

(India, Dr. Rentala Shankar DATTATRAYAM, 1987-1988S)

Seismological Observatories of India Meteorological Department (IMD)

India Meteorological Department (IMD) is the nodal agency of Government of India for monitoring seismic activity in and around the country. IMD had rendered more than a century of seismological service to the nation with the first seismological observatory of the country having been set up by the department at Kolkatta in 1898. The operational task of the department is to quickly estimate the earthquake source parameters immediately on occurrence of an earthquake and disseminate the information to all the user agencies including public information channels, press, media etc. and the concerned State and Central Government agencies responsible for carrying out relief and rehabilitation measures. The information relating to under-sea earthquakes capable of generating tsunamis on the Indian coastal regions is also disseminated to all concerned user agencies including the Indian National Centre for Ocean Information Services (INCOIS), Hyderabad for issue of tsunami related messages and warnings. The earthquake information is transmitted to various user agencies, including public information channels, press, media etc., using different modes of communication, such as SMS, fax, email, IVRS and also posted on IMD's Website (www.imd.gov.in).

Towards meeting the above stated objectives, IMD maintains a seismological network, consisting of a total of 82 observatories, spread over the entire length and breadth of the country (Figure 1 and Table 1). This includes: a) 16-station V-SAT based digital seismic telemetry system around National Capital Territory (NCT) of Delhi, b) 20-station VSAT based real time seismic monitoring network in North East region of the country and c) 17-station Real Time Seismic Monitoring Network (RTSMN) to monitor and report large magnitude under-sea earthquakes capable of generating tsunamis on the Indian coastal regions.. A Control Room is in operation, on 24X7 basis, at IMD Headquarters (Seismology) in New Delhi with state-of-art facilities for data collection, processing and dissemination of information to the concerned user agencies.

As part of early warning system for tsunamis established by the Indian National Center for Ocean Information Services (INCOIS), Hyderabad, a 17-station Real Time Seismic Monitoring Network (RTSMN) was set up by IMD to monitor and report large magnitude under-sea earthquakes capable of generating tsunamis on the Indian coastal regions. The ground motion data recorded at the 17 field stations is transmitted in real time through VSAT communication systems to the two Central Receiving Stations (CRSs) located at IMD, New Delhi and INCOIS, Hyderabad for processing. The

RTSMN system employs state-of-art auto-location software, called Response Hydra (v-1.2), to make preliminary estimates of earthquake source parameters immediately (within a few minutes) after the occurrence of an earthquake. The source parameters include the time of occurrence, location (region), magnitude and focal depth of the earthquake. For providing better azimuthal coverage towards detecting earthquakes of tsunami-genic potential, the RTSMN system has been configured to include about 100 global stations of IRIS (a consortium of Incorporated Research Institutions in Seismology), whose data is available freely through internet.

In addition, a number of seismological observatories are also being maintained by various State and Central Government organizations, Universities, Research institutions and other agencies in the country for specific purposes/as per mandate. These include:

1. National Geophysical Research Institute (NGRI), Hyderabad.
2. Wadia Institute of Himalayan Geology (WIHG), Dehradun.
3. North East Institute of Science & Technology (NEIST), Jorhat.
4. Institute of Seismological Research (ISR), Gandhinagar, Gujarat.
5. Geological Survey of India (GSI), Kolkata.
6. Maharashtra Engineering Research Institute (MERI), Nasik, Maharashtra.
7. Indian Institute of Technology (IIT), Roorkee.
8. Central Building Research Institute (CBRI), Roorkee.

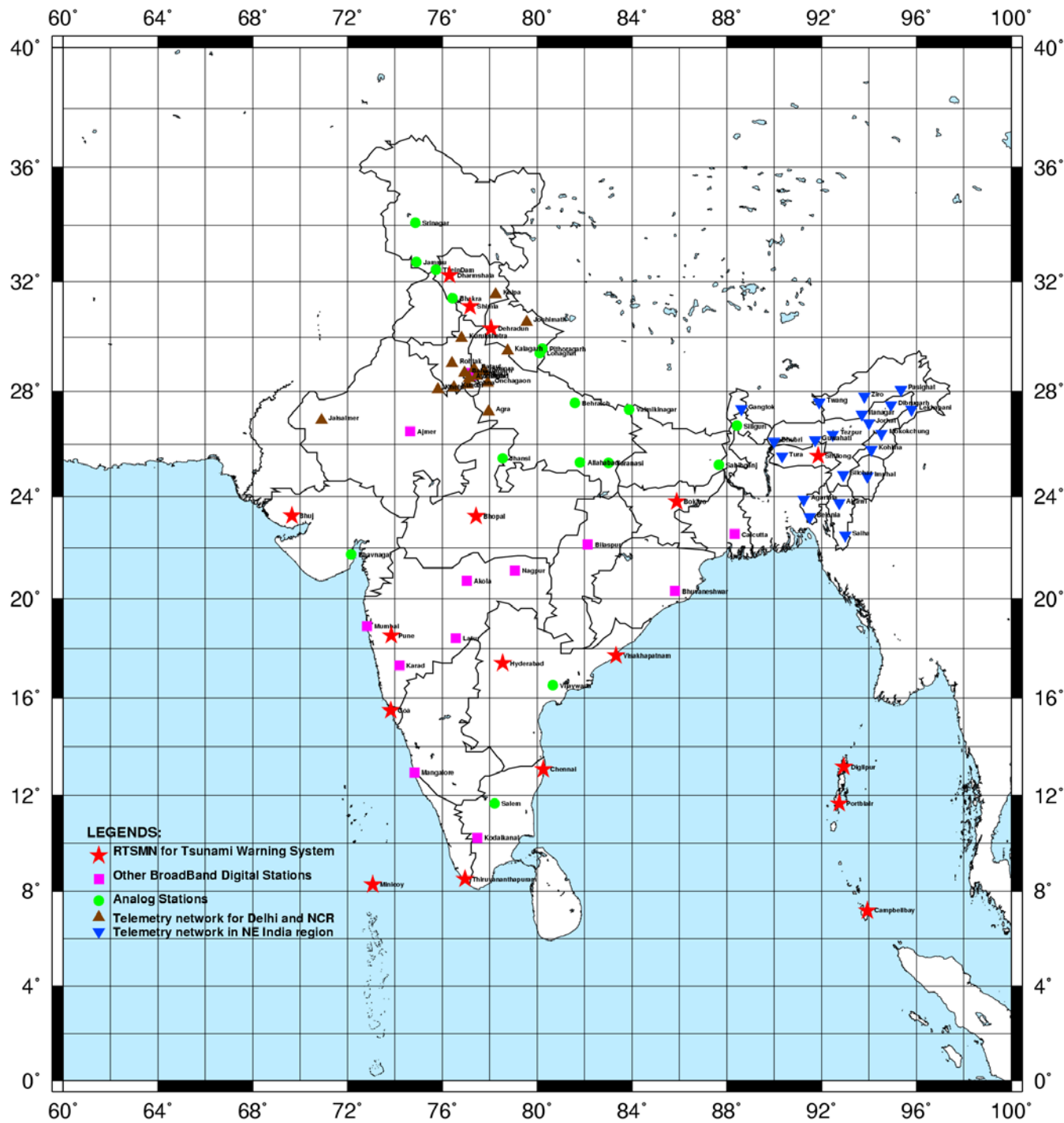


Figure 1. Seismological network of India Meteorological Department (IMD)

Table 1. List of Seismological Observatories Operated by IMD

| S. No. | Name of Station | Latitude (In degree) | Longitude (In degree) | Height above m.s.l. (in meters) | Station category |
|---------------|------------------------|-----------------------------|------------------------------|--|-------------------------|
| 1 | Ajmer | 26.479N | 74.643E | 540 | Other Broadband digital |
| 2 | Akola | 20.703N | 77.015E | 310 | Other Broadband digital |
| 3 | Allahabad | 25.309N | 81.809E | 107 | Analog |
| 4 | Behraich | 27.567N | 81.583E | 123 | Analog |
| 5 | Bhakra | 31.417N | 76.417E | 410 | Analog |
| 6 | Bhavnagar | 21.750N | 72.143E | 182 | Analog |
| 7 | Bhopal | 23.241N | 77.425E | 520 | RTSMN |
| 8 | Bhuj | 23.254N | 69.654E | 80 | RTSMN |
| 9 | Bhubaneshwar | 20.296N | 85.806E | 46 | Other Broadband digital |
| 10 | Bilaspur | 22.129N | 82.132E | 398 | Other Broadband digital |
| 11 | Bokaro | 23.795N | 85.886E | 282 | RTSMN |
| 12 | Calcutta | 22.539N | 88.331E | 6 | Other Broadband digital |
| 13 | Chennai | 13.068N | 80.246E | 15 | RTSMN |
| 14 | Dehradun | 30.323N | 78.056E | 682 | RTSMN |
| 15 | Delhi | 28.683N | 77.217E | 230 | Other Broadband digital |
| 16 | Goa | 15.492N | 73.825E | 58 | RTSMN |
| 17 | Jammu | 32.717N | 74.900E | 360 | Analog |
| 18 | Jhansi | 25.466N | 78.540E | 250 | Analog |
| 19 | Karad | 17.308N | 74.183E | 582 | Other Broadband digital |
| 20 | Kodaikanal | 10.233N | 77.467E | 2345 | Other Broadband digital |
| 21 | Latur | 18.416N | 76.560E | 620 | Other Broadband digital |
| 22 | Lohaghat | 29.417N | 80.100E | 1700 | Analog |
| 23 | Mangalore | 12.942N | 74.823E | 31 | Other Broadband digital |
| 24 | Minicoy | 8.282N | 73.059E | 2 | RTSMN |
| 25 | Mumbai | 18.896N | 72.813E | 6 | Other Broadband digital |
| 26 | Nagpur | 21.102N | 79.062E | 311 | Other Broadband digital |
| 27 | Pithoragarh | 29.583N | 80.217E | 1669 | Analog |
| 28 | Portblair | 11.656N | 92.744E | 79 | RTSMN |
| 29 | Pune | 18.530N | 73.849E | 560 | RTSMN |
| 30 | Sahibganj | 25.217N | 87.667E | 37 | Analog |
| 31 | Salem | 11.650N | 78.200E | 278 | Analog |
| 32 | Shillong | 25.567N | 91.856E | 1600 | RTSMN |
| 33 | Siliguri | 26.700N | 88.417E | 120 | Analog |
| 34 | Srinagar | 34.100N | 74.850E | 1587 | Analog |
| 35 | Thein Dam | 32.433N | 75.717E | 621 | Analog |
| 36 | Thiruvananthapuram | 8.508N | 76.959E | 64 | RTSMN |
| 37 | Valmikinagar | 27.317N | 83.867E | 100 | Analog |
| 38 | Varanasi | 25.300N | 83.017E | 88 | Analog |
| 39 | Vijayawada | 16.517N | 80.650E | 18 | Analog |
| 40 | Visakhapatnam | 17.721N | 83.329E | 82 | RTSMN |
| 41 | Lodi Road | 28.583N | 77.217E | 200 | Other Broadband digital |
| 42 | Campbell Bay | 07.192N | 93.927E | 10 | RTSMN |
| 43 | Dharmshala | 32.248N | 76.307E | 1995 | RTSMN |
| 44 | Diglipur | 13.178N | 92.931E | 30 | RTSMN |
| 45 | Hyderabad | 17.403N | 78.552E | 510 | RTSMN |
| 46 | Shimla | 31.128N | 77.167E | 2200 | RTSMN |
| 47 | Bahadurgarh | 28.688N | 76.939E | 214 | Delhi Telemetry Network |
| 48 | Sohna | 28.245N | 77.063E | 180 | Delhi Telemetry Network |
| 49 | Bisrakh | 28.571N | 77.439E | 200 | Delhi Telemetry Network |

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|----|-------------|---------|---------|------|------------------------------|
| 50 | Agra | 27.231N | 77.944E | 169 | Delhi Telemetry Network |
| 51 | Kurukshetra | 29.962N | 76.821E | 250 | Delhi Telemetry Network |
| 52 | Rohtak | 29.033N | 76.414E | 220 | Delhi Telemetry Network |
| 53 | Kalagarh | 29.506N | 78.754E | 1814 | Delhi Telemetry Network |
| 54 | Ausora | 28.756N | 77.772E | 160 | Delhi Telemetry Network |
| 55 | Rataul | 28.832N | 77.342E | 223 | Delhi Telemetry Network |
| 56 | Kundal | 28.144N | 76.489E | 227 | Delhi Telemetry Network |
| 57 | Ayanagar | 28.482N | 77.127E | 220 | Delhi Telemetry Network |
| 58 | Onchagaon | 28.310N | 77.910E | 237 | Delhi Telemetry Network |
| 59 | Khetri | 28.074N | 75.806E | 320 | Delhi Telemetry Network |
| 60 | Kalpa | 31.546N | 78.260E | 2724 | Delhi Telemetry Network |
| 61 | Jaisalmer | 26.924N | 70.903E | 223 | Delhi Telemetry Network |
| 62 | Joshimath | 30.556N | 79.558E | 1889 | Delhi Telemetry Network |
| 63 | Dhubri | 26.020N | 89.995E | 33 | North East Telemetry Network |
| 64 | Mokochong | 26.321N | 94.516E | 1353 | North East Telemetry Network |
| 65 | Agartala | 23.889N | 91.246E | 18 | North East Telemetry Network |
| 66 | Jorhat | 26.743N | 94.251E | 79 | North East Telemetry Network |
| 67 | Belonia | 23.248N | 91.447E | 20 | North East Telemetry Network |
| 68 | Gangtok | 27.319N | 88.601E | 1348 | North East Telemetry Network |
| 69 | Kohima | 25.720N | 94.108E | 1353 | North East Telemetry Network |
| 70 | Imphal | 24.831N | 93.946E | 792 | North East Telemetry Network |
| 71 | Aizwal | 23.738N | 92.690E | 969 | North East Telemetry Network |
| 72 | Silchar | 24.781N | 92.803E | 18 | North East Telemetry Network |
| 73 | Lekhapani | 27.333N | 95.846E | 139 | North East Telemetry Network |
| 74 | Ziro | 27.526N | 93.850E | 160 | North East Telemetry Network |
| 75 | Tezpur | 26.617N | 92.800E | 83 | North East Telemetry Network |
| 76 | Itanagar | 27.144N | 93.722E | 214 | North East Telemetry Network |
| 77 | Tura | 25.517N | 90.224E | 406 | North East Telemetry Network |
| 78 | Guwahati | 26.193N | 91.691E | 88 | North East Telemetry Network |
| 79 | Dibrugarh | 27.468N | 94.911E | 90 | North East Telemetry Network |
| 80 | Tawang | 27.594N | 91.867E | 297 | North East Telemetry Network |
| 81 | Pasighat | 28.061N | 95.326E | 167 | North East Telemetry Network |
| 82 | Saiha | 22.50 N | 93.00 E | 729 | North East Telemetry Network |