Seismology at School in Nepal: a network and program for education and citizen seismology
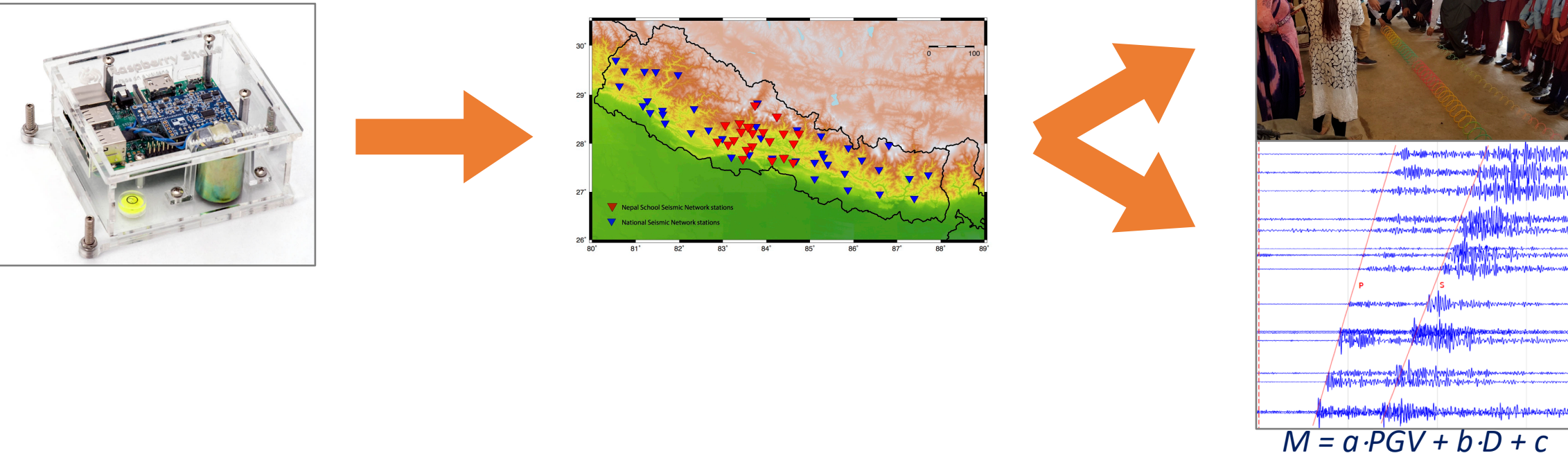
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Graphical abstract

$$M = a \cdot PGV + b \cdot D + c$$

This work is now published in Frontiers in Earth Science
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Seismology at School in Nepal:
a network and program for education and citizen seismology

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Text abstract: We established an initiative in Nepal to introduce seismology in schools, with focus on education and citizen seismology. We have prepared educational materials adapted to the Nepali school system, which we distributed and also share on our program's website. We also installed a low-cost seismometer to record seismicity and to allow learning-by-doing classroom activities. The seismometers installed in 22 schools create Nepal School Seismic Network (NSSN) that allows students to be informed of earthquakes, visualize the respective waveforms, and estimate distance and magnitude of the events. For significant local and regional events, we provide record sections and network instrumental intensity maps.

In 6 months of network operation, more than 194 local and teleseismic earthquakes of M ≥ 4 have been recorded. We provide an earthquake wave detectability graph in distance—magnitude space. Based on our observations, we calibrate a new magnitude equation for Nepal, related to the epicentral distance and to the observed peak ground velocity.

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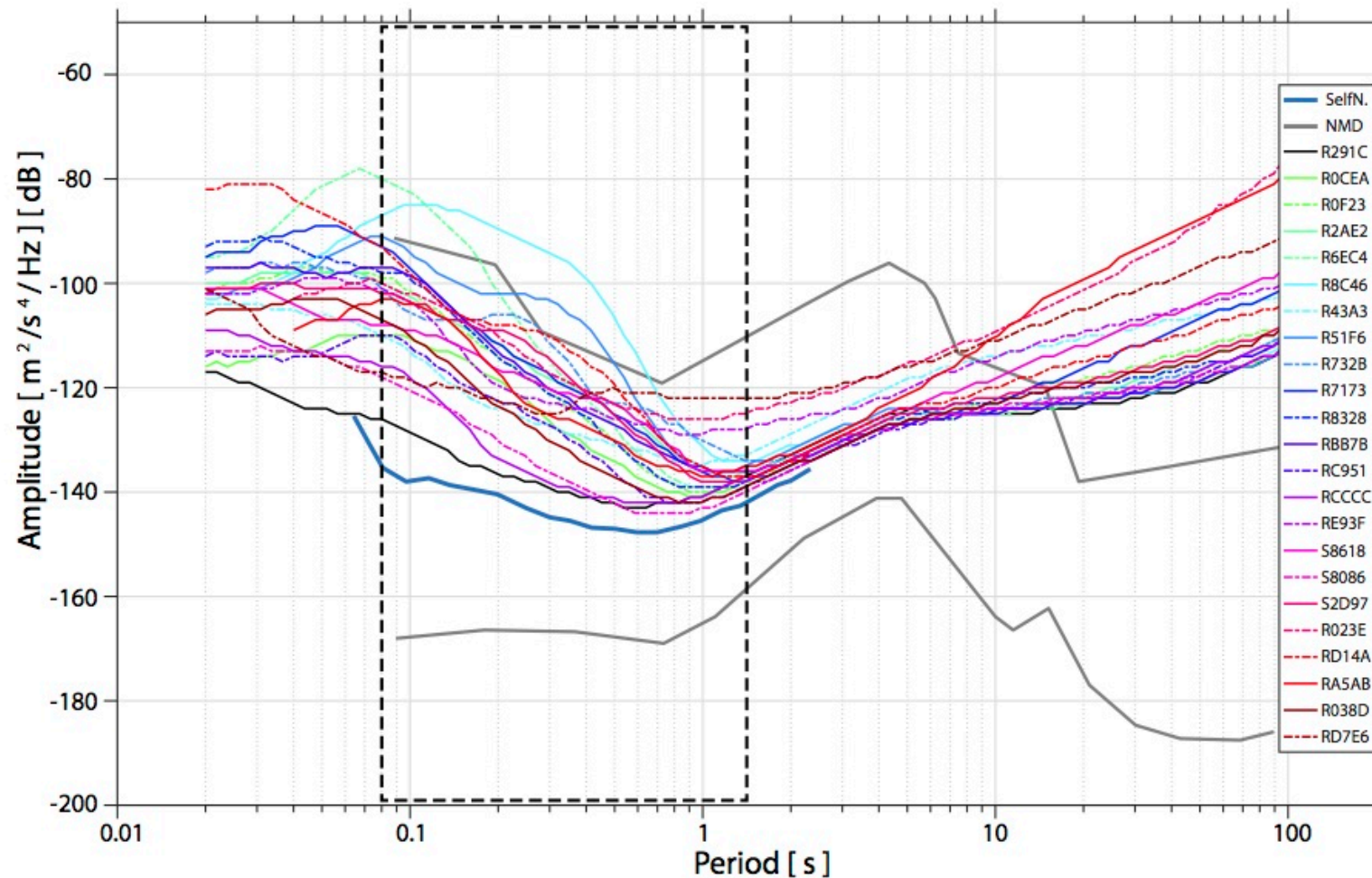# Study area and selected sensor
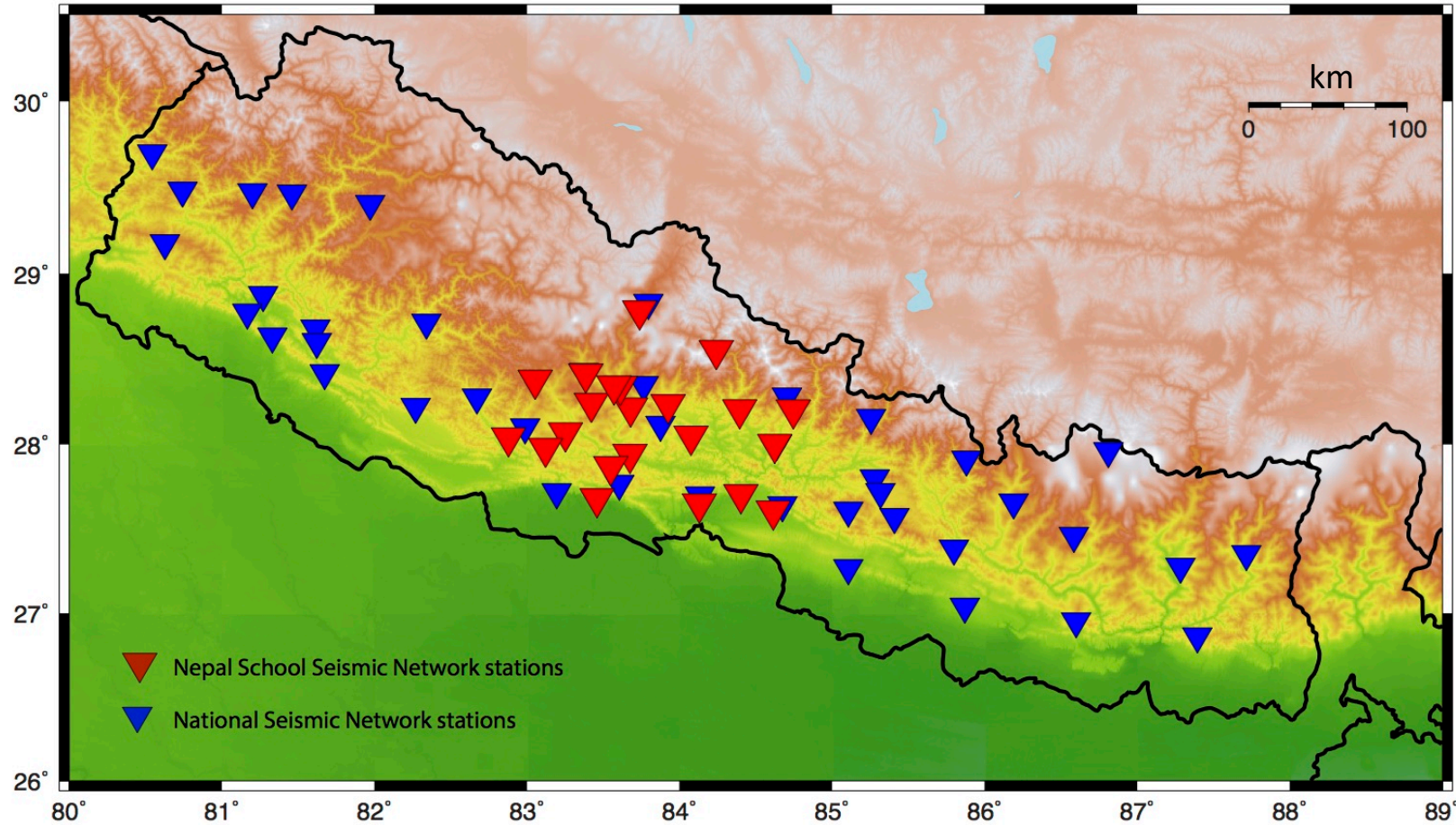
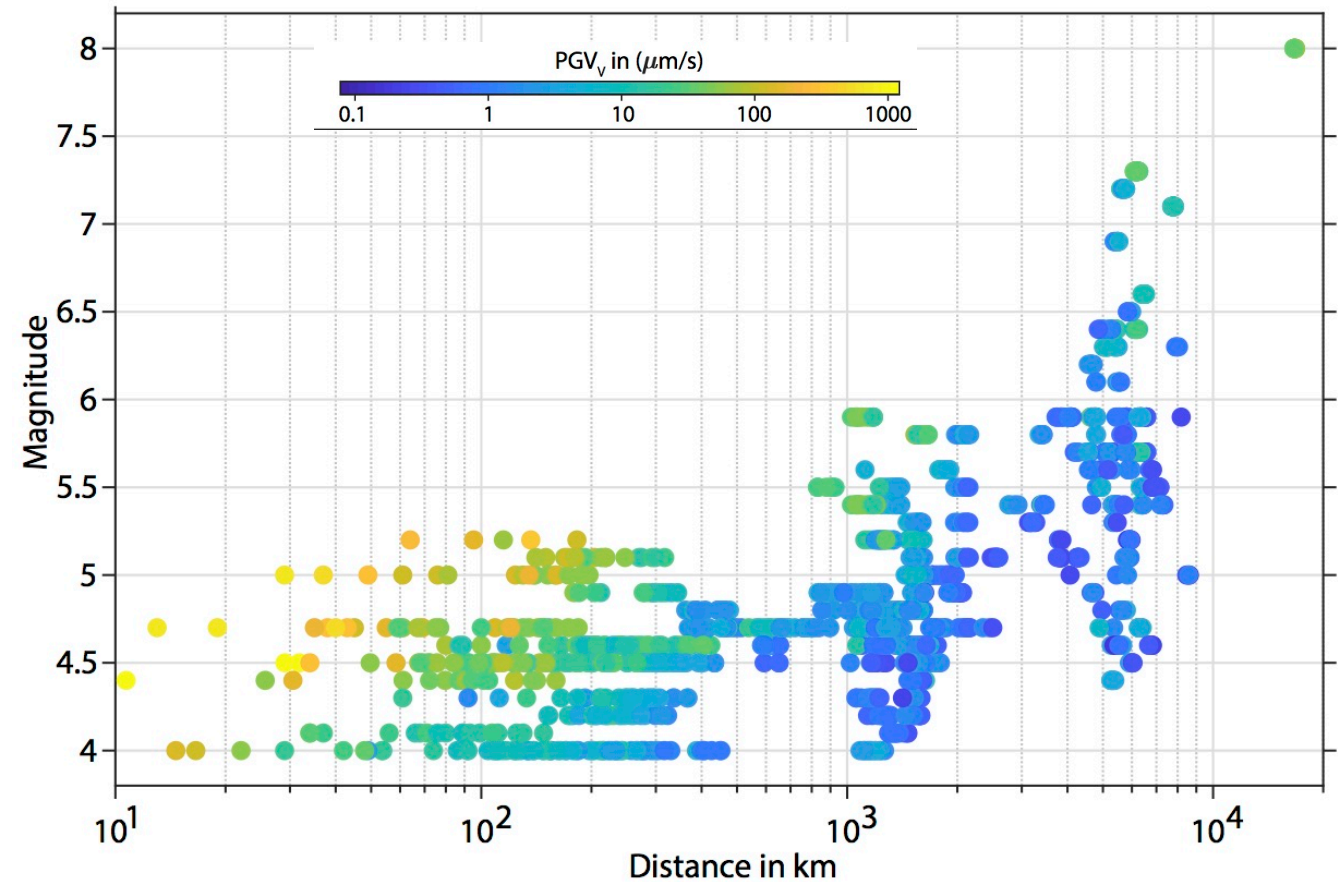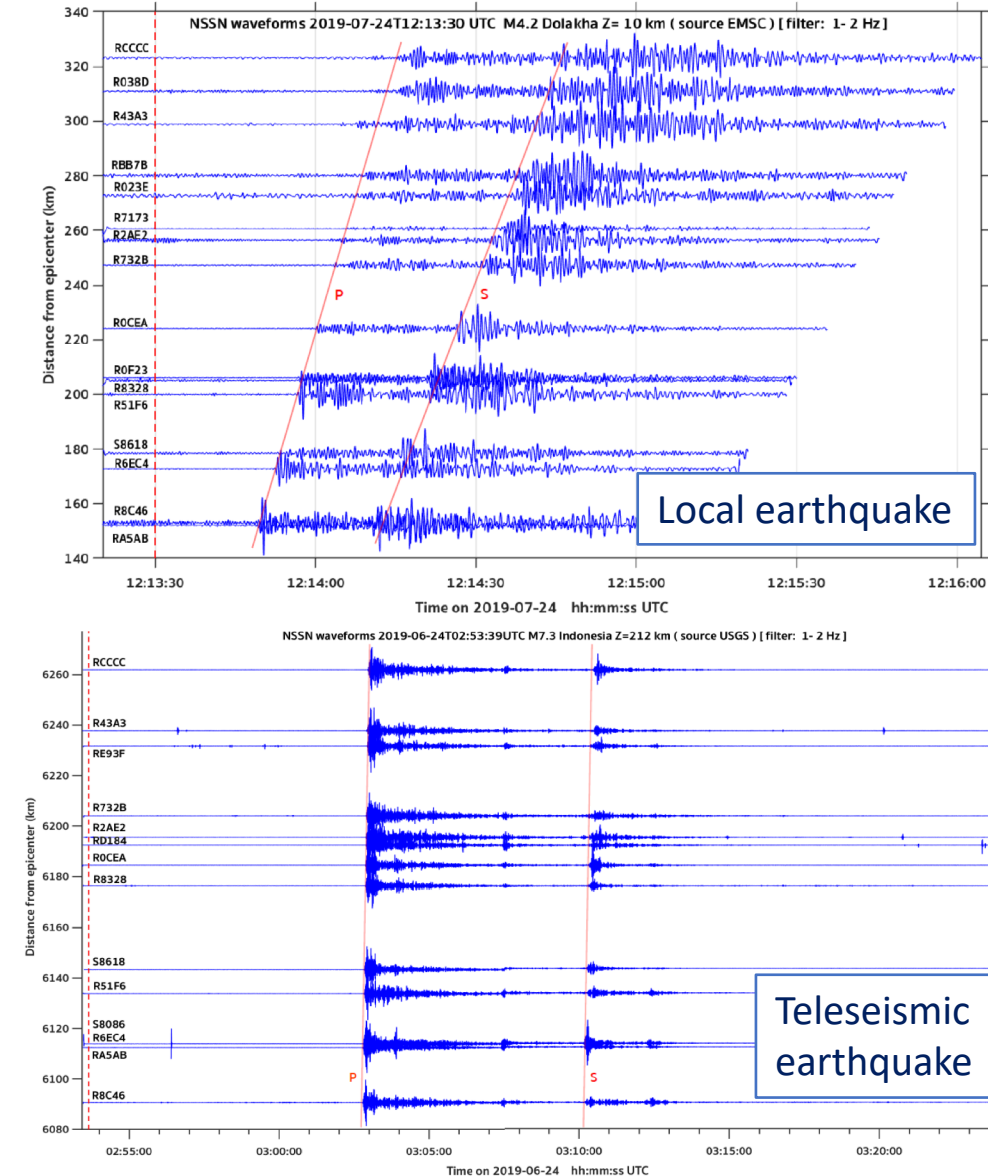*Low-cost seismic network*

Selected sensor: Raspberry Shake 1D

➢ The program is implemented in western Nepal where people seldom learn about earthquakes

➢ Raspberry Shake 1D seismometer was found to be best for our purposes

Noise analysis: PSD PDFs

➢ Using 6-month data, most of sites are below the high-noise model

➢ Only three sites R8C46, R6EC4 and R51F6 are badly affected by daytime noise

Earthquake records

NSSN waveforms 2019-07-24T12:13:30 UTC M4.2 Dolakha Z= 10 km (source EMSC) [filter: 1- 2 Hz]

Local earthquake

NSSN waveforms 2019-06-24T02:53:39UTC M7.3 Indonesia Z=212 km (source USGS) [filter: 1- 2 Hz]
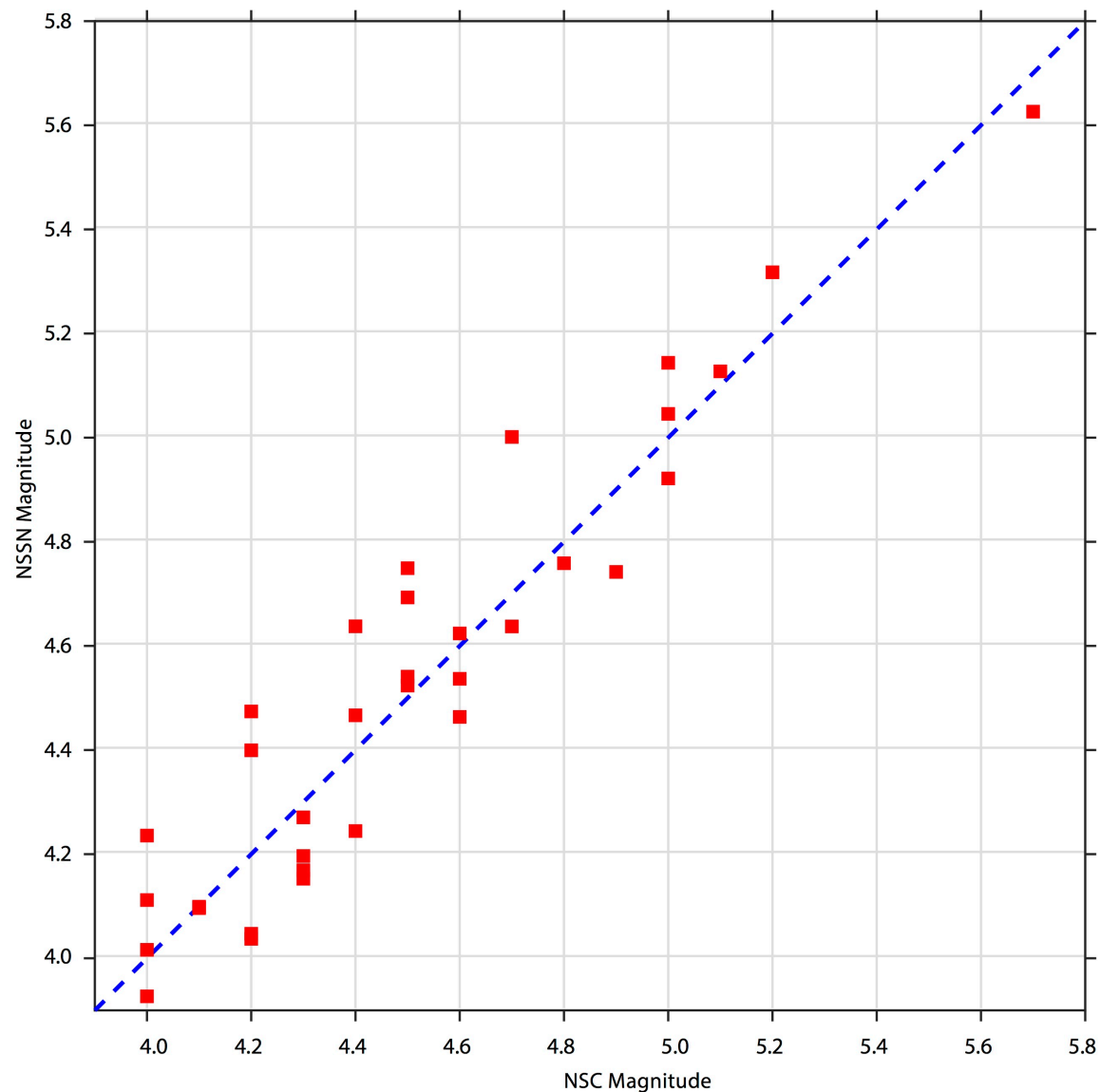
Teleseismic earthquake

➢ All reported local earthquakes and also some regional events of M_L 4.0 beyond 1'000 km distance have been detected

➢ The magnitude and distance dependence of PGV is observed

Shake-maps (network instrumental intensity maps)
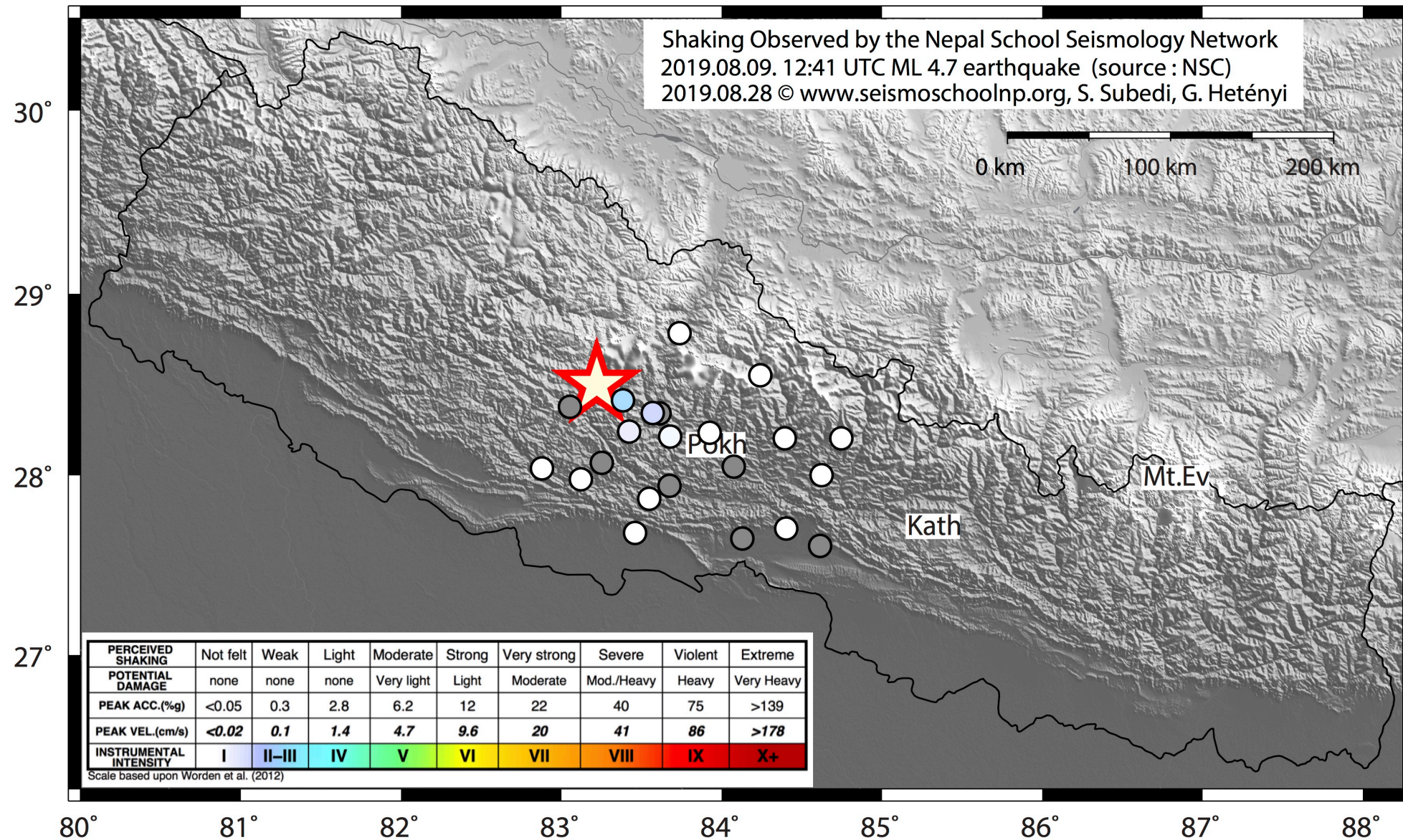
Magnitude calibration equation

The new magnitude equation is calibrated based on the NSSN data and is aimed to reproduce the magnitudes reported by the national agency.

The calibrated magnitude is

$$M_{NSSN} = 1.05 \times \log_{10}(PGV) + 1.08 \times \log_{10}(D) + 0.75$$

where PGV is in µm/s on the vertical component and D is epicentral distance in km

Educational implementation

(A) (B)

➢ Different educational activities have been organized to increase earthquake awareness and preparedness. (A) Teacher's training (B) Classroom activities in schools. See our other _EGUdisplay_ and our website for documents.

Conclusions

- The program jointly established an educational network with the close involvement of 22 schools, each hosting a low-cost seismometer which spans the Nepal School Seismology Network in the region where a great earthquake is due

- Various educational activities were performed, involving schools, students, teachers and communities

- Useful seismological results could be produced for both education (record sections, shake-maps) and research (event detectability)

- A new local magnitude equation for Nepal is calibrated based on the data observed by the NSSN, which is applicable to consistently compute the magnitude of forthcoming local events

www.seismoschoolnp.org

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