

StrongMotions
Knowledge and Clarity **Inc.**

**Ground Motion Record from
M 6.2 Norcia, Italy Earthquake of
August 24, 2016**

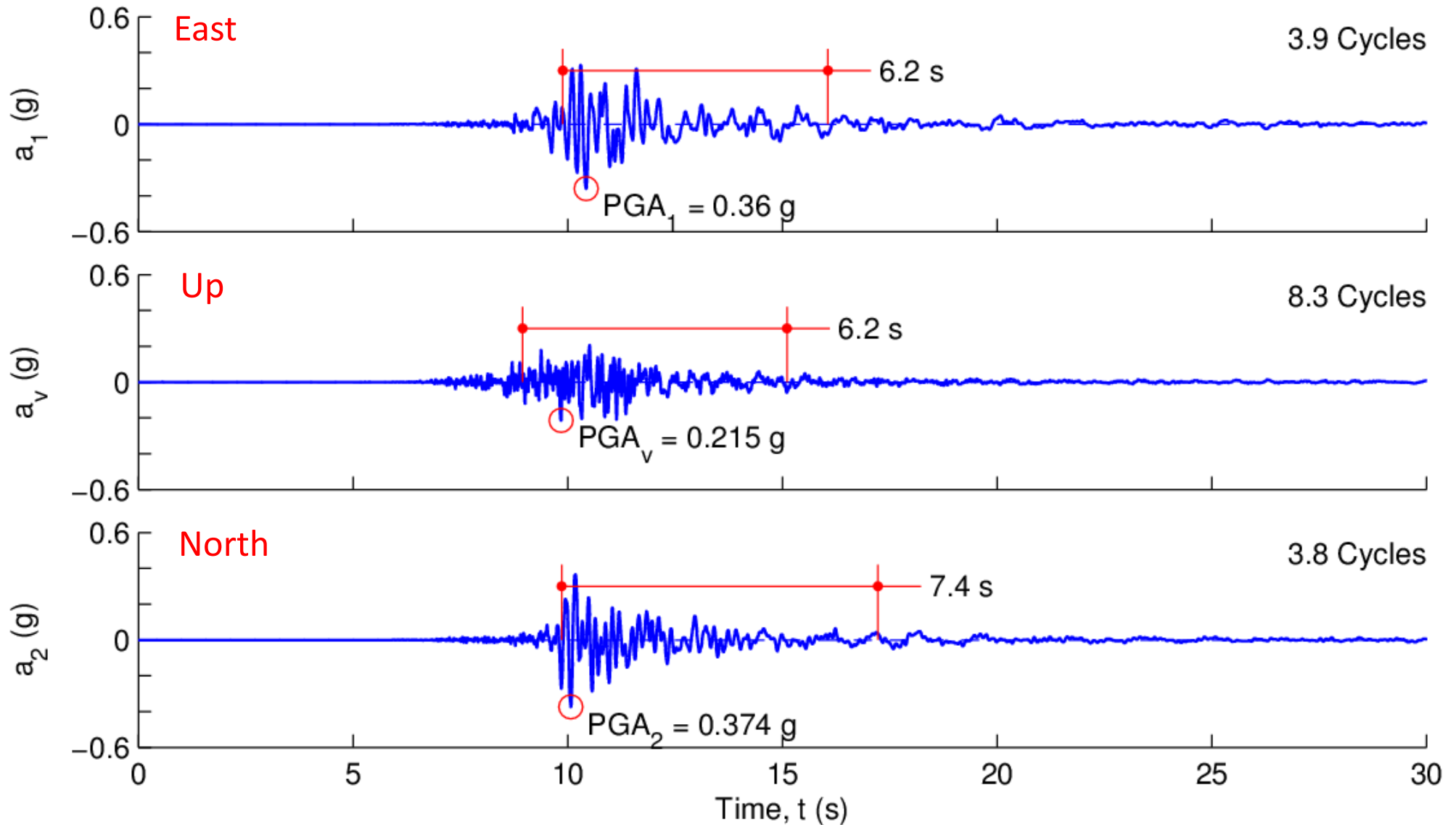
Praveen K. Malhotra

August 26, 2016

Acknowledgment

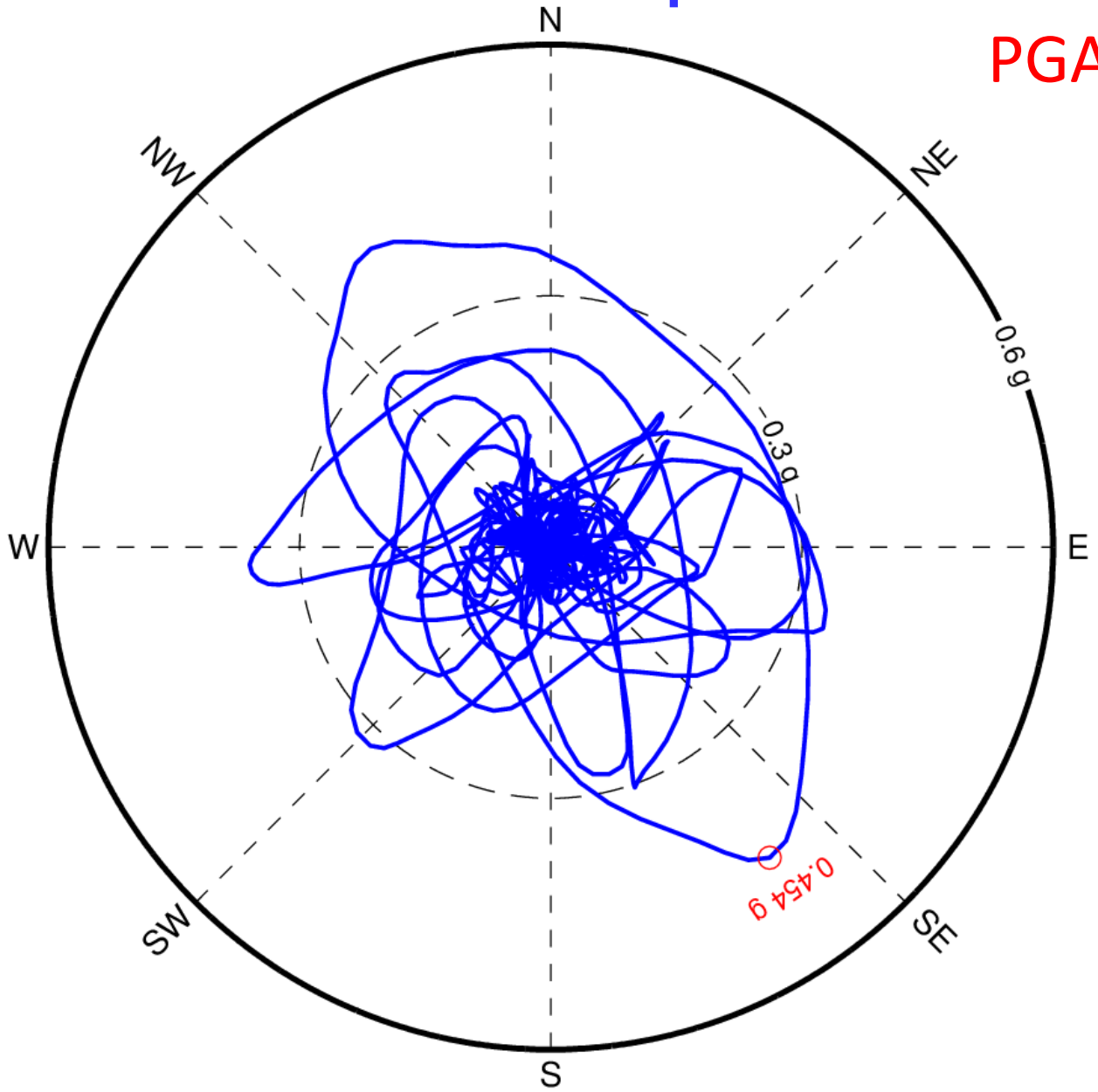
- Data processing is preliminary. No warranty of any kind is assumed
- Data may be obtained from **Italian National Strong Motion Network (RAN)** managed by the **Department of Civil Protection (DPC)**:
<http://ran.protezionecivile.it/IT/index.php>
- Professor Fabrizio Paolacci and Ms. Lucina Corradi helped access the data

Accelerations in Norcia 14 km from Epicenter

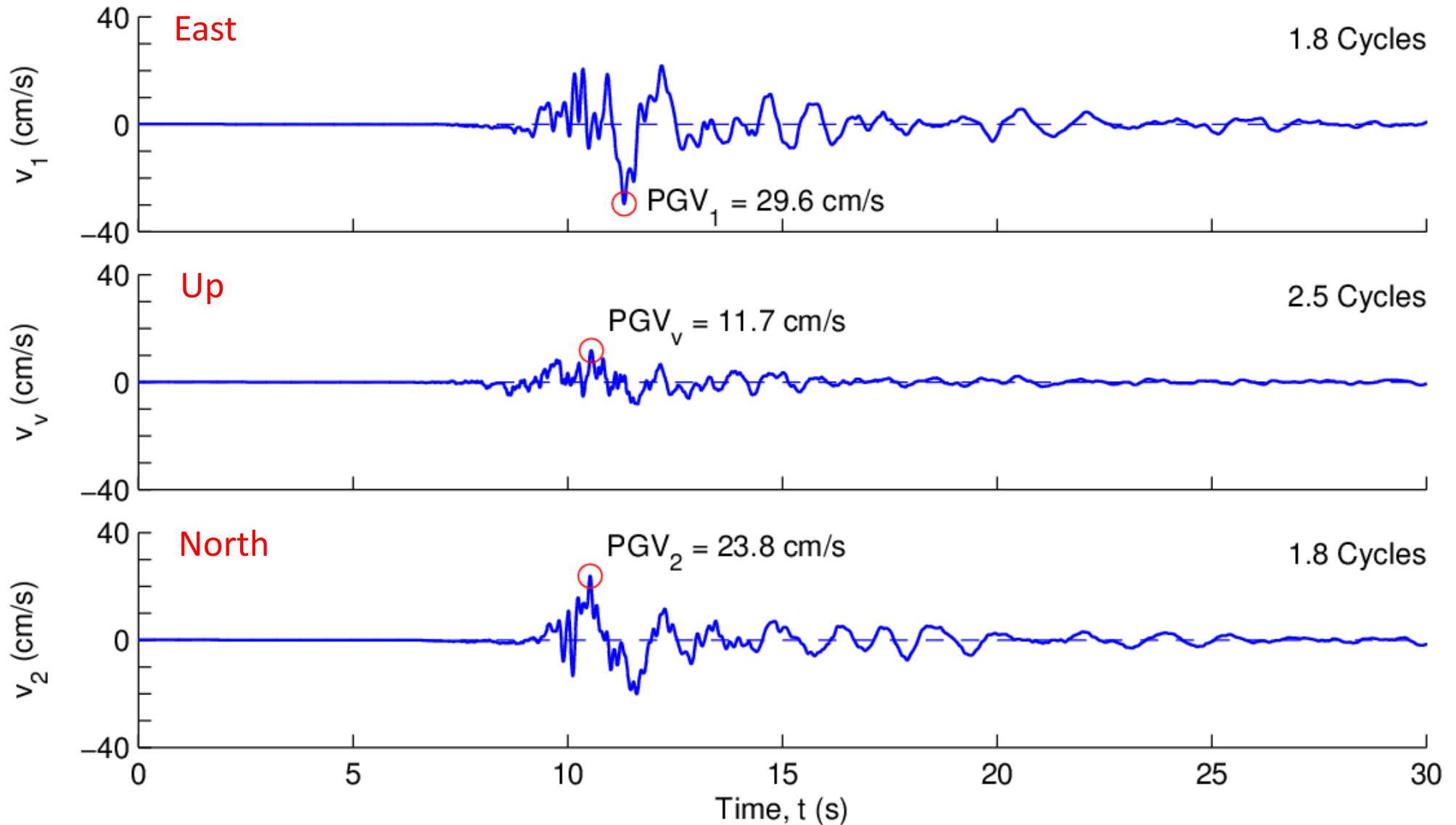


Resultant Horizontal Accelerations in Norcia 14 km from Epicenter

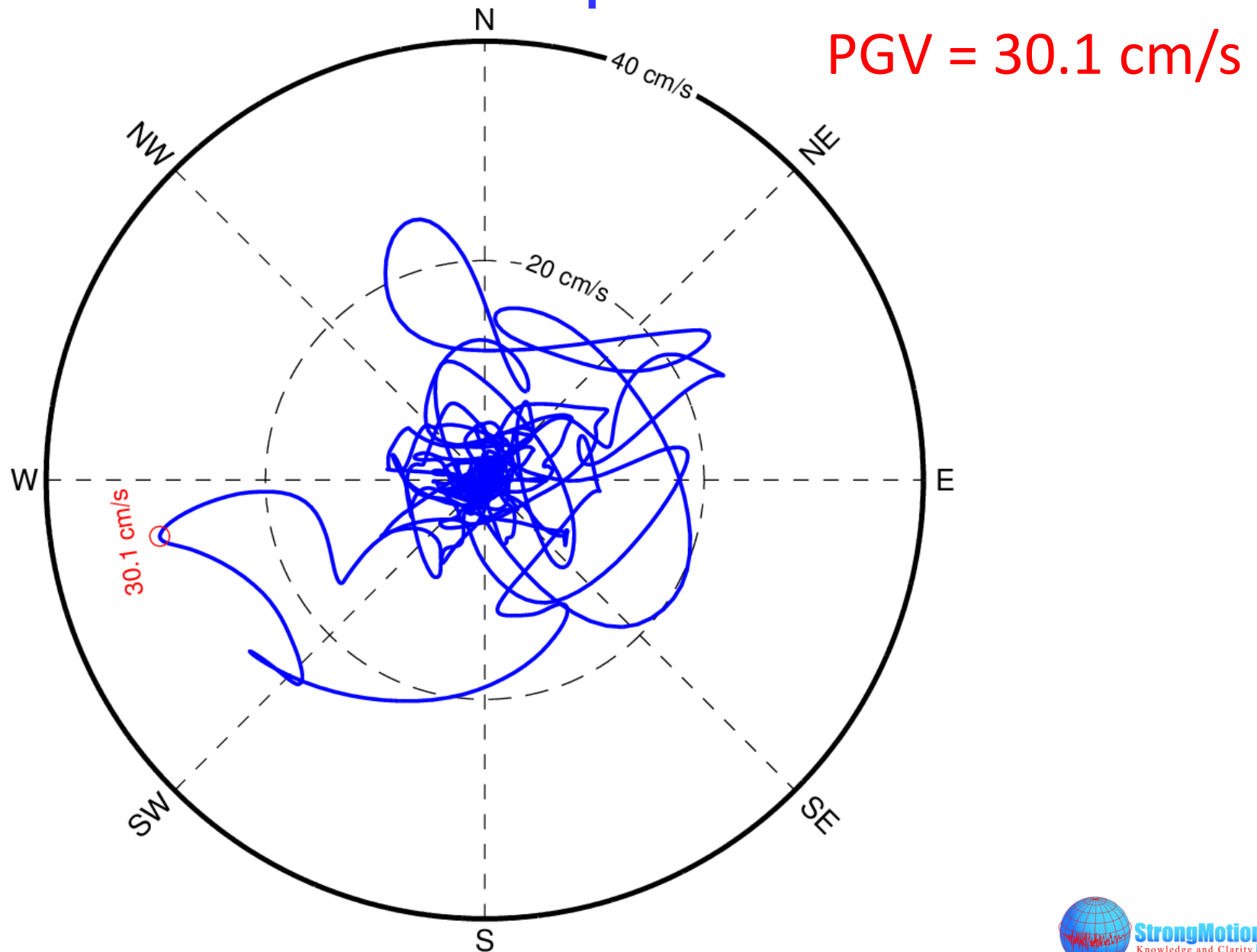
PGA = 0.454 g



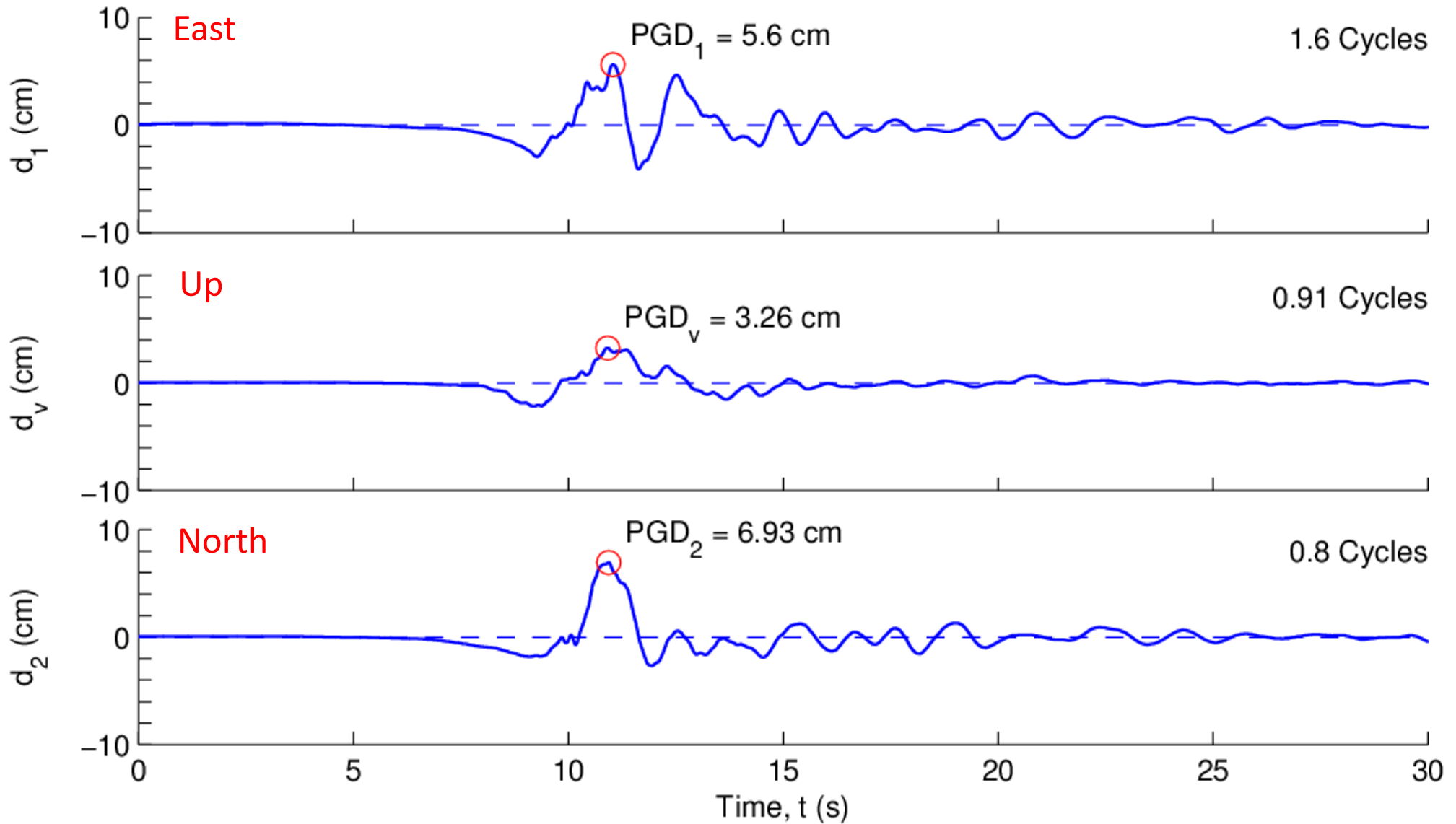
Velocities in Norcia 14 km from Epicenter



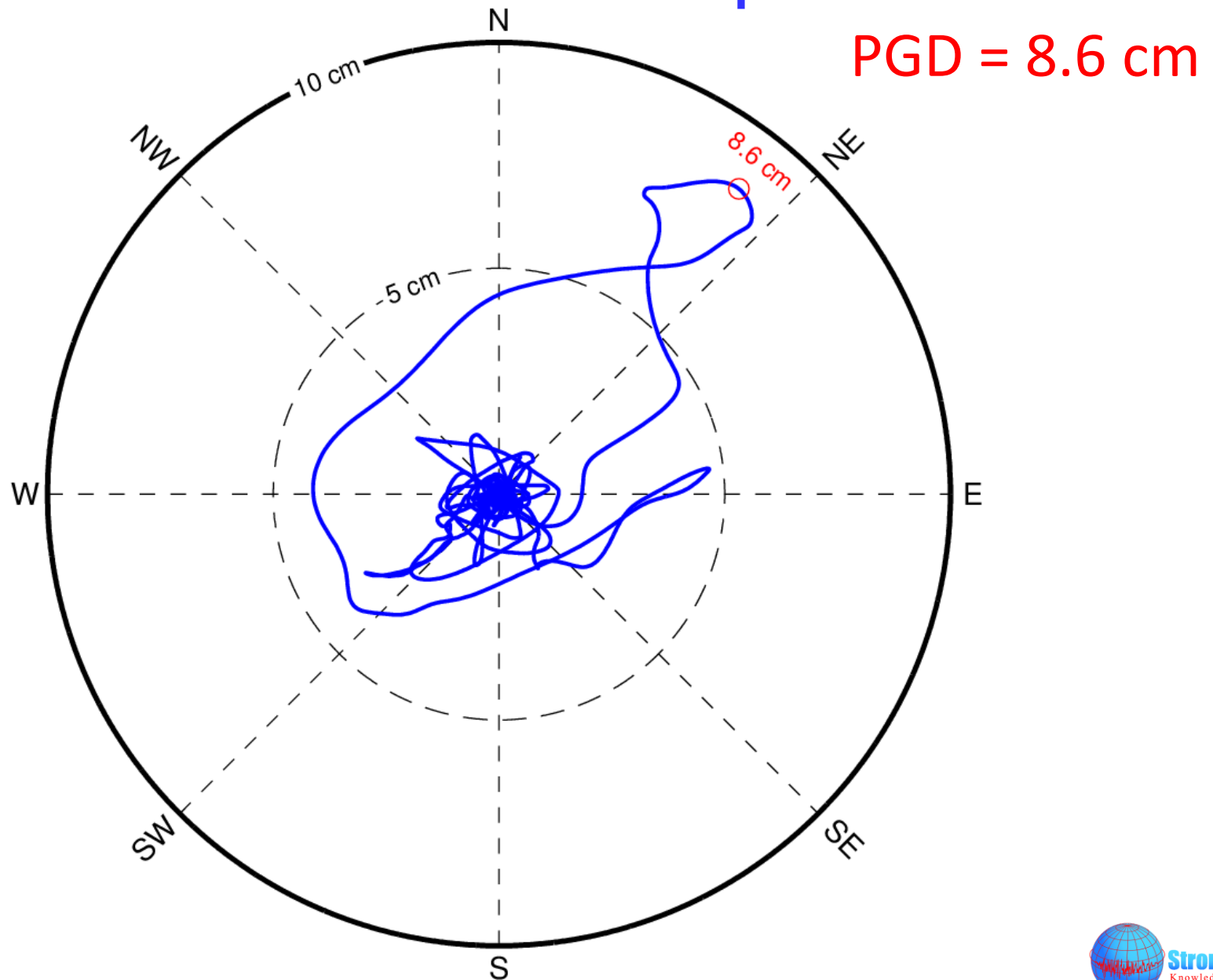
Resultant Horizontal Velocities in Norcia 14 km from Epicenter



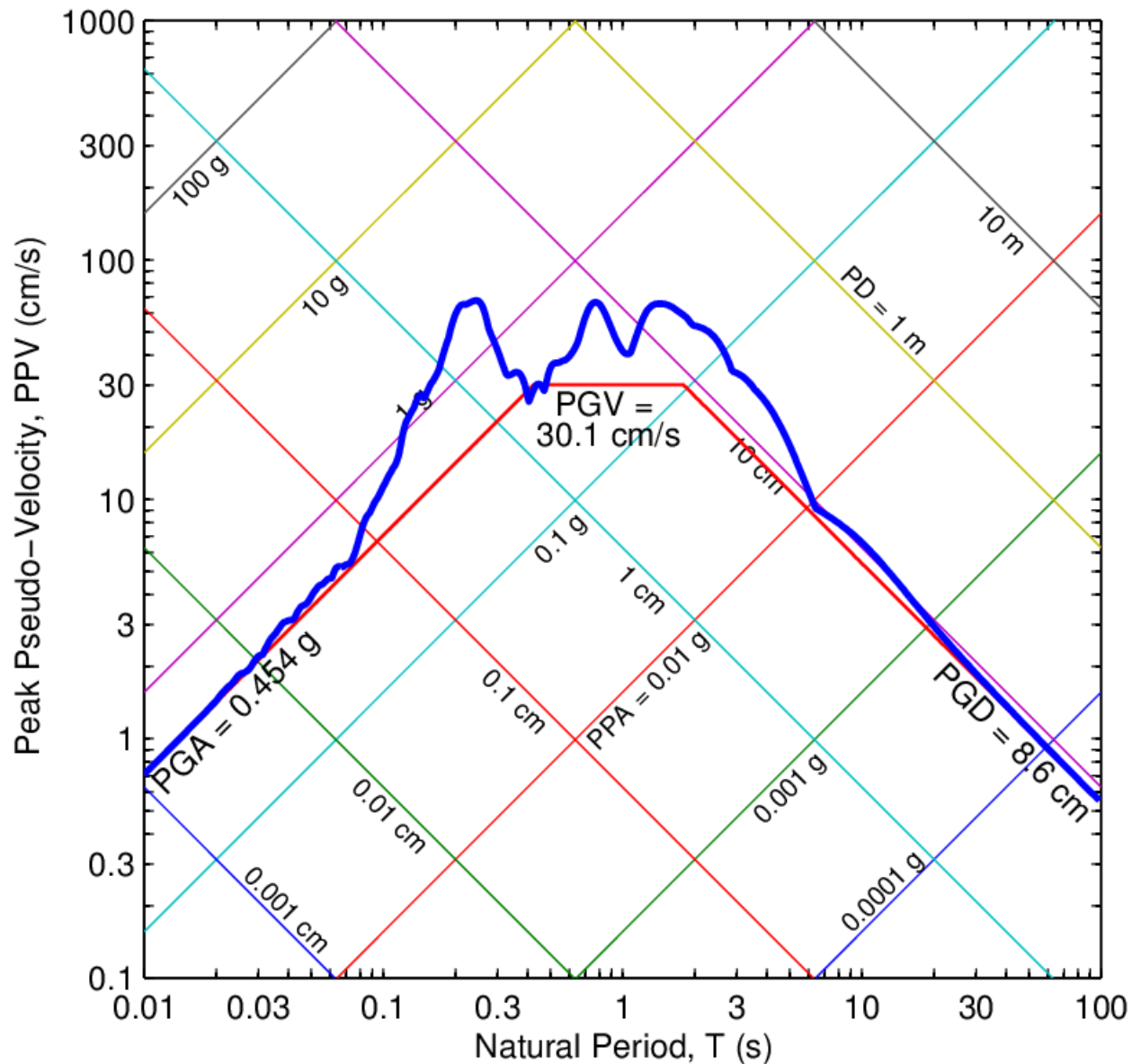
Displacements in Norcia 14 km from Epicenter



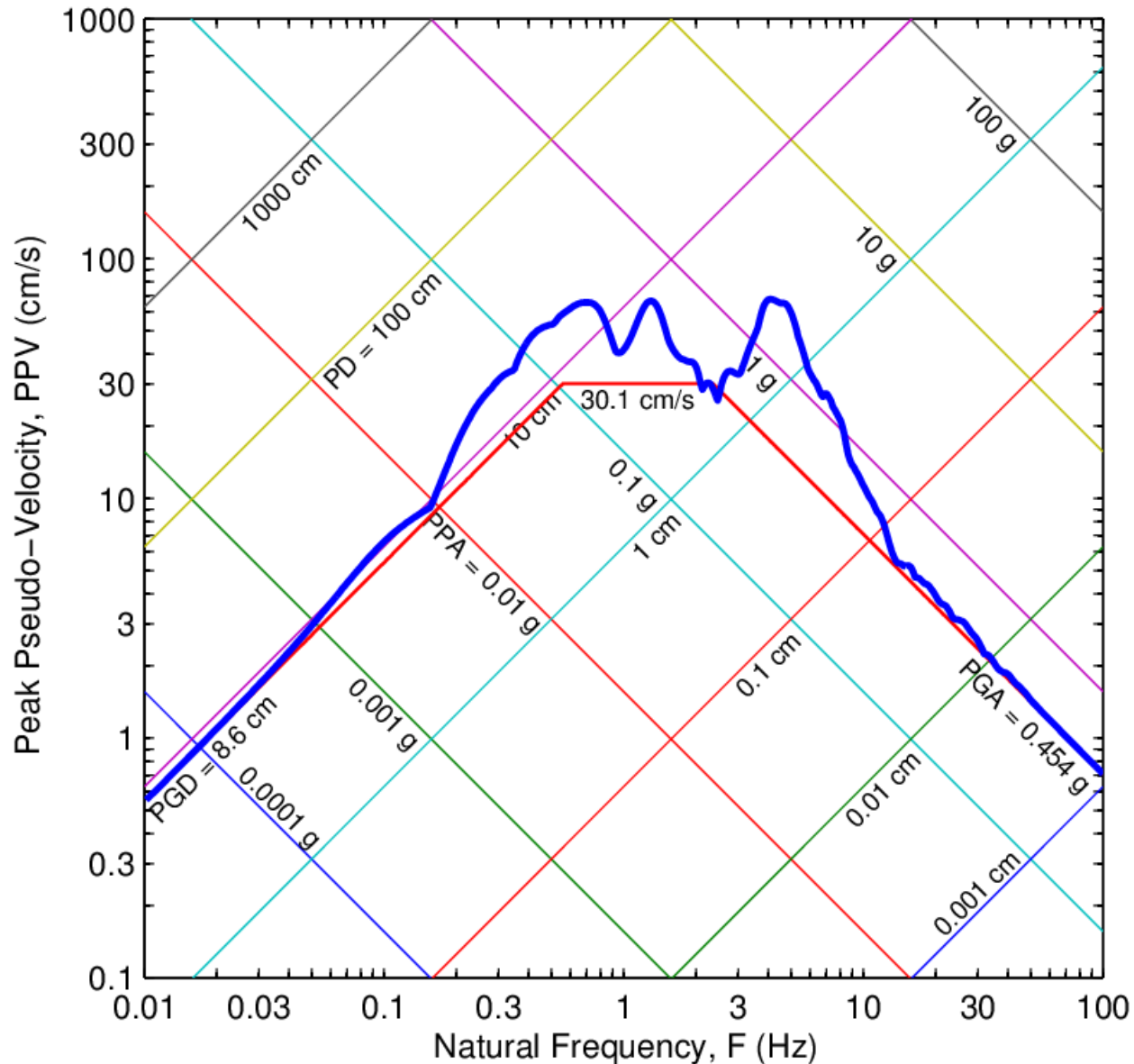
Resultant Horizontal Displacements in Norcia 14 km from Epicenter



5% Damping Response Spectrum of Horizontal Ground Motion in Norcia (versus Period)



5% Damping Response Spectrum of Horizontal Ground Motion in Norcia (versus Frequency)



Central Period & Normalized Velocity

- Central period,

$$T_c = 2\pi (PGD/PGA)^{0.5} = 0.9 \text{ s}$$

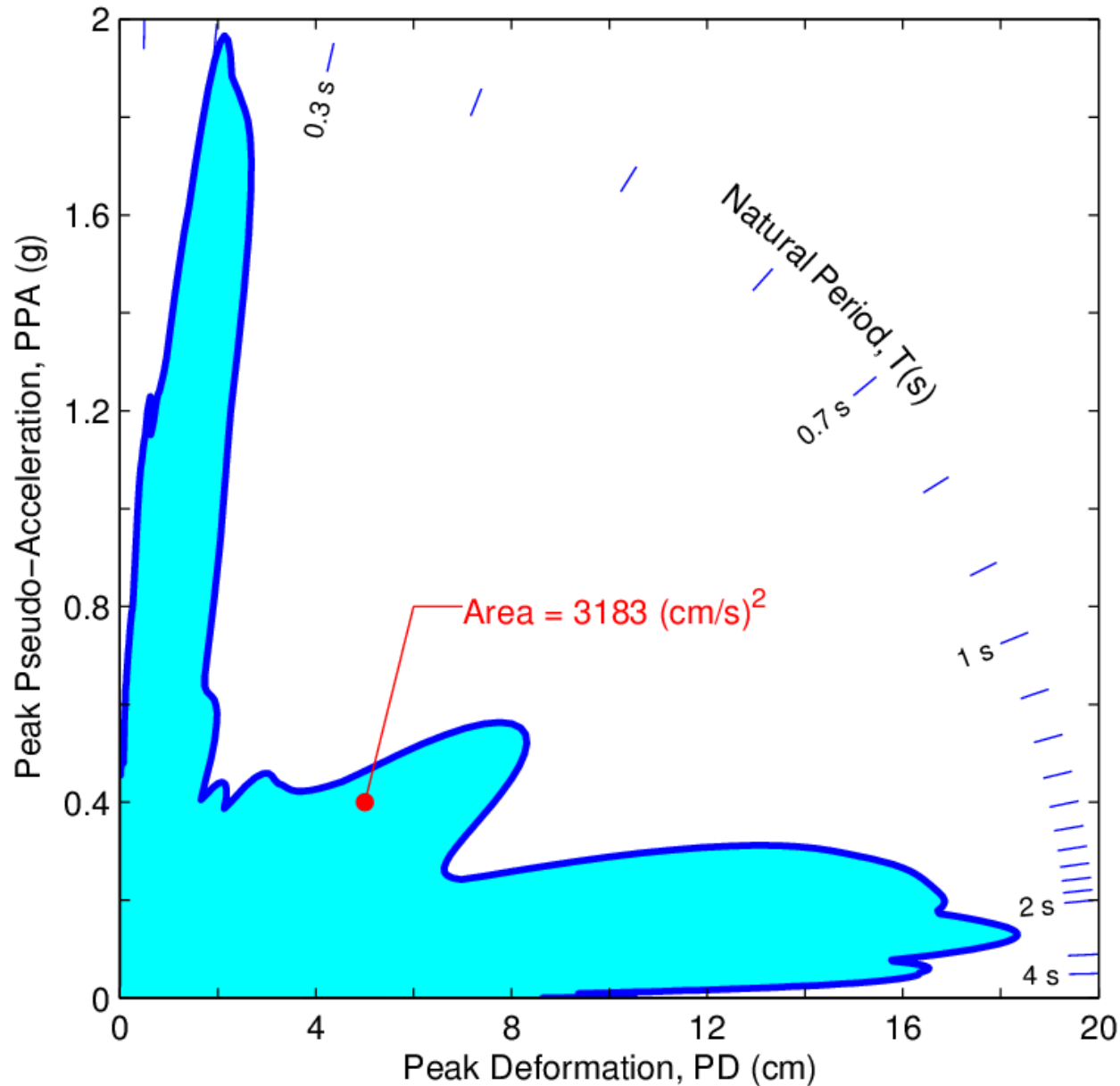
Hence, medium-frequency ground motion

- Normalized velocity,

$$PGV_n = PGV/(PGD \cdot PGA)^{0.5} = 0.5$$

Hence, medium-band ground motion

Acceleration-Deformation Response Spectrum of Horizontal Ground Motion in Norcia



Deformation Demands on Structures of Various Lateral Strengths

| Lateral Resistance (% of Weight) | Deformation Demand (cm) |
|-------------------------------------|----------------------------|
| 50% | 1.9 cm |
| 30% | 6.8 cm |
| 25% | 6.7 cm |
| 20% | 17 cm |
| 10% | 17 cm |

Observations

- High deformation demand on weak structures with lateral strength $< 25\%$ of weight. Hence, damaging to weak, brittle systems
- Duration and number of cycles are consistent with the magnitude of earthquake
- Medium-frequency, medium-band ground motion