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Servizio Sismico Svizzero
Swiss Seismological Service

ETH zürich

Secondary (triggered) earthquake hazards (landslides, liquefaction) in Swiss ShakeMaps

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ECGS & ESC/EAEE Workshop

European Center for Geodynamics and Seismology

european center for geodynamics and seismology
centre européen de géodynamique et de séismologie

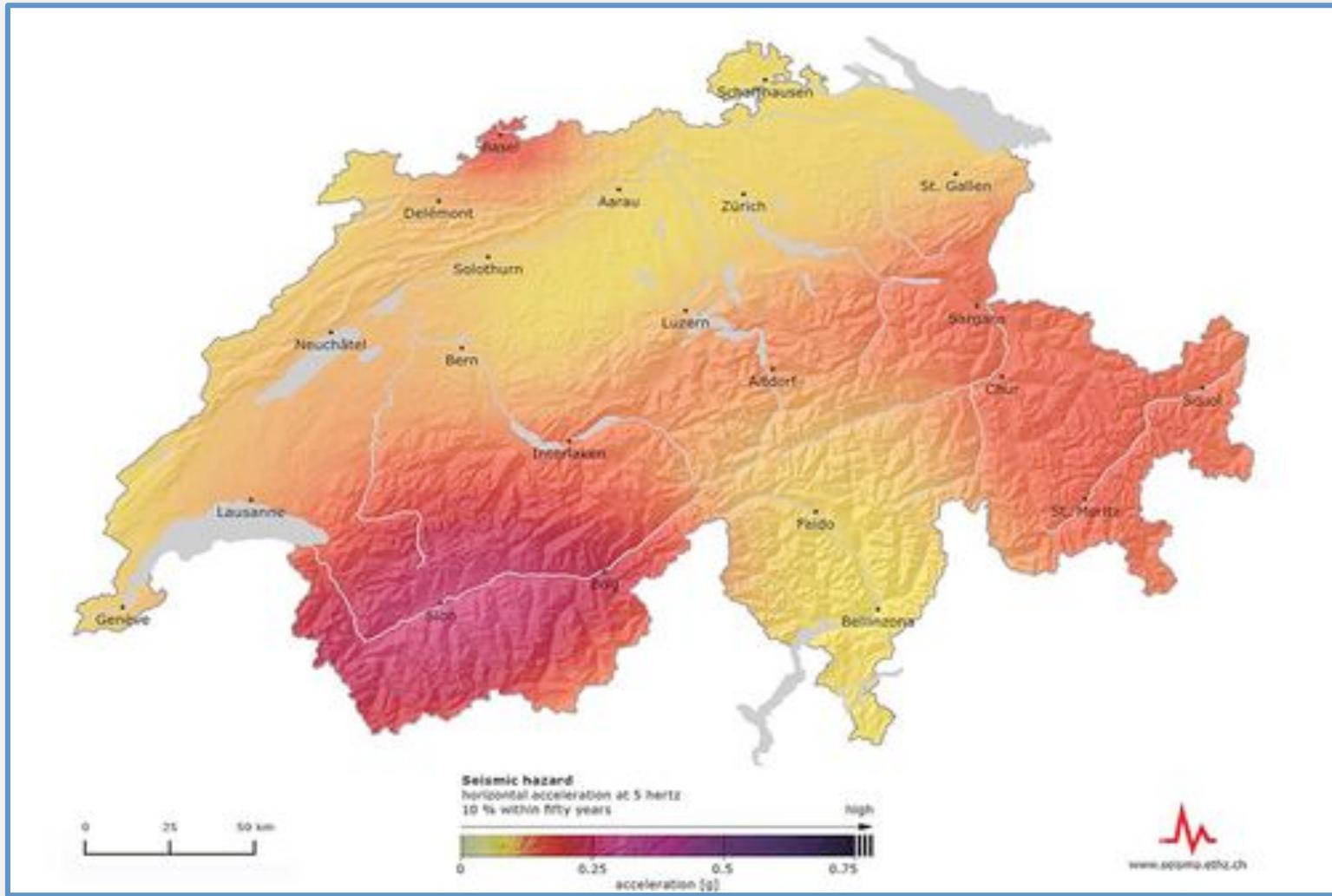


Swiss seismic hazard map 2015



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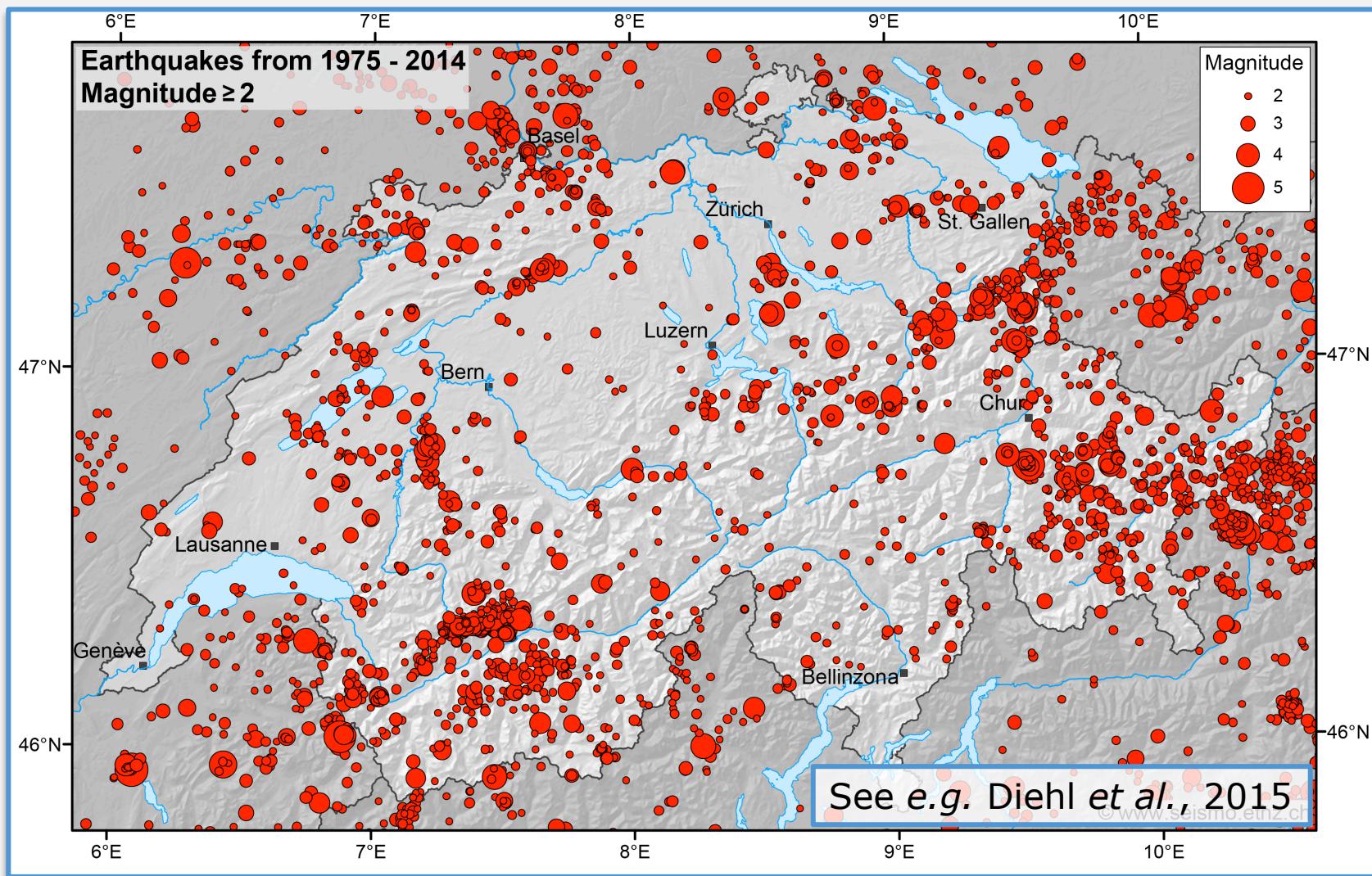


Instrumental seismicity



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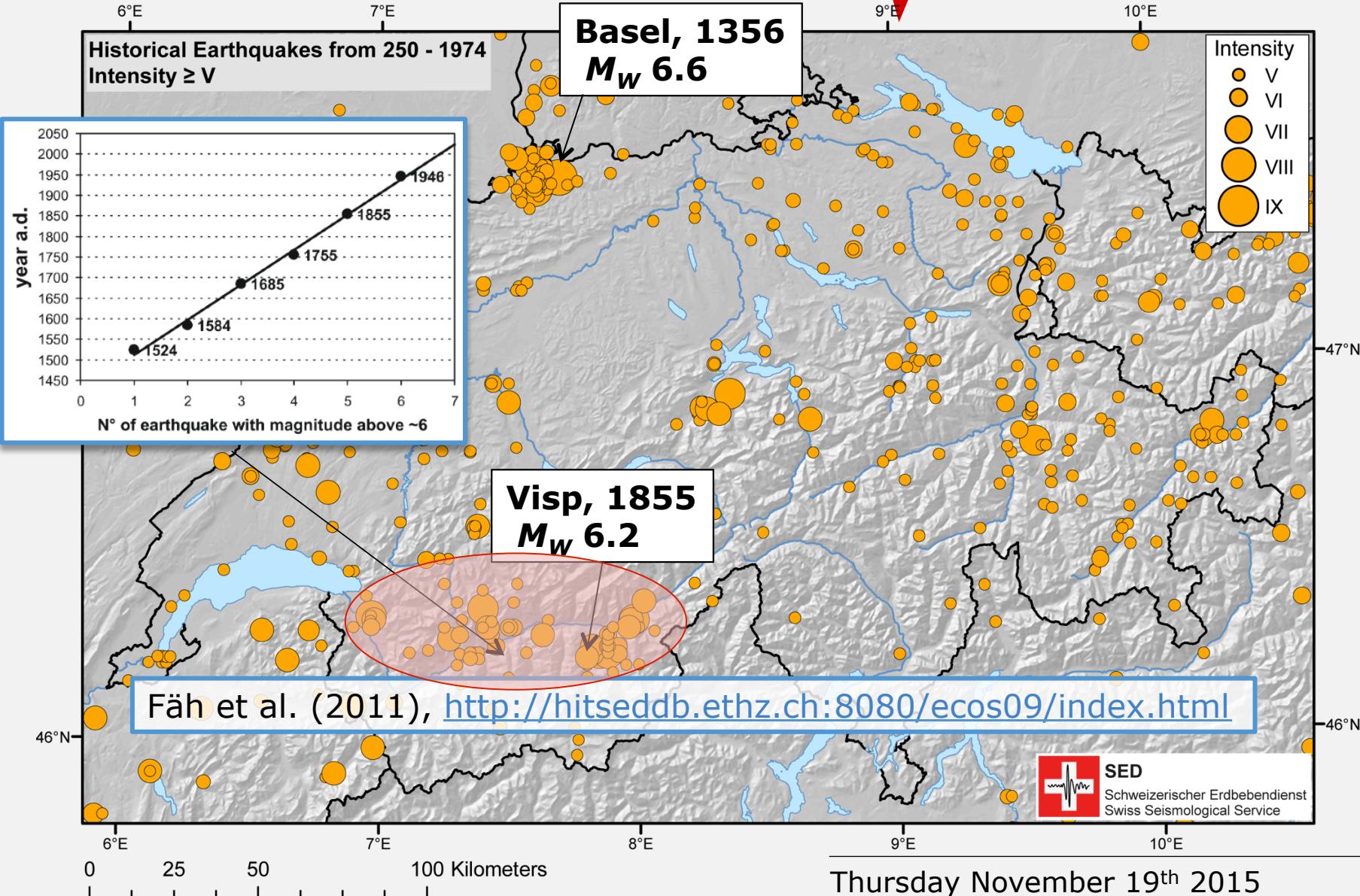


Historical seismicity



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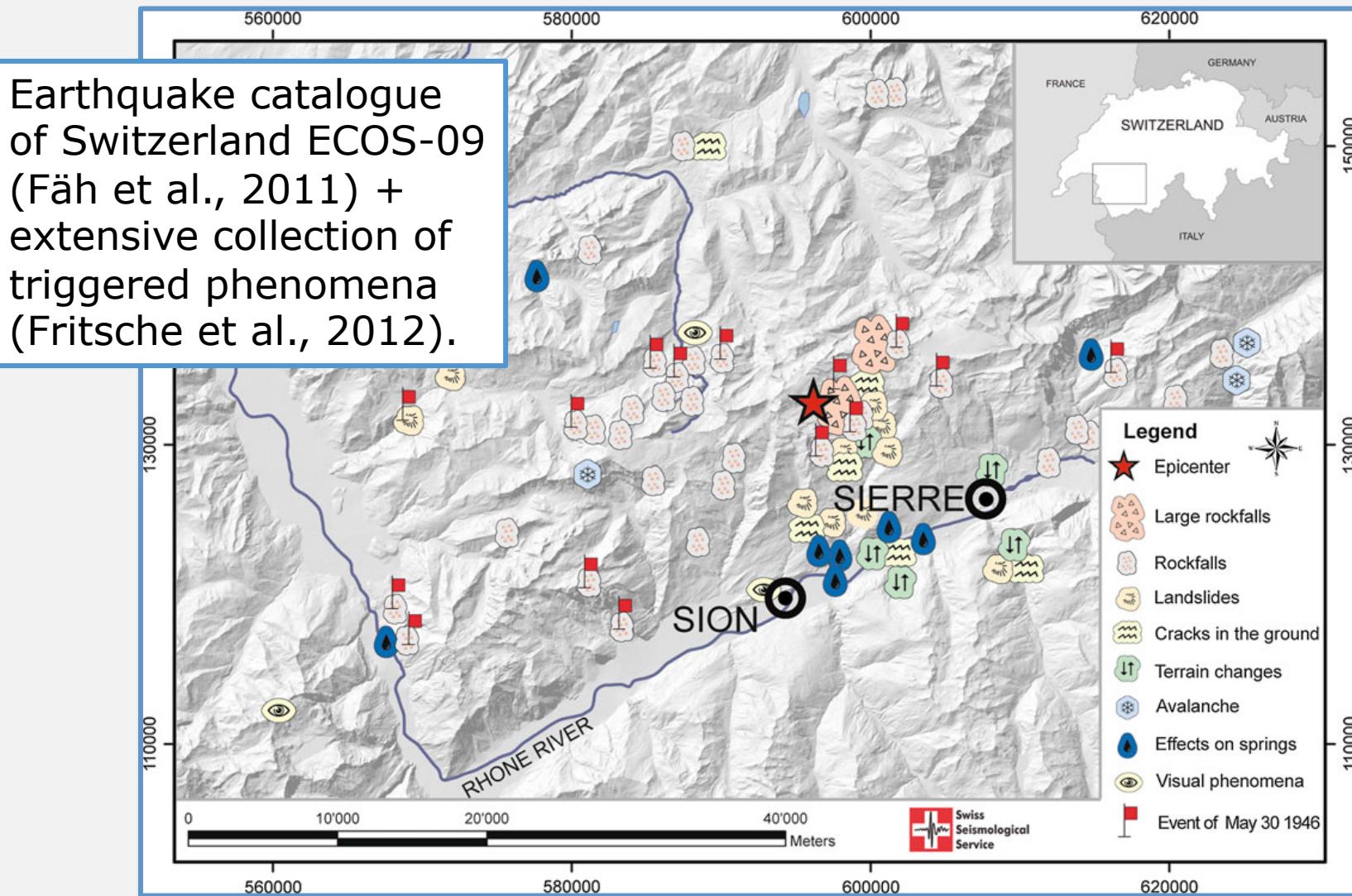


Catalogues



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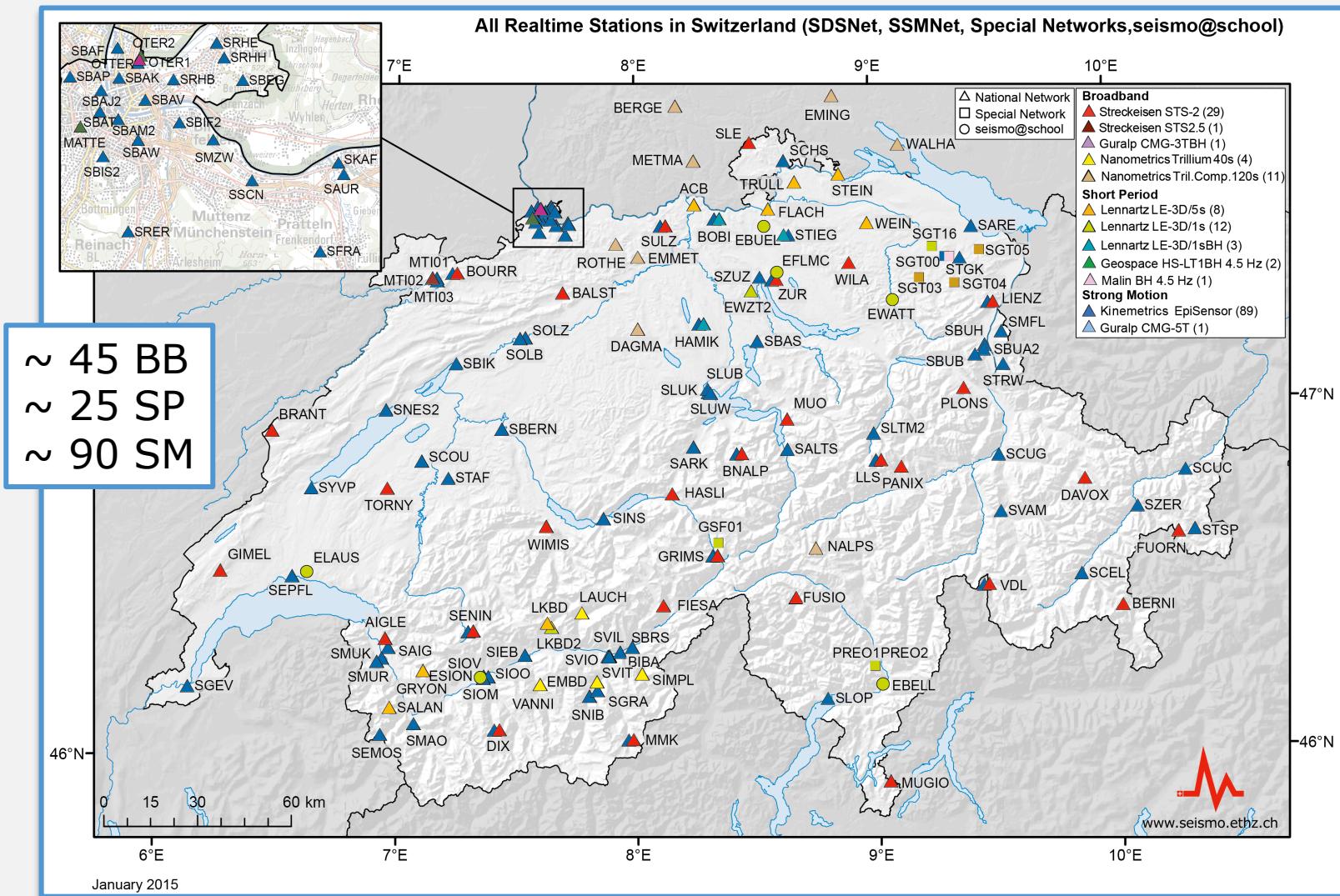


Real-time Swiss national seismic networks



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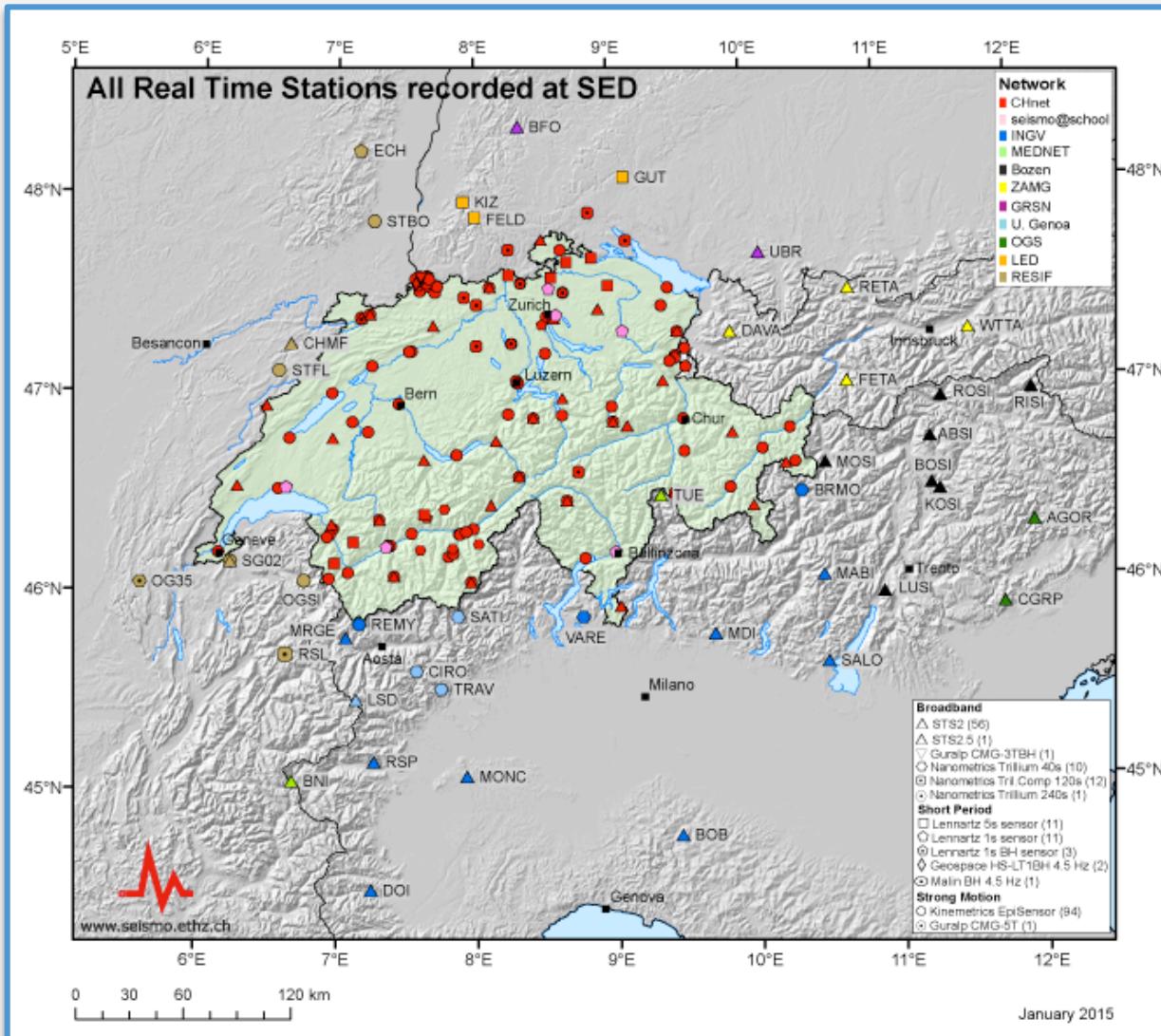


International data exchange



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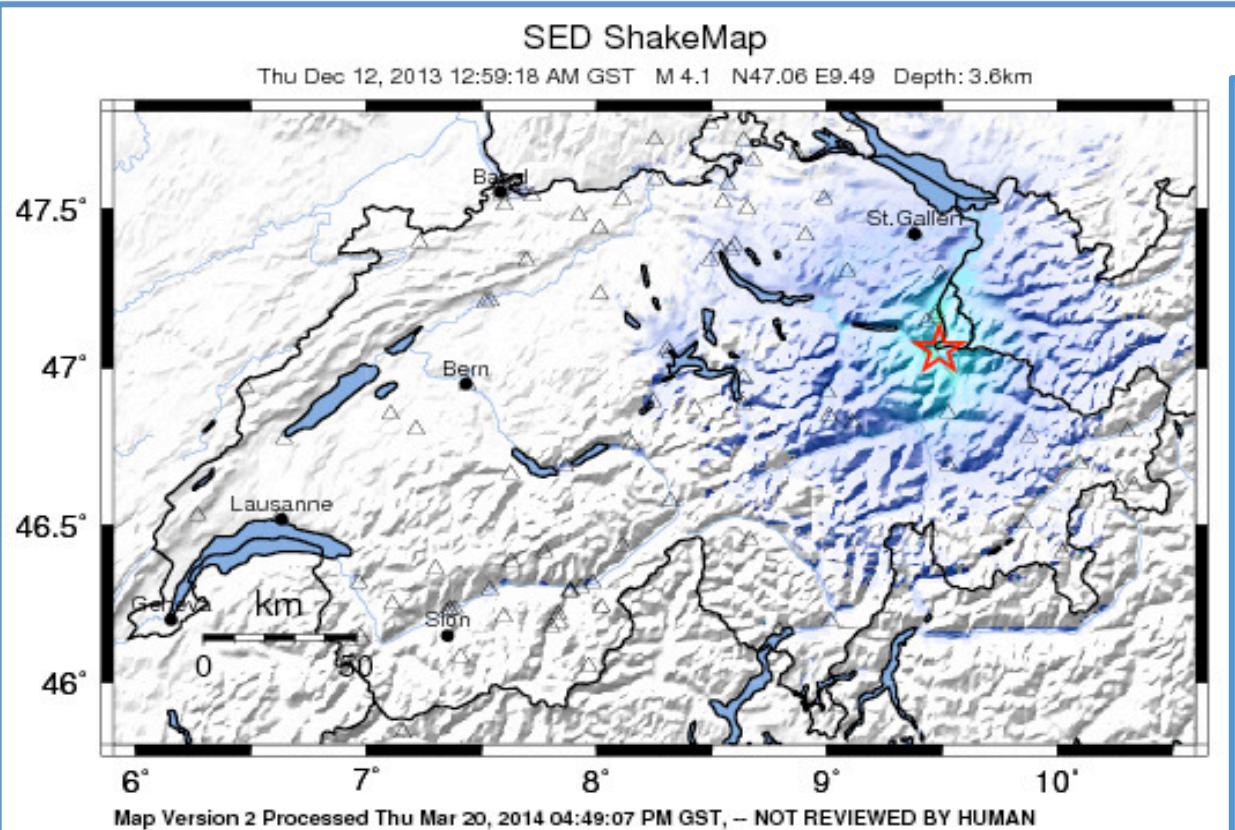


Swiss ShakeMap



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PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

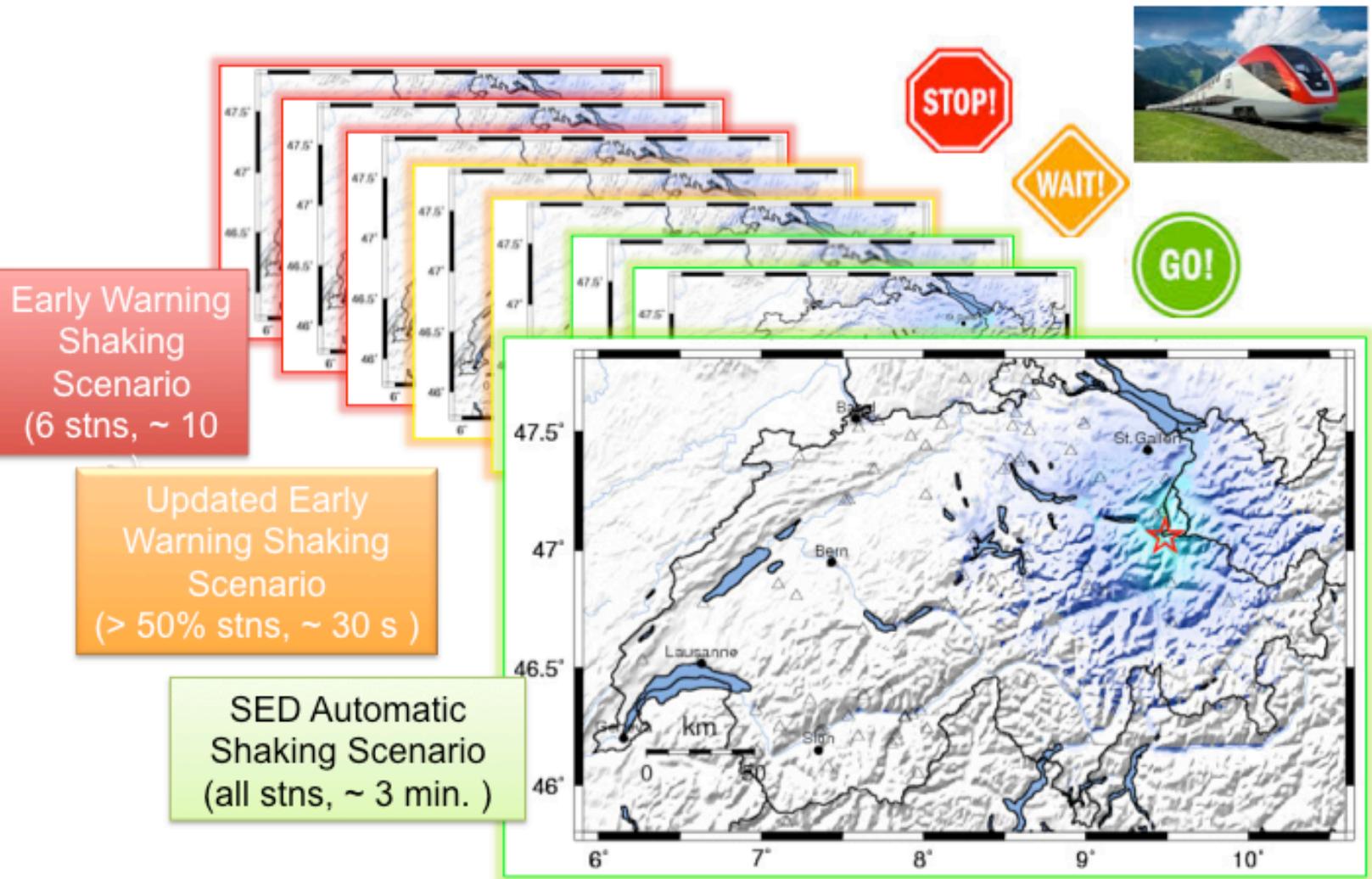
- USGS codes since 2007;
- PRP / SSMNet renewal
- GMPE Edwards and Fäh (BSSA-2013);
- GMICE Faenza and Michelini (GJI-2010);
- Site amplification based on macroseismic intensity observations;
- DYFI (testing)
- SC3 & scwfparam
- Cauzzi et al. (GJI-2015)

Why?



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Mechanistic models

vs

Empirical models

ShakeMap

Nowicki et al., EG 2014
Zhu et al., EQS 2015

$$Z = Z(\text{predictors}) = a + bx_1 + bx_2 + \dots; \\ P = 1/(1+\exp(-Z))$$

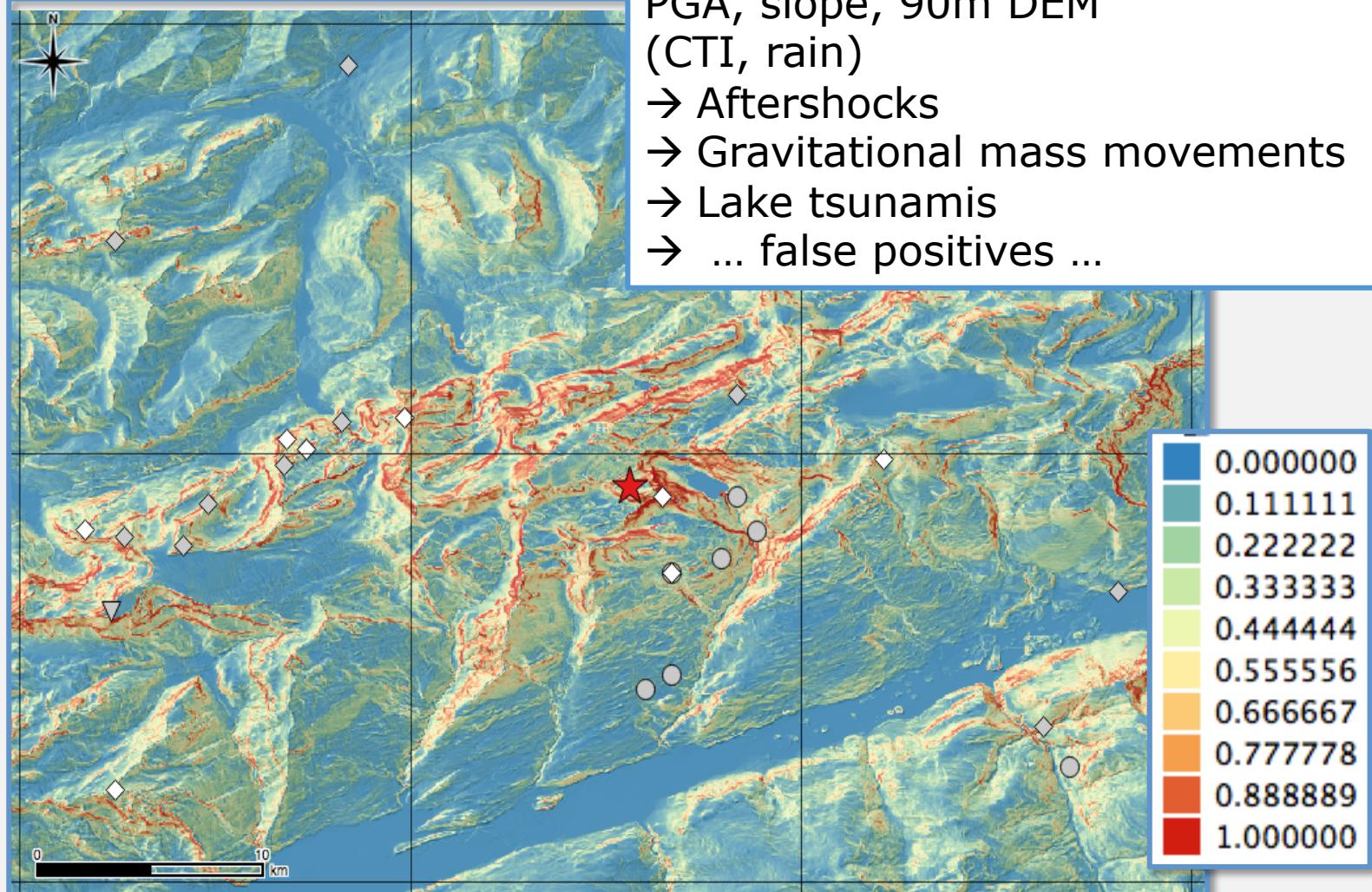
Forward modeling
corrected based on
analyses of
residuals

Sierre 1946 M_W 5.8 landslide likelihood



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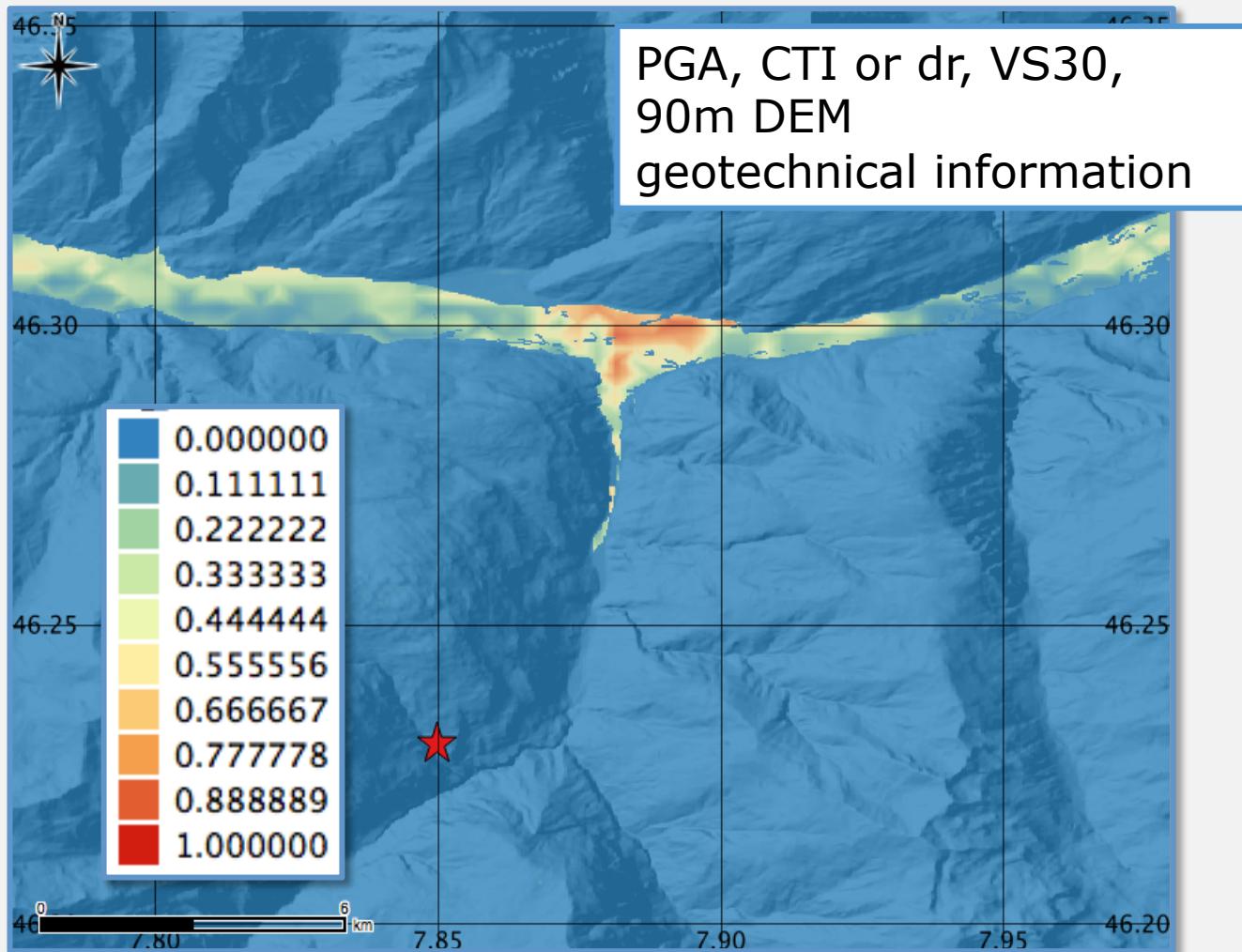


Visp 1855 M_w 6.2 liquefaction likelihood



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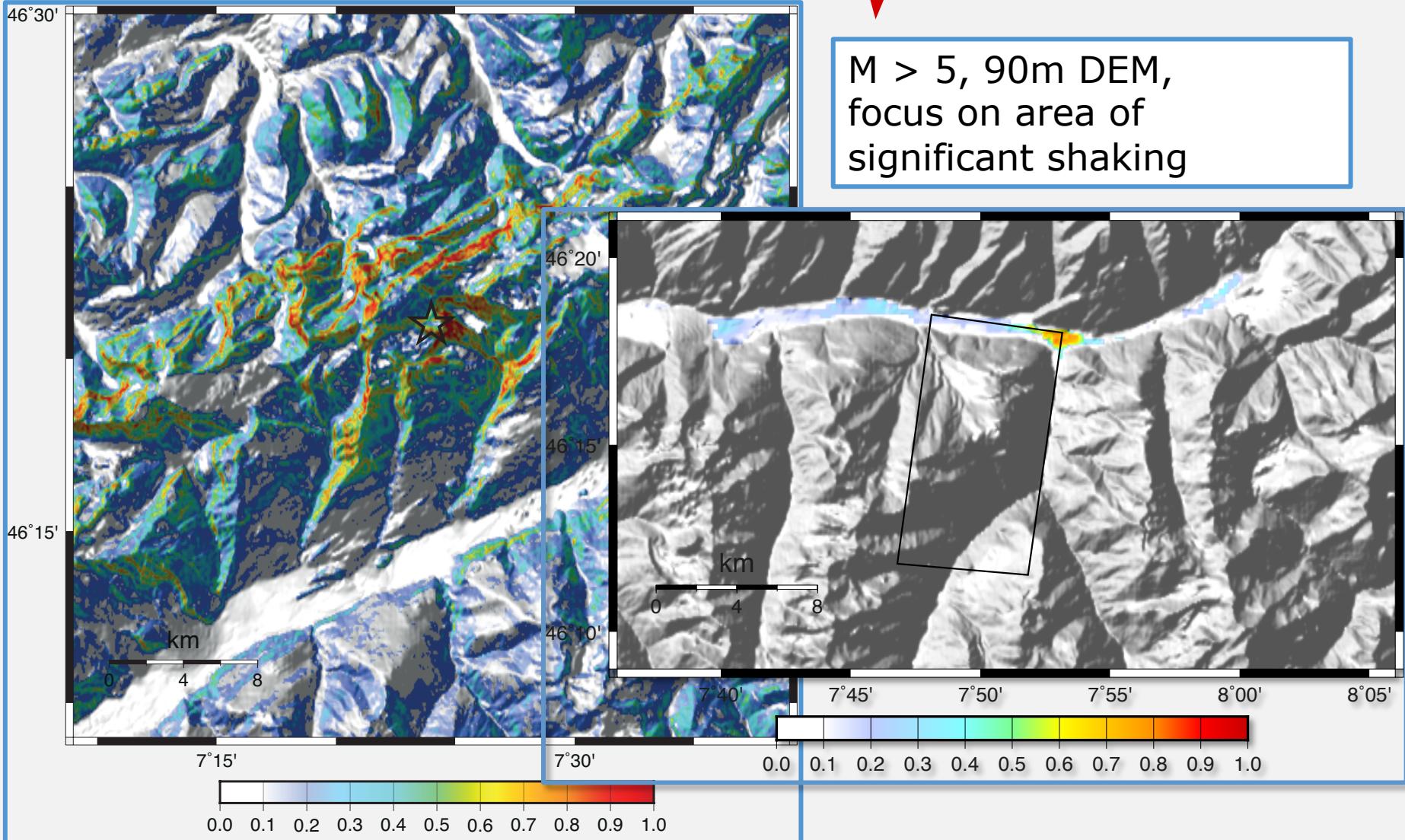


ShakeMap implementation



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Delivery to end-users: earthquake hazard display



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