Description of Study Area
Regional Test Site: Barcelonnette

Coordinating partner:	CNRS	
Person(s) in charge for the data management:	Name:	Jean-Philippe Malet
	email address:	jeanphilippe.malet@eost.u-strasbg.fr
	Tel No.	+33 6 75 00 68 41

STUDY AREA: BARCELONNETTE – UBAYE VALLEY				
Country:	France	Location:	South French Alps, Department of Alpes-de-Hautes-Provence, 100 km North of Nizza	
Scale:	☐ Single slide	☒ Catchment	☒ Regional	
Reference geographical coordinates	NW corner: E 6°30.00 N 44°26.50 SE corner: E 6°52.35 N 44°19.30	Google Earth™ kml file submitted with this form:	☐ Yes ☐ No	

DATA OWNERSHIP & STAKEHOLDERS	
Data owner:	CNRS
Owner contact data (optional):	+ RTM (Restauration des Terrains en Montagne) – They are already end-users of the project (a letter of intent has been send at the proposal stage) + DREAL (Direction Régionale de l'Environnement, de l'Aménagement et du Logement)
Owner is (or is interested in becoming) end-user of CHANGES:	☒ Yes ☐ No
Confidentiality/ Access to data	☒ Public (full access and deployment) ☐ Not Public (specify whether authorization is already available/requested):
Stakeholders:	+ RTM (Restauration des Terrains en Montagne) – They are already end-users of the project (a letter of intent has been send at the proposal stage) + DREAL (Direction Régionale de l'Environnement, de l'Aménagement et du Logement) + Municipalities of Barcelonnette, Faucon, St-Pons, Jausiers, Uvernet, Enchastrayes
Case study is suitable for (check relevant box, TA refers to Topic Actions in Changes):	☒ TA1.1 Inventory of approaches /case studies on the analysis of changes in risks ☒ TA1.2 Climate change models & expected changes in triggering conditions ☒ TA1.3 Probabilistic models for flood hazard assessment ☒ TA1.4 Probabilistic models for landslide hazard assessment ☐ TA2.1 Current vulnerability situation based on historical developments ☒ TA2.2 Expected changes in ecosystems and land use patterns ☐ TA2.3 Uncertainties in vulnerability of infrastructure, buildings and land use ☒ TA3.1 Inventory of software tools for probabilistic risk assessment ☒ TA3.2 Probabilistic risk assessment of hydro-meteorological hazards ☒ TA3.3 Web-based environment for probabilistic risk assessment ☒ TA3.4 Risk scenarios and risk maps in the study areas ☐ TA4.1 Inventory of risk management strategies in Europe ☐ TA4.2 Risk information in Strategic Environmental Assessment / spatial planning

	☒ TA4.3 Cost-benefit analysis for the planning of risk reduction measures ☒ TA4.4 Emergency preparedness and early warning scenarios ☒ TA4.5 Internet-based Decision Support System for change-proof planning ☐ TA5.1 Risk governance strategies for different EU countries ☒ TA5.2-5.3-5.4 Web-based risk communication and visualisation tool

LANDSLIDE DATA / INFORMATION				
Historical data:	☒ Yes ☐ No	If yes, specify (including time span): + Event database (including damage): 1750 – 2010 (on going) + Multi-temporal inventory : <1900, > 1900 + Mitigation work database: 1890 – 2010 (on going)		
Movement type:	☒ Falls ☐ Topples ☒ Slide rotational ☒ Slide translational ☐ Spreads ☒ Flows ☒ Complex		Material: Type of occurrence	☒ Rock ☒ Debris ☒ Earth ☐ Other (specify): ☒ First time ☒ Recurrent ☒ Reactivation
Triggering mechanism	Rainfall, snowmelt, seismic acceleration			
Average velocity:	Variable according to the type of processes: - debris flows : up to 5 m.s-1 - shallow landslides and creep: cm.year-1 - large active mudslides: 0.01 – 0.05 m.day-1 / in acceleration, velocities up to 0.4-0.5 m.day-1 have been observed.-			
Landslide geometry:	Thickness (m)	Very variable according to the type of process		
	Surface* (m^2)	Very variable according to the type of process		
	Volume (m^3)	Very variable according to the type of process		
Run-out:	Height (m)	Very variable according to the type of process		
	Distance (m)	Very variable according to the type of process		
Area extension Number of active mass movements	Surface (km²) Nbr.	300 Ca. 150		
Further notes:	The Barcelonnette area is part of the French Observatory on Landslides (OMIV) – Website: http://eost.u-strasbg.fr/omiv			

* For multiple or regional system, specify the overall area extension

FLOOD DATA / INFORMATION				
Historical data:	☒ Yes ☐ No	If yes, specify (including time span): + Event database (including damage): 1750 – 2010 (on going) + Mitigation work database: 1890 – 2010 (on going)		
Monitoring data: Number of stations:	☒ Water height ☒ Discharge ☒ Water velocity ☒ Fluid concentration ☒ Other: ..... 2 discharge stations		Records on flood event: Type of occurrence	☒ Map of flood extent ☒ Map of damage ☒ Other: ..... ☒ Years ☒ Decades
Triggering:	Rainfall, snowmelt			
Area extension	Surface (km²)	300		

Number of recorded floods	Nbr.	5
Further notes:	The Barcelonnette area is part of the French Observatory of Gravitational Processes (OMIV) – Website: http://eost.u-strasbg.fr/omiv	

DATA ON CONDITIONNING FACTORS				
Topographic maps:	☒ Yes ☐ No	If yes, specify :	Scale(s): TopoMap25 (1/25000) TopoMap10 (1/10000)	Year(s): 1998, 1945, 1899 1945, 1899
Digital Elevation Model	☒ Yes ☐ No	If yes, specify:	Resolution and accuracy: Digital Terrain Model (IFSAR product, 2 m grid) Digital Terrain Model (elevation lines, 10m grid) Digital Terrain Model (BD Alti, 50m grid)	
Optical, airborne / satellite images:		☒ Yes ☐ No	If yes, specify coverage and date: - Aerial airborne orthophotographs (1948, 1956, 1974, 1982, 1988, 2000, 2004, 2008) - Landsat ETM (TM30m & P15m) (1984, 1988, 2000, 2004) - VHR satellite image (SPOT5 – 2.5m, 2002, 2004, 2007, 2008 / Ikonos, 2006)	
Radar, satellite images:		☐ Yes ☒ No	If yes, specify type (technique), scale and date: SAR Interferometry (ERS) TerraSarX	
Ground-pictures of the area of interest		☒ Yes ☐ No	> 1000 – Access to the RTM photo archives with photo startinjg in the 1880s	

Geology and geomorphology: (available on several sites)	☒ Yes ☐ No	- Various geomorphological maps (region, sub catchments, local landslides; scale 1/10,000 to 1/500) - Geological map (1/50000) - Map of engineering soil (1/10,000)
Geophysics: (available on several landslides)	☒ Yes ☐ No	- Several ERT (electrical resistivity tomography) cross-sections (Super-Sauze, La Valette, Poche, Bois Noir, Faucon, Adroit, Pra Bellon) - Several active seismic tomographies (Super-Sauze, La Valette, Poche, Adroit)
Geotechnical data: (available for several sites and several soil types)	Site: ☒ Yes ☐ No	- A total of 40 boreholes in the area on several sites - A total of 30 inclinometers in the area on several sites - Dilatation tests in boreholes - Several permeability tests (under pressure) Etc
	Lab: ☒ Yes ☐ No	- Physical identification (grain size, Atterberg, density, etc) - Triaxial tests (drained, undrained) - Oedometer tests - Ring shear tests - Rheometrical tests (cone-plane, plate-plate geometry)
Groundwater:	☒ Yes ☐ No	- a total of 15 piezometers with continuous monitoring on several sites - soil temperature - soil suction
Thematic conditioning factors map:	☒ Yes ☐ No	- Debris flow sources and deposits map (events >2003) 1/10000 - Geomorphologic map 1/10,000 (region); 1/5000 to 1/500 (local sites)

		- Geomorphodynamic map 1/10,000 (region); 1/5000 to 1/500 (local sites) - Derivatives of topographic map, 1/10,000 - Lithology map 1/50,000 - Tectonic map 1/10,000 - Engineering soil map 1/10,000 - Hydrological map 1/10,000 (stream, spring, lake, etc) - Landcover map (1890, 1956, 1974, 1982, 2000 & 2004) - Changed landcover map (period 2050-2100) - Forest map (including tree characteristics) 1/10,000

DATA ON TRIGGERING FACTORS		
Rainfall data:	☒ Yes ☐ No	- 10 raingauges distributed on the area (period 1900-ongoing) Climate change data available (scenario A2 – GIEC), downscaled at 250 m resolution on some specific sites of the area (specific downscaling procedure by Meteo-France). Period of simulation: 2050-2100 Analysis of synoptic weather situations favourable to landslides
Temperature data:	☒ Yes ☐ No	- 4 meteo station (air temperature, air humidity, wind speed & direction, net radiation) distributed on the area
Humidity data:	☒ Yes ☐ No	- 4 meteo station (air temperature, air humidity, wind speed & direction, net radiation) distributed on the area
Earthquake strong motion data:	☒ Yes ☐ No	- seismic station at Jausiers - seismic station at Super-Sauze mudslide
Monitoring and/or early warning systems:	☒ Yes ☐ No ☐ Envisaged	- Daily data transfer of displacements (dGPS) & meteo data for LaValette et Super-Sauze landslides - Web access at the OMIV Website (http://eost.u-strasbg.fr/omiv) - EWs by RTM (infra red camera + optical camera + benchmark displacement + debris flow detection; automated linked to Prefecture Alpes-de-Haute-Provence) for LaValette landslide - EWs by RTM for Adroit landslide (water level in piezometers) - Thresholds for pre-alarm/alarm/alert available - No data transmission for water discharge

DATA ON ELEMENTS AT RISK & DATA ON LAND PLANNING
Elements at risk (specify): Roads, bridges, buildings, ski and summer leisure facilities … located on or near active landslides, on active torrential cones and in the floodplain Data available: - Element at risk map (including attributes of the elements at risk) – 1/10,000 - Database of mitigations works (check dams, etc) – 1/10,000 - Data on damages on elements at risk - Fragility functions and value of some category of buildings

- Risk perception enquiry performed in 2009 (> 350 answers to questionnaires - Land planning documents for all municipalities		
Human losses (death and injuries) due to previous events:	☐ Yes ☒ No	If yes, quantify:
Economic loss due to previous events:	☒ Yes ☐ No	If yes, quantify in ca. 50 M € for the last 10 years
Social consequences due to previous events:	☒ Yes ☐ No	Relocation of some inhabitants, destruction of housing, destruction or closing of roads
Mitigation (already performed or envisaged):	☒ Yes ☐ No	+ Non structural – Monitoring system + Structural – Water drainage, Check dams, debris barriers and reforestation for landslides; Rivers dykes for floods
Land planning already established for the case:	☒ Yes ☐ No	PPR (French Risk Maps) for the 6 municipalities of the area (multi-risks, eg. snow avalanches, landlsides, floods, earthquake) History of regulation maps available (Zermos, PER, PPR)

NUMERICAL MODELLING / RISK ANALYSES		
Numerical modelling (already done):	☒ Yes ☐ No	Several types of models (analytic, physical, static, FEM…) for various landslides sites within the Barcelonnette area : - Model for slow displacements, model for fluidization, models for mudflow behavior, hydrological model ; - Static modeling of safety factors ; - FEM modeling (Flac / GefDyn / Abaqus) ; - Physical modeling (inclined plane) ; - Various debris flow runout and spreading models. - 1D & 2D hydrodynamic model of water flooding (Sobek, HEC/RAS)
Risk analyses (already carried out)	☒ Yes ☐ No	Quantitative on local sites (La Valette, Super-Sauze, Faucon torrent) Semi-quantitative at the regional scale (Barcelonnette area) No risk analyses for floods

REFERENCES	
References (papers and other published material, www site), specify:	See: http://eost.u-strasbg.fr/omiv/Publications_barcelo_area.html Risk Assessment here: http://eusoils.jrc.ec.europa.eu/library/themes/Landslides/Meeting102007/Landslide_France.pdf WebGIS Barcelon@ http://eost.u-strasbg.fr/omiv/main-page.html

The case history has been considered in other research projects?	☒ Yes ☐ No	- EC FP3 TESLEC, EC FP4 NEWTECH, EC FP5 ALARM, EC FP6 MOUNTAIN RISKS, EC-FP7 ChangingRISKS - French funding: PNRH, ACI MOTE, ACI SAMOA, ACI GACH2C, ECCO ECOU-PREF, ANR TRIGGERLAND, ANR SISCA, ANR FOSTER

GENERAL COMMENT & PICTURES

For a detailed description of the study site, the main research questions and the knowledge of the site, see: http://eost.u-strasbg.fr/omiv/barcelo_area_intro.html

Add a serie of photographs of the study areas:

South-facing slope

North-facing slope