CSQ-49 Summary

Question 1	**Knowledge Advancement Objectives**	**Observables**	**Measurement Requirements**	**Tools & Models**	**Policies / Benefits**
Could we improve the observations of active boundary areas dynamics?	A) Knowing better seismic cycles, both in spatial and time scale	• interseismic, deformation ground velocity • coseismic, deformation Ground velocity Acceleration • postseismic deformation Ground velocity • Map surface rupture events • Map surface temperature anomalies along fault zone	Observed area: 100km Spatial resolution 100-10 m Accuracy <10 mm Deformation on all 3 directions N-S, E-W, Vertical Surface temperature variations with high spatial (<30 m) and radiometric accuracy (0.1 k)	InSar Techniques Optical techniques to measure surface deformation. Seismic source models, models to estimate evolution of fault scarp with time Temperature-emissivity separation techniques, time series analysis using AI and machine learining techniques	Improve the knowledge of earthquake risk in high populated areas Improve planning to strengthen infrastructures and buildings Study better evacuation plans
	B) improve systematic measurements of changes in topography associated to active tectonics	• Map active fault zones at different scales • Measure systematically change in topography associated to active tectonics	DEM and DTM at different scales High Spatial resolution <0,5 m Vertical resolution <1 m Update every 6 months	Photogrammetric Techniques Structure from motion techniques	

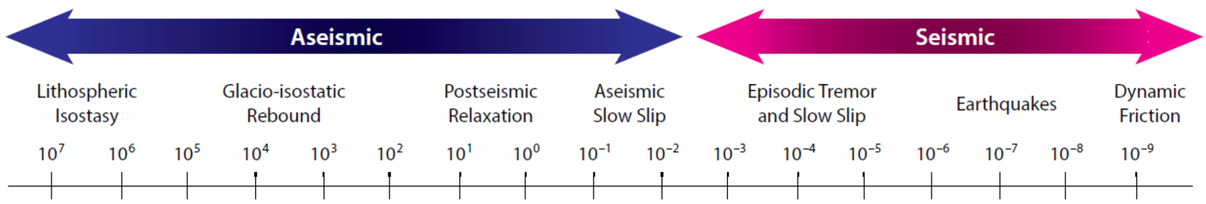
	C) Improve the study soil gas change and isotopic signatures during seismic sequences	• Methan(CH4), hydrogen (H2) carbon dioxide (CO2), radon in soils	CO2, CH4 flux Radon flux	FTIR, LIDAR, Optical imagery in SWIR- Dilatancy-Diffusion (DD) model (Sholz et al. 1973).	

CSQ-49 Narrative

The study of earthquake sources and their relationship to the active fault structures seen at the surface has made a significant contribution to our understanding of plate tectonics, as well as determining where strain is currently building up in the crust. Geodetic systems are particularly suited to determining how much of a fault surface is locked and accumulating strain, as opposed to releasing it aseismically. Establishing this is a critical constraint in assessing the seismic potential for a fault system (Avouac 2015). The relatively new field of seafloor geodesy is opening up our ability to use GNSS to observe deformation underwater (Bürgmann and Chadwell 2014), which is particularly important for the Earth's subduction zones that cause the largest earthquakes and associated tsunamis.
Earthquakes produce two major sets of measurable physical phenomena Firstly, seismic waves propagate from the earthquake source, radiating outwards, and can be measured globally by seismometers. It is these waves that are the source of the ground shaking (accelerations) that comprise the bulk of the hazard to buildings in major earthquakes. Secondly, a permanent displacement of the Earth's surface occurs due to the change in the accumulated elastic energy that results from the sudden slip across the fault surface (which in itself can be a direct hazard if buildings straddle the fault rupture). This static displacement leads in the long-term (after many earthquake cycles) to the permanent deformation of the crust, accommodating the translation of plates and crustal blocks,as well as resulting in the growth of geological structures and mountains

The availability of topographic and geodetic information at fine spatial and temporal scales enabled a new researches on active faults in recent decades, and these data continue to fuel discoveries. Beyond simply documenting earthquake rupture, Earth-surface changes recorded by InSAR and GPS can document aseismic "afterslip" in the ensuing days to months

The Earth-surface record of fault zone evolution allows us to examine processes over timescales ranging from a single earthquake rupture to the integrated effects of faulting over millions of years



Duration (years)