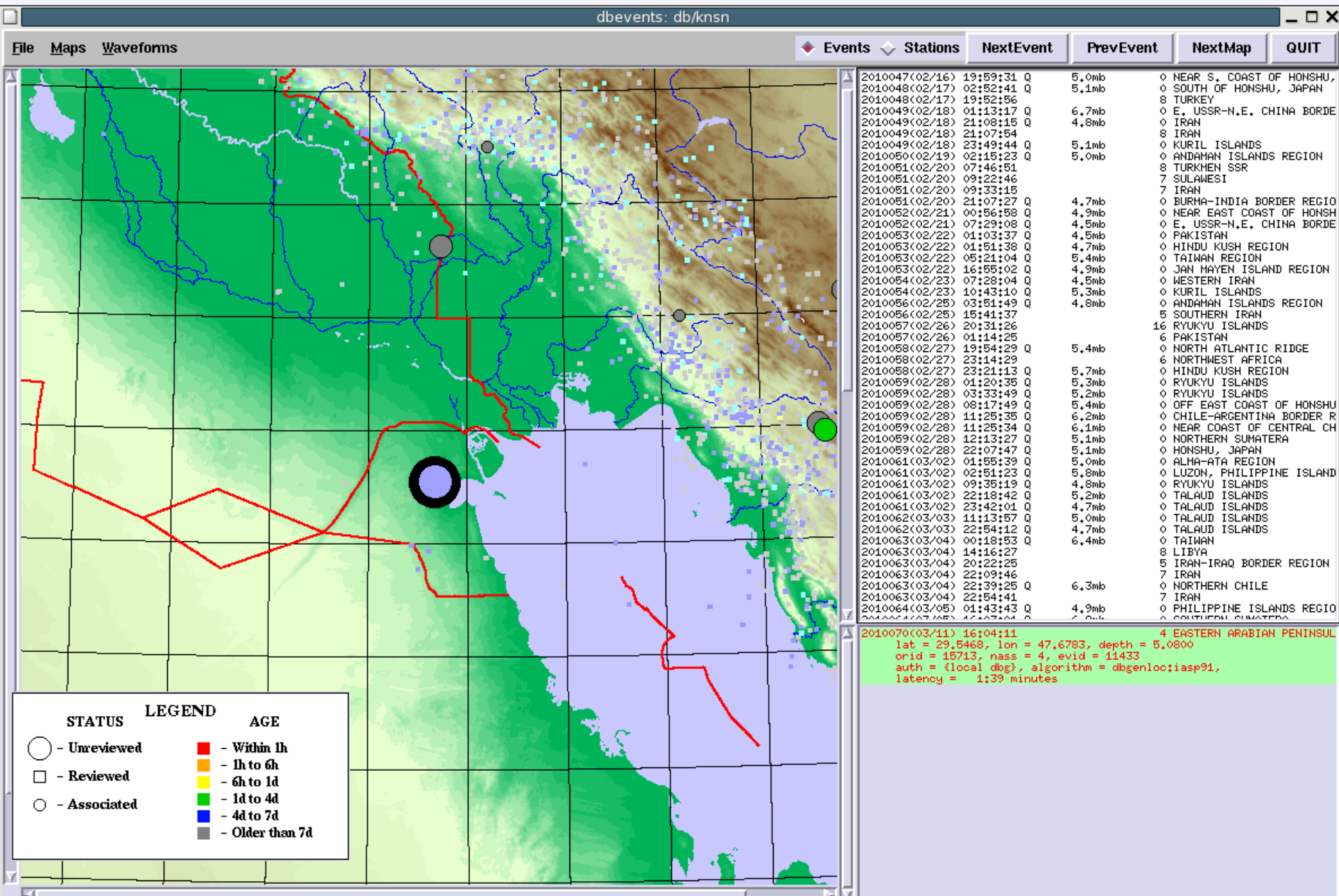
| | | | | | |
|----------------|----------|---------|-------|------|------|
| 2009056(02/25) | 20:47:10 | 1.6m1 | 3 | EAST | |
| 2009057(02/26) | 21:09:33 | Q 5.5mb | 0 | BAND | |
| 2009058(02/27) | 02:21:16 | Q 4.7mb | 0 | LUZO | |
| 2009058(02/27) | 12:05:00 | 3.1m1 | 3 | PERS | |
| 2009058(02/27) | 20:52:49 | Q 4.7mb | 0 | CRET | |
| 2009059(02/28) | 00:35:56 | Q 5.5mb | 0 | HOKK | |
| 2009059(02/28) | 14:33:06 | Q 6.3mb | 0 | SOUT | |
| 2009060(03/01) | 00:07:39 | 1.3m1 | 4 | EAST | |
| 2009060(03/01) | 02:32:52 | 1.8m1 | 4 | EAST | |
| 2009060(03/01) | 15:52:48 | 4.7mb | 7 | SOUT | |
| 2009060(03/01) | 15:42:13 | Q 5.2mb | 0 | FIJI | |
| 2009060(03/01) | 17:12:36 | 2.0m1 | 4 | EAST | |
| 2009061(03/02) | 00:03:45 | Q 5.7mb | 0 | SULA | |
| 2009061(03/02) | 14:57:32 | 2.1m1 | 3 | EAST | |
| 2009061(03/02) | 18:44:01 | 1.7m1 | 3 | EAST | |
| 2009061(03/02) | 21:46:35 | 4.1m1 | 7 | IRAN | |
| 2009062(03/03) | 00:09:28 | | 5.1ms | 5 | IRAN |
| 2009062(03/03) | 04:01:27 | 3.1m1 | 4 | PERS | |
| 2009062(03/03) | 04:03:02 | 3.5m1 | 3 | IRAN | |
| 2009062(03/03) | 04:06:16 | 1.8m1 | 3 | EAST | |
| 2009062(03/03) | 14:22:17 | Q 5.0mb | 0 | AFGH | |
| 2009062(03/03) | 16:21:48 | Q 5.0mb | 0 | SICH | |
| 2009063(03/04) | 20:45:30 | Q 5.1mb | 0 | MARI | |
| 2009064(03/05) | 10:49:36 | 1.0m1 | 3 | EAST | |
| 2009064(03/05) | 15:49:54 | Q 5.1mb | 0 | SOUT | |
| 2009064(03/05) | 19:41:40 | Q 5.5mb | 0 | NORT | |
| 2009064(03/05) | 22:03:06 | 1.8m1 | 5 | EAST | |
| 2009065(03/06) | 06:04:39 | 2.4m1 | 5 | IRAN | |
| 2009065(03/06) | 08:21:17 | 1.8m1 | 3 | EAST | |
| 2009065(03/06) | 08:42:39 | 1.6m1 | 3 | EAST | |
| 2009065(03/06) | 08:46:23 | 2.0m1 | 3 | EAST | |
| 2009065(03/06) | 10:50:29 | Q 6.4mb | 0 | NORT | |
| 2009066(03/07) | 14:33:06 | Q 5.3mb | 0 | HOKK | |
| 2009066(03/07) | 15:09:26 | 6.0mb | 7 | ARCT | |
| 2009066(03/07) | 16:27:17 | Q 5.6mb | 0 | FLOR | |
| 2009066(03/07) | 16:25:54 | 6.7mb | 8 | SOUT | |
| 2009066(03/07) | 23:19:40 | | 3 | EAST | |
| 2009066(03/07) | 23:49:37 | 2.2m1 | 4 | PERS | |
| 2009067(03/08) | 12:05:20 | 1.9m1 | 3 | IRAN | |
| 2009068(03/09) | 13:08:49 | 1.3m1 | 3 | EAST | |
| 2009069(03/10) | 03:02:58 | 1.9m1 | 3 | EAST | |
| 2009070(03/11) | 00:34:15 | | 3 | IRAQ | |

2009070(03/11) 00:34:15 3 IRAQ
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auth = oa_1, algorithm = (3,90),
latency = 36:24 minutes

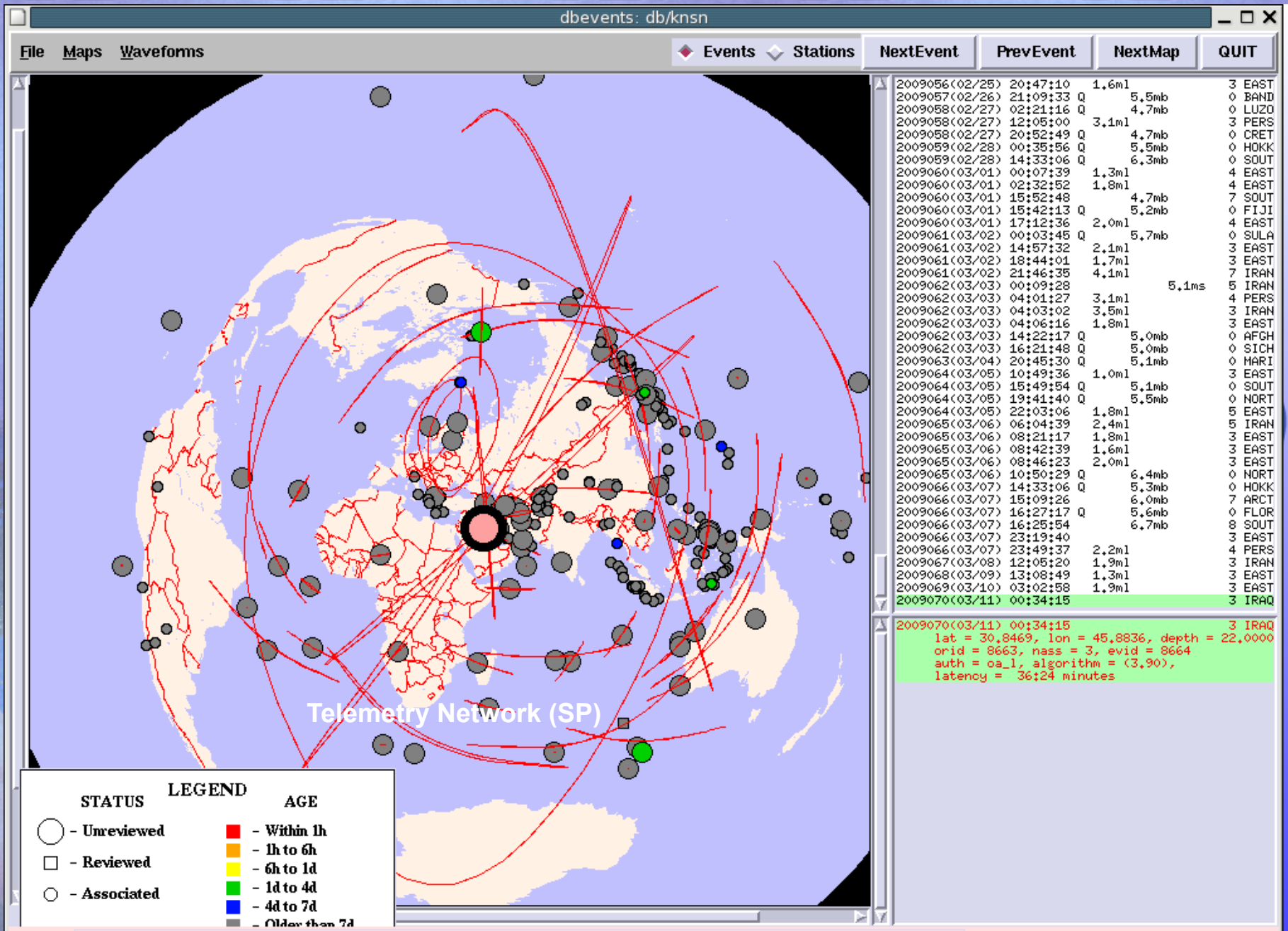
STATUS **LEGEND** **AGE**

○ - Unreviewed ■ - Within 1h
□ - Reviewed ■ - 1h to 6h
○ - Associated ■ - 6h to 1d
 ■ - 1d to 4d
 ■ - 4d to 7d

Now



Before

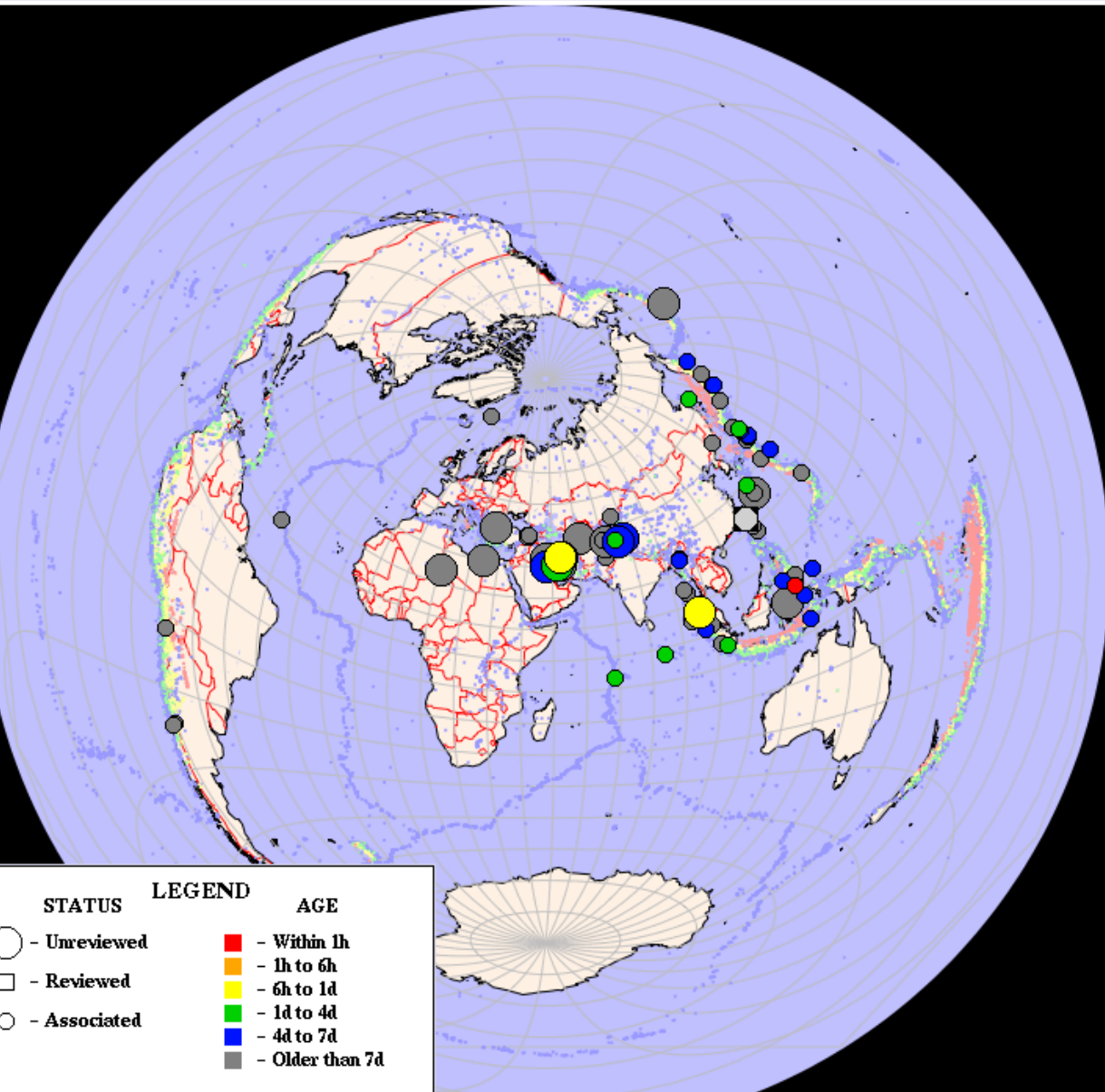


Now

dbevents: db/knsn

Maps Waveforms

Events Stations NextEvent PrevEvent NextMap



| ID | Time | Mag | Type | Location |
|----------------|----------|-------|------|----------------------|
| 2010047(02/16) | 19:59:31 | 5.0mb | Q | NEAR S. COAST OF |
| 2010048(02/17) | 02:52:41 | 5.1mb | Q | SOUTH OF HONSHU, |
| 2010049(02/18) | 01:13:17 | 6.7mb | Q | TURKEY |
| 2010049(02/18) | 21:08:15 | 4.8mb | Q | E. USSR-N.E. CHINA |
| 2010049(02/18) | 21:07:54 | | Q | IRAN |
| 2010049(02/18) | 23:49:44 | 5.1mb | Q | IRAN |
| 2010050(02/19) | 02:15:23 | 5.0mb | Q | KURIL ISLANDS |
| 2010051(02/20) | 07:46:51 | | Q | ANDAMAN ISLANDS RE |
| 2010051(02/20) | 09:22:46 | | Q | TURKMEN SSR |
| 2010051(02/20) | 09:33:15 | | Q | SULAWESI |
| 2010051(02/20) | 21:07:27 | 4.7mb | Q | IRAN |
| 2010052(02/21) | 00:56:58 | 4.9mb | Q | BURMA-INDIA BORDER |
| 2010052(02/21) | 07:29:08 | 4.5mb | Q | NEAR EAST COAST OF |
| 2010053(02/22) | 01:03:37 | 4.5mb | Q | E. USSR-N.E. CHINA |
| 2010053(02/22) | 01:51:38 | 4.7mb | Q | PAKISTAN |
| 2010053(02/22) | 05:21:04 | 5.4mb | Q | HINDU KUSH REGION |
| 2010053(02/22) | 16:55:02 | 4.9mb | Q | TAIWAN REGION |
| 2010054(02/23) | 07:28:04 | 4.5mb | Q | JAN MAYEN ISLAND P |
| 2010054(02/23) | 10:43:10 | 5.3mb | Q | WESTERN IRAN |
| 2010056(02/25) | 03:51:49 | 4.8mb | Q | KURIL ISLANDS |
| 2010056(02/25) | 15:41:37 | | Q | ANDAMAN ISLANDS RE |
| 2010057(02/26) | 20:31:26 | | Q | SOUTHERN IRAN |
| 2010057(02/26) | 01:14:25 | | Q | 16 RYUKYU ISLANDS |
| 2010058(02/27) | 19:54:29 | 5.4mb | Q | 6 PAKISTAN |
| 2010058(02/27) | 23:14:29 | | Q | 6 NORTH ATLANTIC RII |
| 2010058(02/27) | 23:21:13 | | Q | 6 NORTHWEST AFRICA |
| 2010059(02/28) | 01:20:35 | 5.7mb | Q | HINDU KUSH REGION |
| 2010059(02/28) | 03:33:49 | 5.3mb | Q | RYUKYU ISLANDS |
| 2010059(02/28) | 08:17:49 | 5.2mb | Q | RYUKYU ISLANDS |
| 2010059(02/28) | 11:25:35 | 5.4mb | Q | OFF EAST COAST OF |
| 2010059(02/28) | 11:25:35 | 6.2mb | Q | CHILE-ARGENTINA BO |
| 2010059(02/28) | 11:25:34 | 6.1mb | Q | NEAR COAST OF CENT |
| 2010059(02/28) | 12:13:27 | 5.1mb | Q | NORTHERN SUMATERA |
| 2010059(02/28) | 22:07:47 | 5.1mb | Q | HONSHU, JAPAN |
| 2010061(03/02) | 01:55:39 | 5.0mb | Q | ALMA-ATA REGION |
| 2010061(03/02) | 02:51:23 | 5.8mb | Q | LUZON, PHILIPPINE |
| 2010061(03/02) | 09:35:19 | 4.8mb | Q | RYUKYU ISLANDS |
| 2010061(03/02) | 22:18:42 | 5.2mb | Q | TALAUD ISLANDS |
| 2010061(03/02) | 23:42:01 | 4.7mb | Q | TALAUD ISLANDS |
| 2010062(03/03) | 11:13:57 | 5.0mb | Q | TALAUD ISLANDS |
| 2010062(03/03) | 22:54:12 | 4.7mb | Q | TALAUD ISLANDS |
| 2010063(03/04) | 00:18:53 | 6.4mb | Q | TAIWAN |
| 2010063(03/04) | 14:16:27 | | Q | 8 LIBYA |
| 2010063(03/04) | 20:22:25 | | Q | 5 IRAN-IRAQ BORDER F |
| 2010063(03/04) | 22:09:46 | | Q | 7 IRAN |
| 2010063(03/04) | 22:39:25 | 6.3mb | Q | 0 NORTHERN CHILE |
| 2010063(03/04) | 22:54:41 | | Q | 7 IRAN |
| 2010064(03/05) | 01:43:43 | 4.9mb | Q | 0 PHILIPPINE ISLANDS |

| | | | | |
|--|----------|-------|---|------------------|
| 2010063(03/04) | 00:18:53 | 6.4mb | Q | 0 TAIWAN |
| lat = 22.9000, lon = 120.9100, depth = 35.0000 | | | | |
| orid = 15448, nass = 12, evid = 11160 | | | | |
| auth = QED, algorithm = -, | | | | |
| latency = 29:36 minutes | | | | |
| 2010063(03/04) | 00:18:50 | | Q | 12 TAIWAN |
| lat = 23.0051, lon = 121.5116, depth = 15.0000 | | | | |
| orid = 15446, nass = 14, evid = 11160 | | | | |
| auth = uni, algorithm = tele(3,95), | | | | |
| latency = 23:03 minutes | | | | |
| 2010063(03/04) | 00:18:50 | | Q | 11 TAIWAN REGION |
| lat = 22.8337, lon = 121.0612, depth = 13.7860 | | | | |
| orid = 15442, nass = 12, evid = 11160 | | | | |
| auth = {uni dbg}, algorithm = dbgenloc:iasp91, | | | | |
| latency = 12:27 minutes | | | | |
| 2010063(03/04) | 00:18:49 | | Q | 11 TAIWAN REGION |
| lat = 22.8252, lon = 121.3272, depth = 10.0575 | | | | |
| orid = 15447, nass = 13, evid = 11160 | | | | |
| auth = {uni dbg}, algorithm = dbgenloc:iasp91, | | | | |
| latency = 24:09 minutes | | | | |

Before



Now



But

Sometimes



Completed Projects

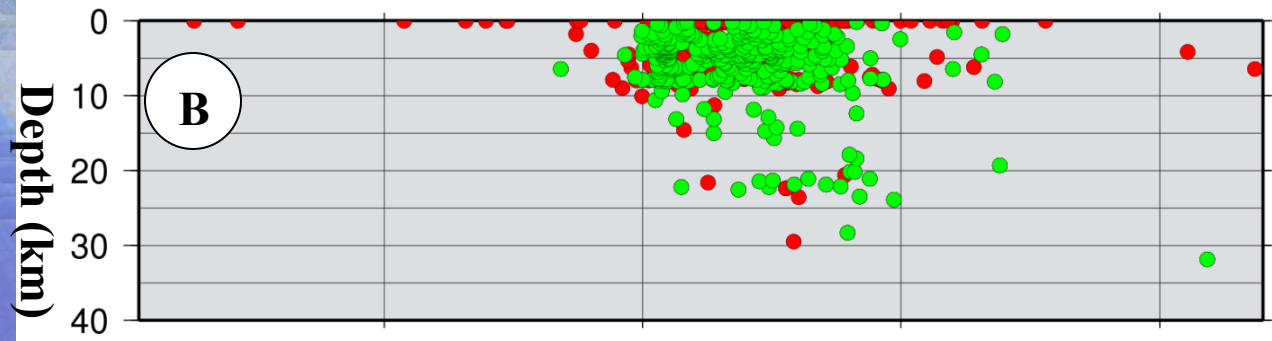
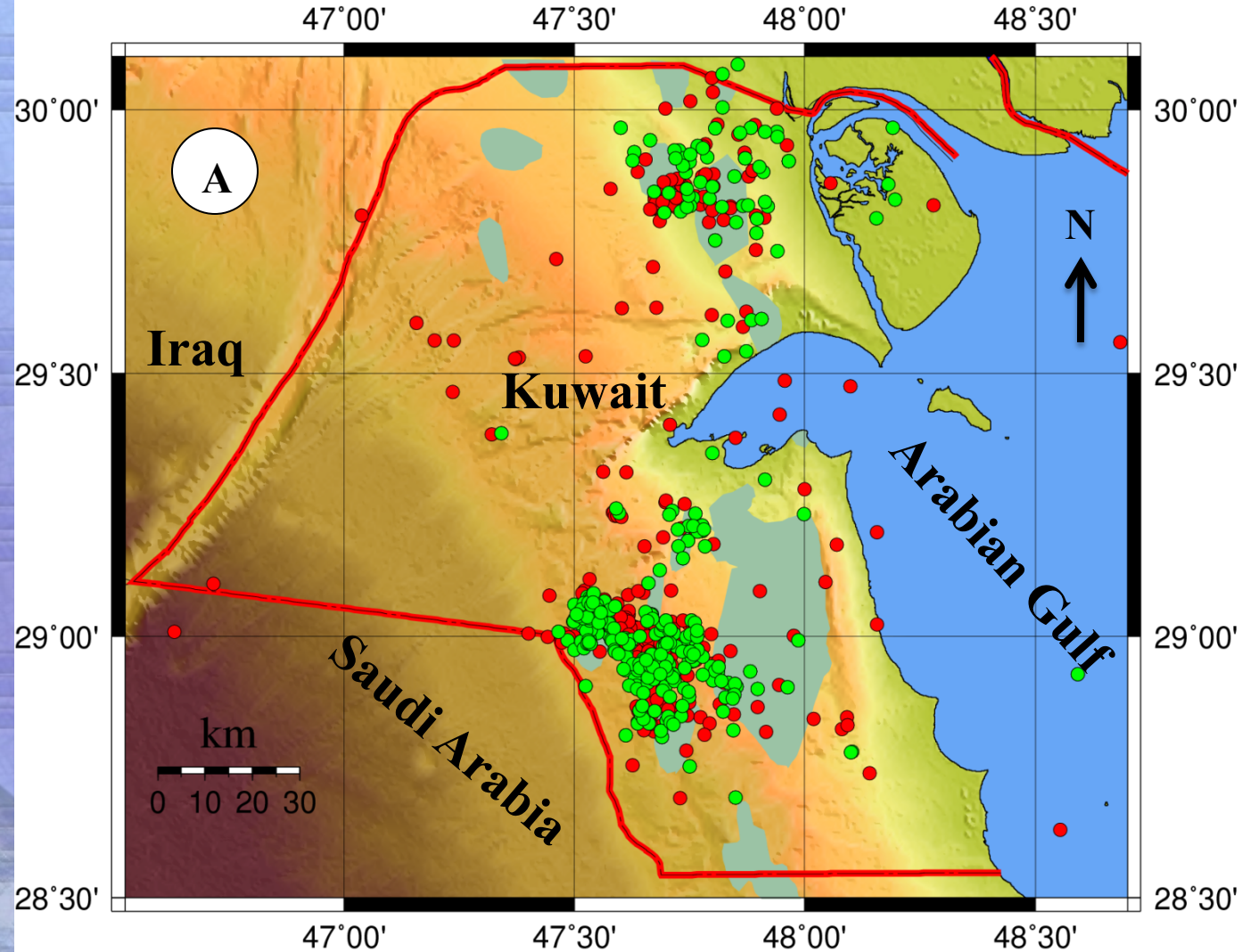
EB012C: Seismic Risk Assessment of Building Construction in Kuwait
- **Lack of soil parameters (V_s, f, A_f).**

EB013K: Evaluation of Current Design Practices of Residential Buildings
- **Lack of UBC for Kuwait.** - **Over design of structural members**

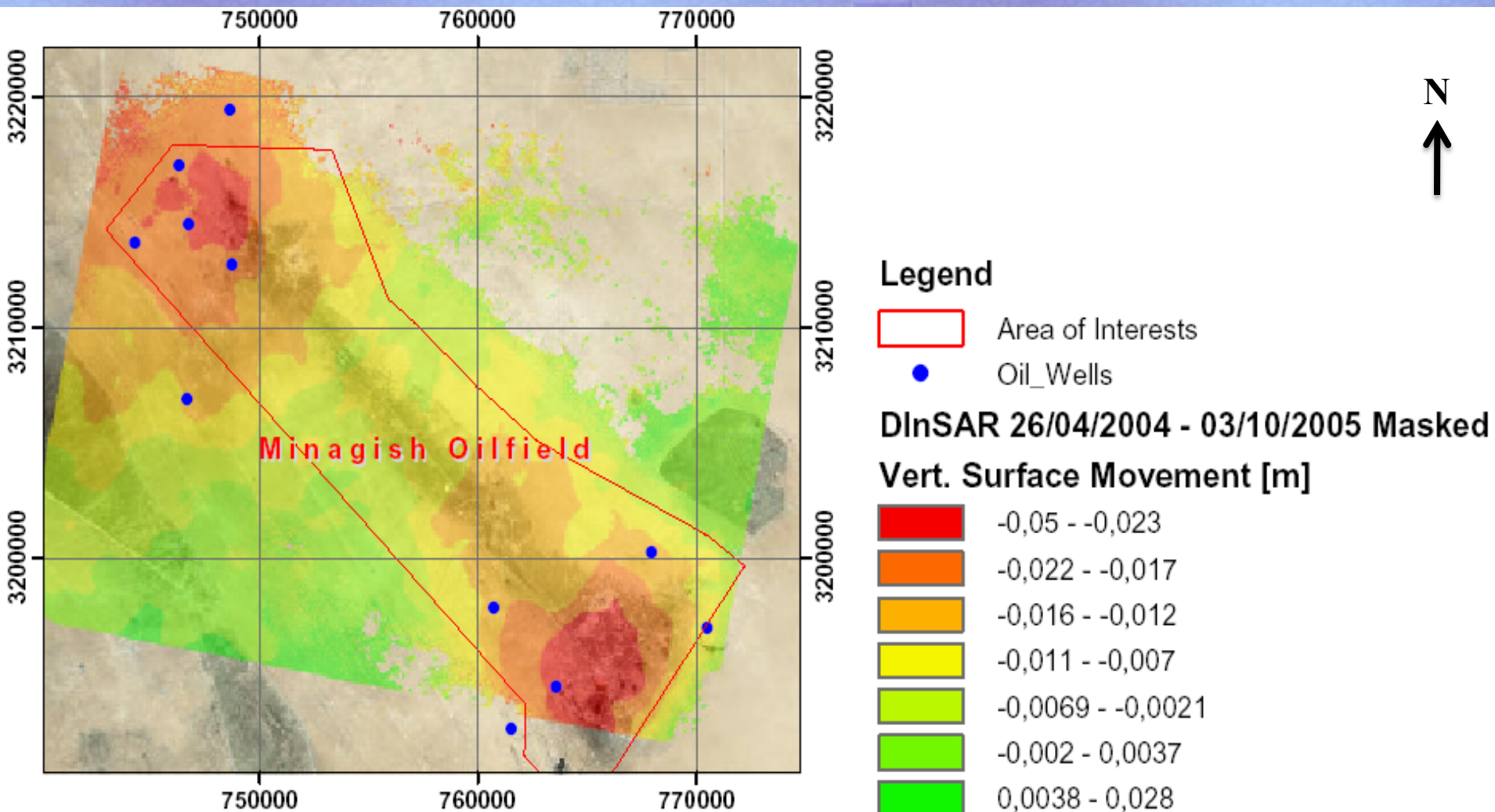
EC011C: Assessment of the Seismic Hazard for the State of Kuwait.
- Need for site studies.

- The absence of a national building code has led to the design of buildings in Kuwait to involve inconsistent and non-uniformity.**
- **The lack of soil parameters has led to inconsistent values for seismic hazard and risk mitigation.**

Earthquake Activity



Surface Subsidence in Minagish and Umm-Gudair oil fields





Proposed Projects

- **Oil Reservoir Characterization.**
- **Seismic Effects of Sites in Kuwait City.**
- **Enable KNSN through the KISR homepage.**
- **Adding two field station NE of Kuwait.**



Seismic Effects of Sites in Kuwait City

Objectives

The objective of this study is to determine the effects of sites in Kuwait City on seismic wave's propagation in terms of:

- Shear wave velocity values, V_s
- Surface sediment thickness, h
- Dominant frequencies in soil, f
- Site amplification factors, A_f

Tall buildings, Towers, High population, Commercial buildings, Agencies,.....It is the CAPITAL of the State







Oil Reservoir Characterization

Objectives

- Define the extend and the characteristics of faults and potential fractures located near oil reservoirs, producing and injection wells.
- Study the correlation between microseismic activities and oil production
- Asses the potential earthquake hazard of largest seismic event that can be expected within the oilfields.
- Determine the rate and extent of surface deformation.

To do that

- It is proposed in this project to install 50 down-hole seismic stations within the oilfields at 150 m depth and upgrade the current KNSN stations .
- Determination of Surface Deformation by GPS.
- Finding effective and automatic ways to enhance signal to noise ratio, detect seismic events and pick P and S phases if needed.



Enable KNSN through the KISR homepage

Kuwait Institute for Scientific Research - KISR - Windows Internet Explorer

http://www.kisr.edu.kw/

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ENVIRONMENTAL ENGINEERING TECHNOLOGY

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Promoting scientific and applied research, particularly in matters related to industry, natural and food resources and other primary constituents of national economy, in an endeavor to serve the goals of economic, technological and scientific development

News & Events

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News & Events

ISS

The second cruise for the survey of Demersal fish stocks in the Arabian Gulf. The cruise started in Kuwait on 8th October 2009 from Kuwait to Bahrain and Saudi Arabia.



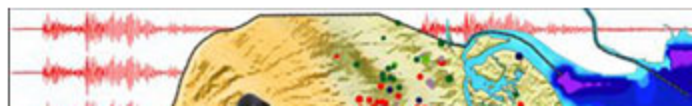
Kuwait National Seismic Network

[Introduction](#) | [The Design of the Kuwait National Seismic Network](#) | [Recording and Analysis Center](#) | [Earthquake Activities in the State of Kuwait](#) | [Parameters of Earthquakes Recorded in the State of Kuwait](#)

Introduction

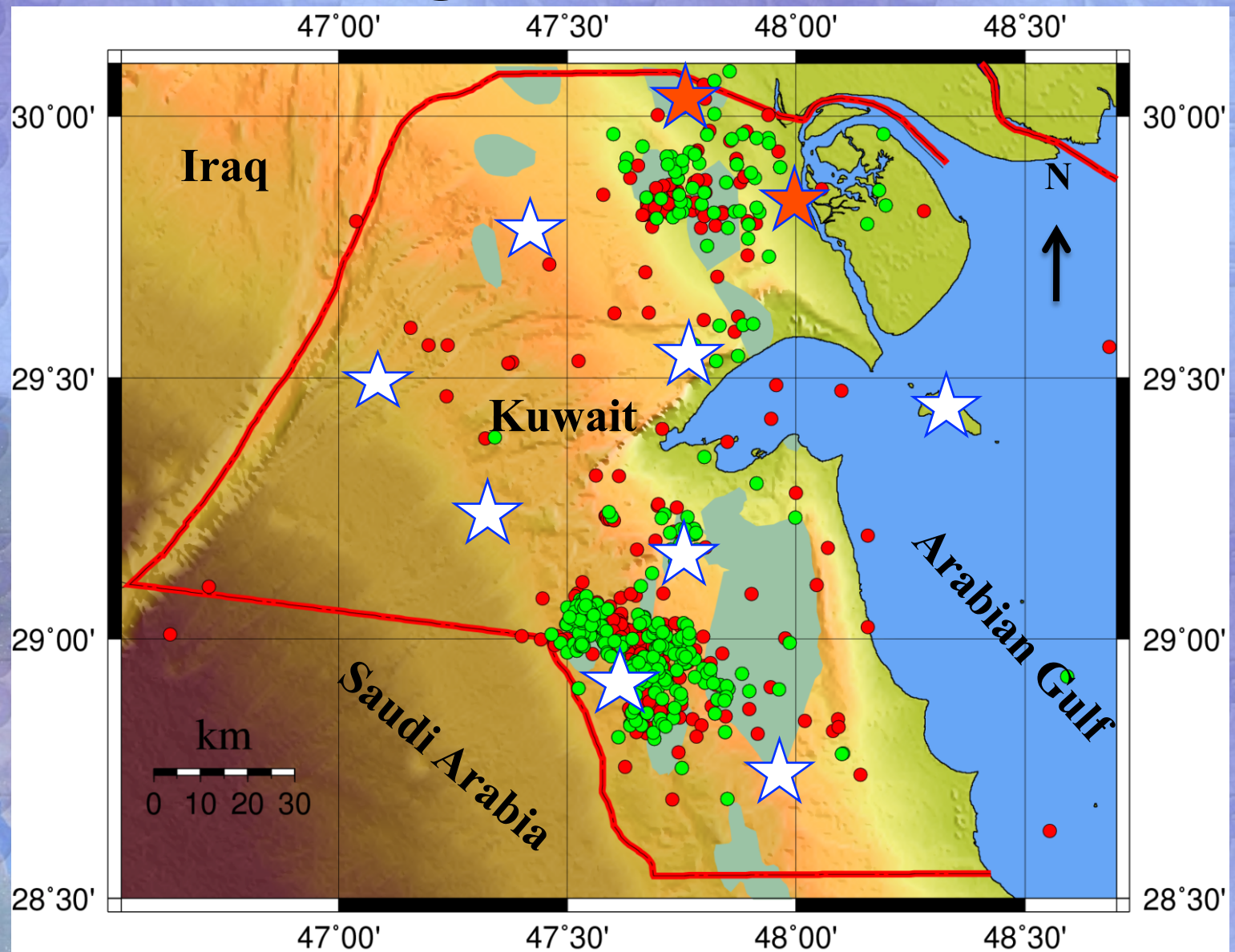
Based on the instructions of the Council of Ministers (1994), the Kuwait Institute for Scientific Research (KISR) established the Kuwait National Seismic Network (KNSN) in 1996. The KNSN started functioning in March 1997. The network was designed to:

- ▶ Monitor the seismic activities in the State of Kuwait.
- ▶ Record earthquake events inside Kuwait and in the surrounding areas, i.e., (local, regional and teleseismic events).
- ▶ Proceed with necessary studies and research concerned with seismology
- ▶ Characterize seismicity status in the State of Kuwait to develop local seismic hazard maps.
- ▶ Cooperate with concerned authorities to establish seismic codes for buildings.
- ▶ Exchange seismic data with international seismological networks.
- ▶ Create a cadre of qualified national manpower in the field of seismology.





Adding two field station NE of Kuwait



Thank you

