Progetti Sismologici

GIORNATA di LAVORO

“RELAZIONI DI ATTENUAZIONE”

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Maximum Observable Shaking (MOS) maps of Italy

by UR 3.13 (S1 project)

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UR 3.13 “Reference ground-shaking map of the Italian territory”

Objective n°1

Maximum Observable Shaking (MOS) maps of the Italy

Objective n°2

Definition of near-field areas surrounding major seismogenic sources

1. **The MOS “Maximum Observable Shaking” is a deterministic reference motion, computed at the bedrock level**

2. We can discuss Attenuation Relationships in terms of MOS concept

3. MOS is a deterministic reference motion that can be considered as a limit (**upper bound**) to the shaking computed from “spectral attenuation relationships” (i.e. PGA, PGV, Arias Intensity, SI (Housner Intensity), SA, PSV and SD).

The MOS concept

- **Broad Band**: need to reproduce the Near- and Far-source properties of the wave fielfd, combining **deterministic low-frequency** waveforms with **stochastic high-frequency** synthetics

- **Maximum Observable Shaking (MOS)**

- **DISS: Seismic Zone (SZ),** Maximum Credible Earthquake **(MCE)**, Typical Fault **(TF)**

- **Credible Rupture Model**
  It's kinematic: slip distribution map, but rise time constant, and rupture velocity are constant.

- **Roto-translation** of the ground shaking computed for each segment of the SZ. We take the maximum of the shaking

Amplitude spectra are reconciled at intermediate frequencies, where their domain of validity overlaps (Mai and Beroza, 2003).

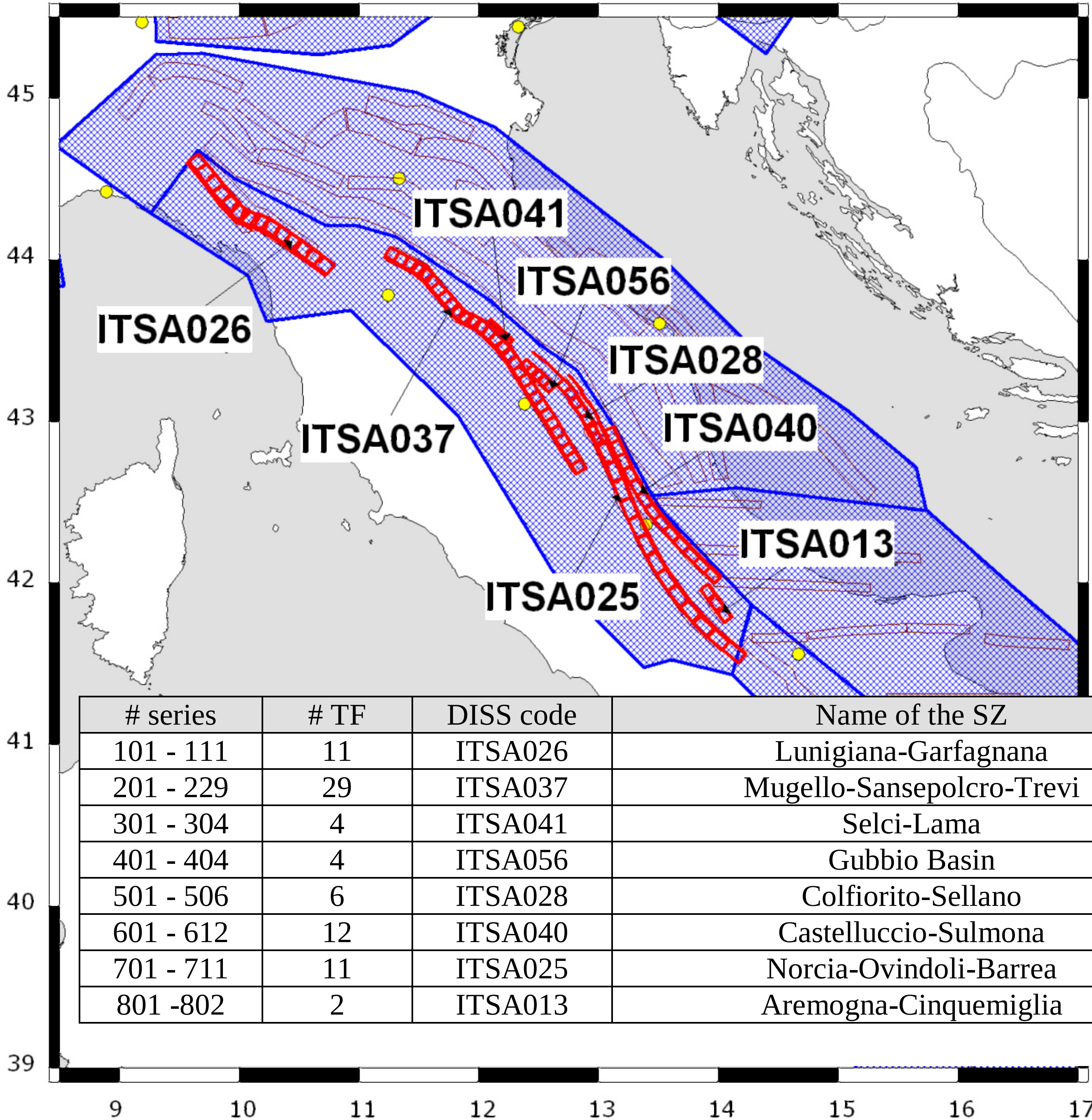
The maximum shaking (PGA, SI) that potentially may occur in a given area, in response to Maximum Credible Earthquakes (Lorito et al 2009) acting on a Source Zone (SZ)

For each SZ an Maximum Credible Earthquake (MCE) is associated to a Typical Fault (TF) that floats along the entire SZ

Slip is a "constrained" stochastic process (*Mai and Beroza, 2002*) where correlation lengths are computed from their scaling with Mo.

Basili R., G. **Valensise**, P. **Vannoli**, P. **Burrato**, U. **Fracassi**, S. **Mariano**, M.M. **Tiberti**, and E. **Boschi** (2008). The Database of Individual Seismogenic Sources (DISS), version 3: summarizing 20 years of research on Italy's earthquake geology, *Tectonophysics*, doi:10.1016/j.tecto.2007.04.014.

The case of entire Macro Region MR4



# series	# TF	DISS code	Name of the SZ	Mw	Depth
101 - 111	11	ITSA026	Lunigiana-Garfagnana	6.3	1.0 km
201 - 229	29	ITSA037	Mugello-Sansepolcro-Trevi	6.1	0.6 km
301 - 304	4	ITSA041	Selci-Lama	5.5	1.0 km
401 - 404	4	ITSA056	Gubbio Basin	6.0	2.5 km
501 - 506	6	ITSA028	Colfiorito-Sellano	6.0	3.4 km
601 - 612	12	ITSA040	Castelluccio-Sulmona	6.4	1.0 km
701 - 711	11	ITSA025	Norcia-Ovindoli-Barrea	6.7	1.0 km
801 -802	2	ITSA013	Aremogna-Cinquemiglia	6.4	1.0 km

The case of SEISMIC SOURCE ITSA025

Seismic Zone : ITSA025
(11 segments TF)

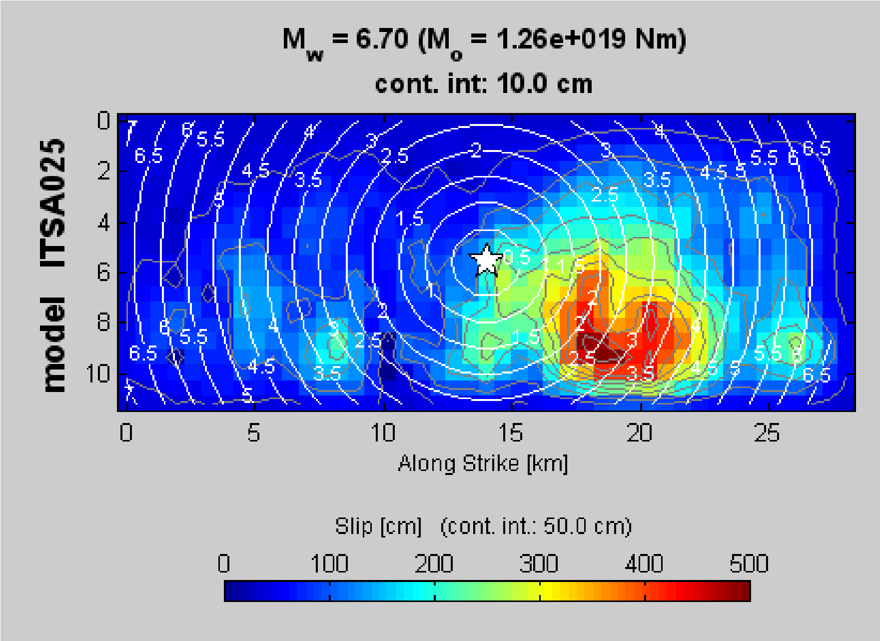
TF and **MCE** are based on the Avezzano 1915 quake Mw 7.0

For our computation
we use Mw_{MCE} = 6.7
L=28 km, W=15.4 km, Ztop=1 km
[based on geodetic and seismological data mainly]

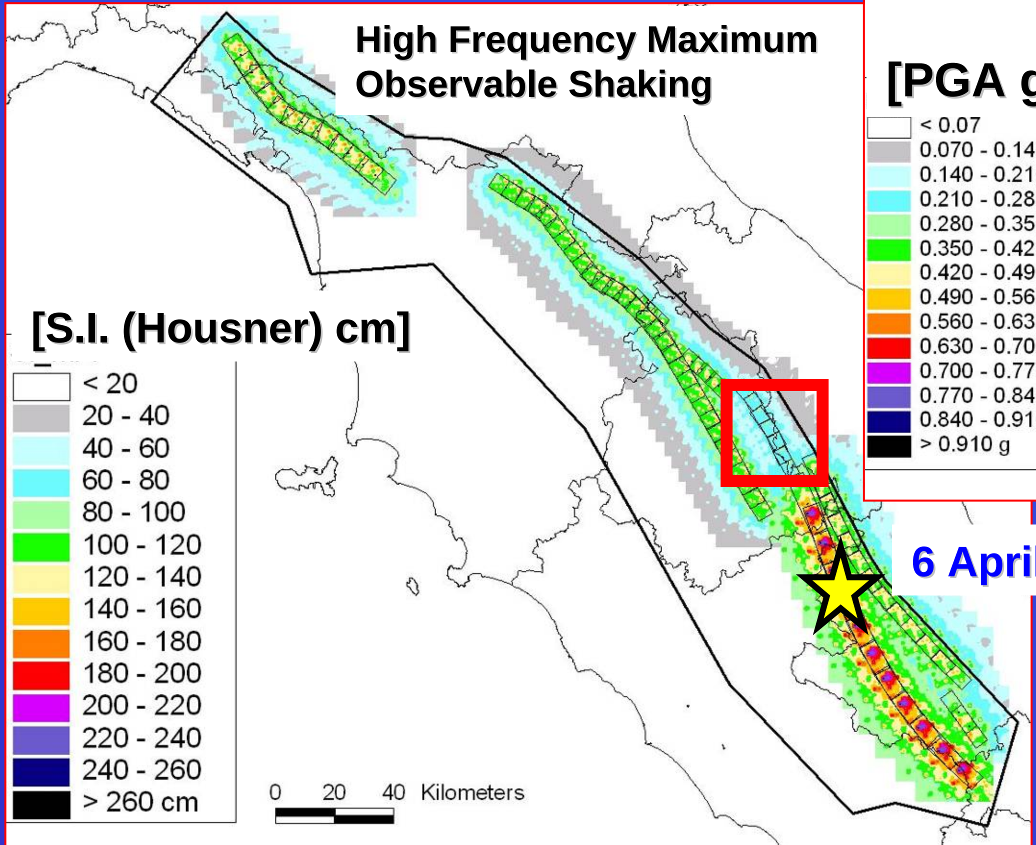
CREDIBLE RUPTURE MODEL

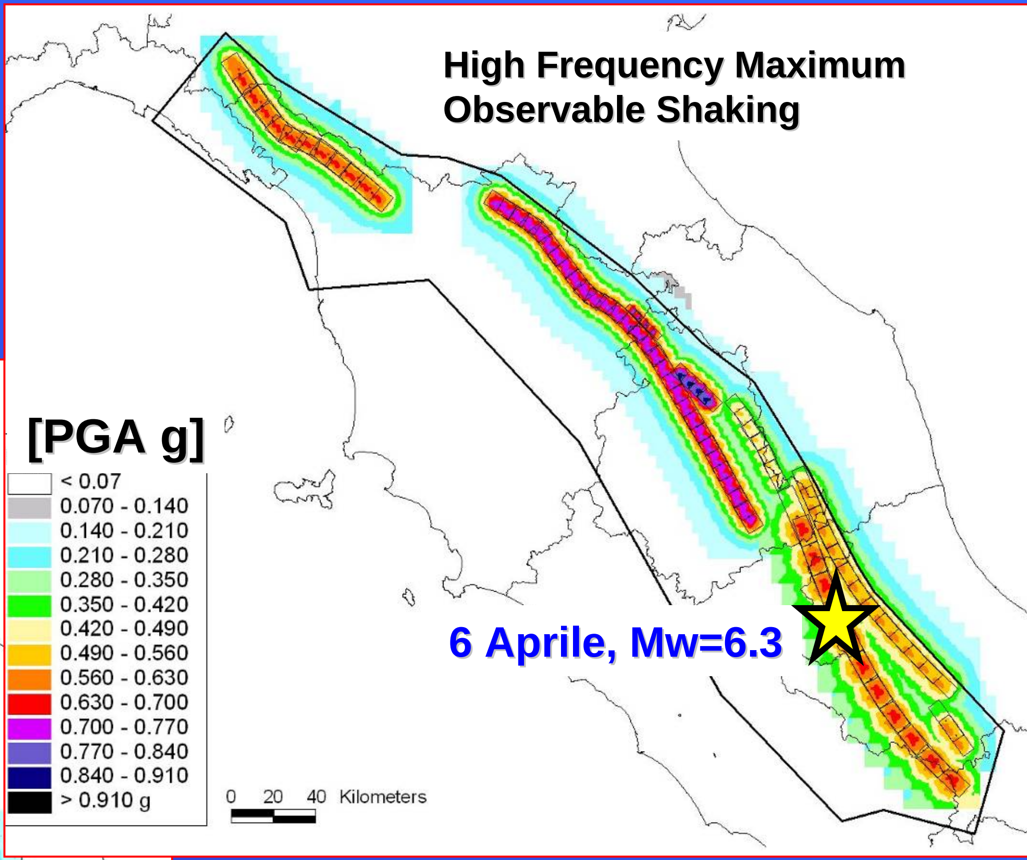
Compute the ground shaking for an area surrounding 20 km the TF and let it shift along the SZ

When a site has more than one value of shaking we take the maximum



HF MOS and future BB MOS





Avezzano, 1915 MCE
Mw_{MCE}= 6.7
L=28 km, W=15.4, Ztop=1 km

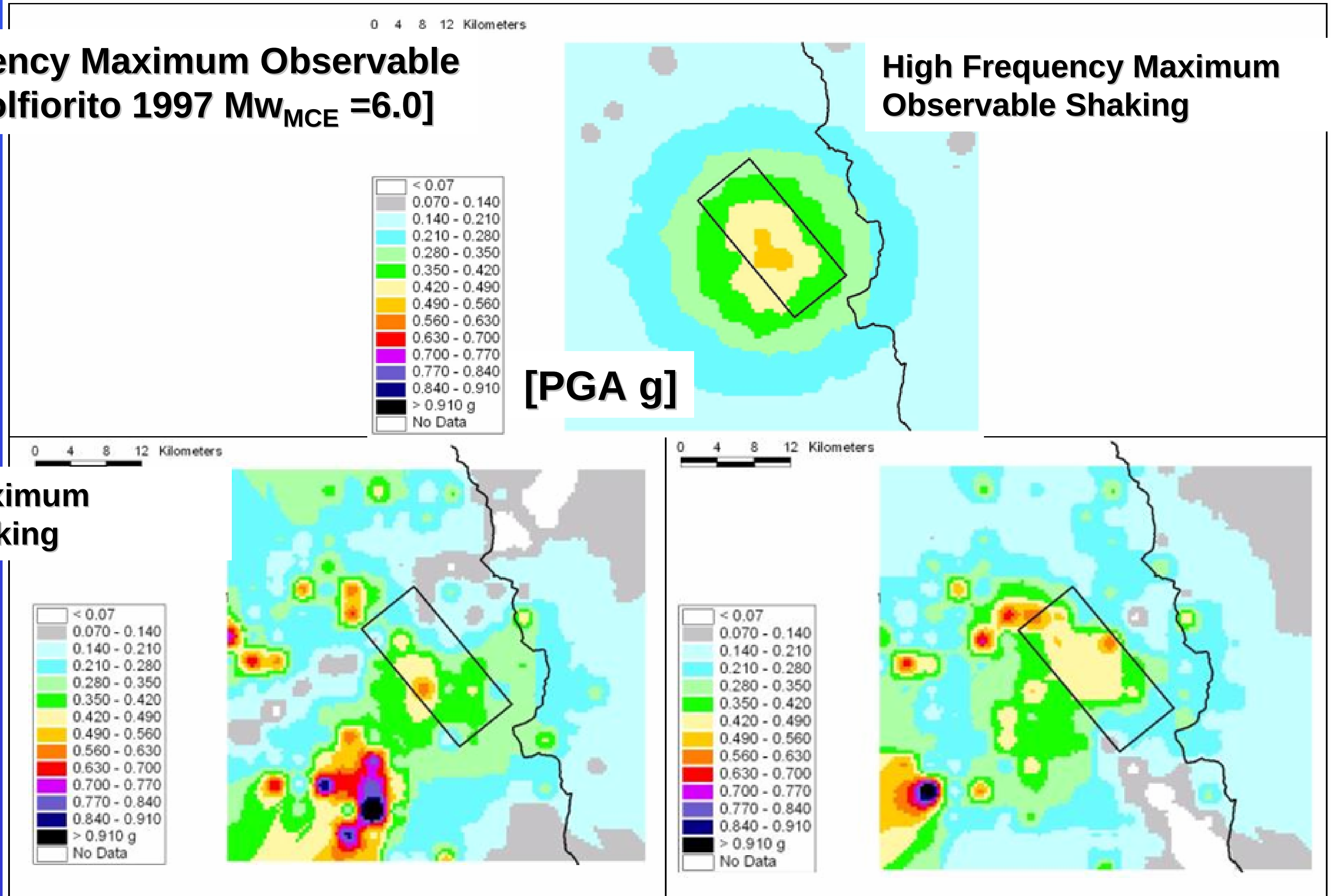
HF MOS and future BB MOS

High Frequency Maximum Observable Shaking [Colfiorito 1997 Mw_{MCE} =6.0]

[PGA g]

High Frequency Maximum Observable Shaking

Broad Band Maximum Observable Shaking



Comparison between HF and BB derived PGA maps

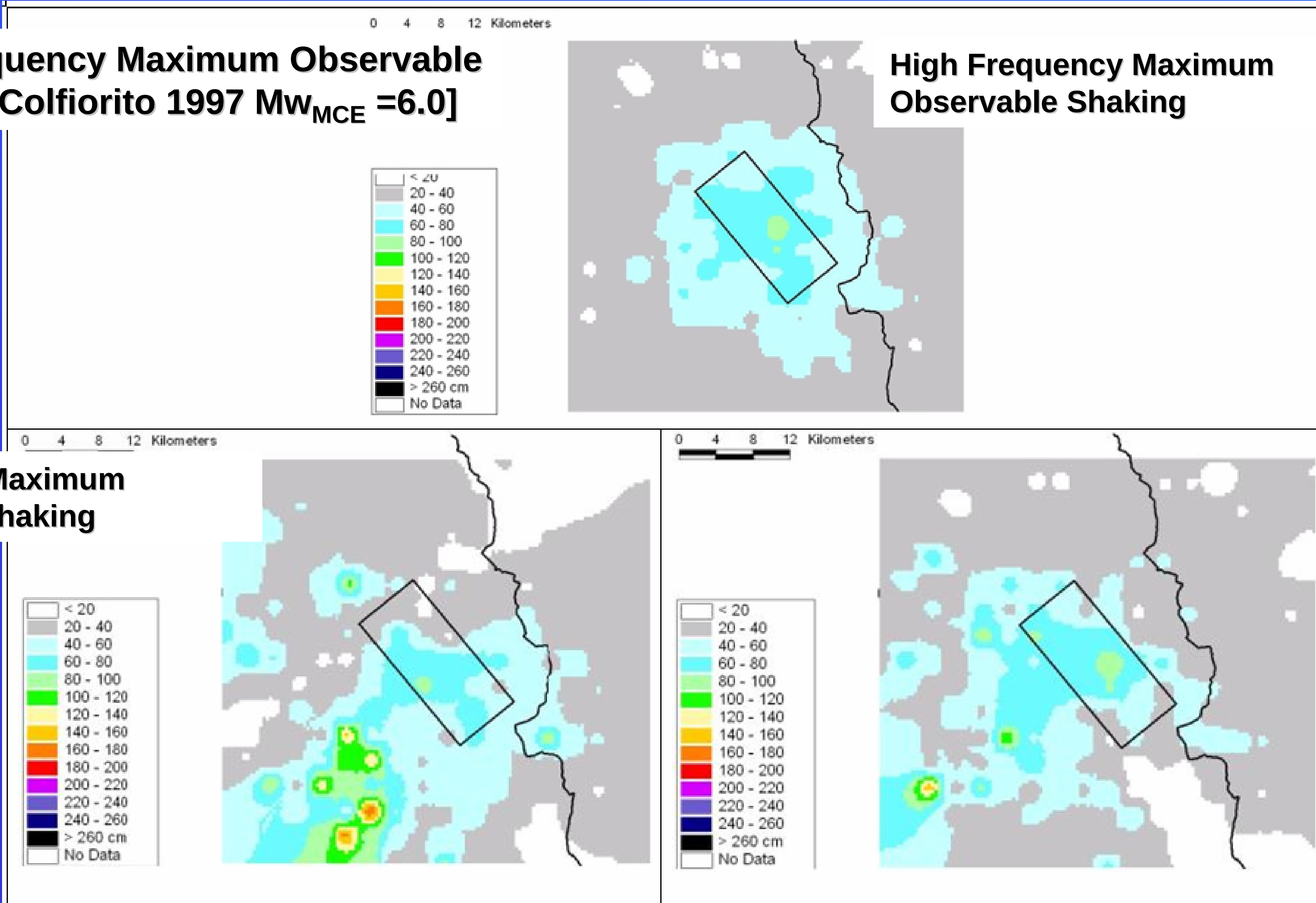
HF MOS and future BB MOS

High Frequency Maximum Observable Shaking [Colfiorito 1997 Mw_{MCE} =6.0]

[SI cm]

High Frequency Maximum Observable Shaking

Broad Band Maximum Observable Shaking



Comparison between HF and BB derived SI maps

FINAL REMARKS

1. **GMP Equations have been derived based on** different fault-distances metrics, considering magnitude, style of faulting and various site parameters, but they do not consider finite-fault effects (aside from directivity corrections), the effects of potentially heterogeneous slip distribution, or the influence of the relative position of the nucleation point with respect to the overall fault, the areas of large moment release on the fault, and the site location.

2. **Because ground-shaking scenarios are based** on a much wider range of physics-based source properties, they could be used for developing future GMP's that, starting from recorded strong motion data, need to be completed with a much wider range of information.