

## Data available in Barcelonnette



South-facing slope



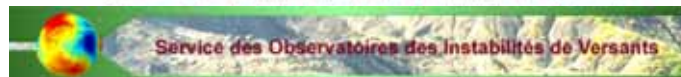
North-facing slope



FP7 ITN CHANGES - KO Meeting, 13-14 January 2010

## FRENCH OBSERVATORY ON LANDSLIDES - OMIV

<http://eost.u-strasbg.fr/omiv>



- Objectifs
- Projets
- Publications
- Liens
- Contact

### Sites OMIV:

La Chapelle



Sarrièrès



Mes d'Auzonnet



Super Saône



### Autres sites étudiés par les partenaires OMIV:

Saint-Gobain



Chamossat



Chamossat E



Tignes



La Plaz



La Vallette



Villanoble



Col du Tour de France



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## FRENCH OBSERVATORY ON LANDSLIDES - OMIV

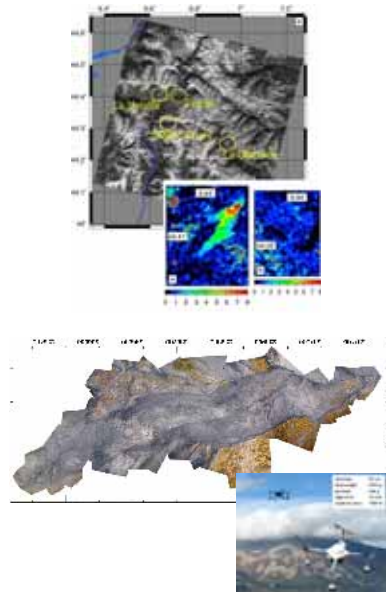
Barcelonn@  
A WebGIS service for sharing data and information on Mountain Risks in the Barcelonnette area (South French Alps)

Barcelonn@ OMIV & Mountain-Risk WebGIS service

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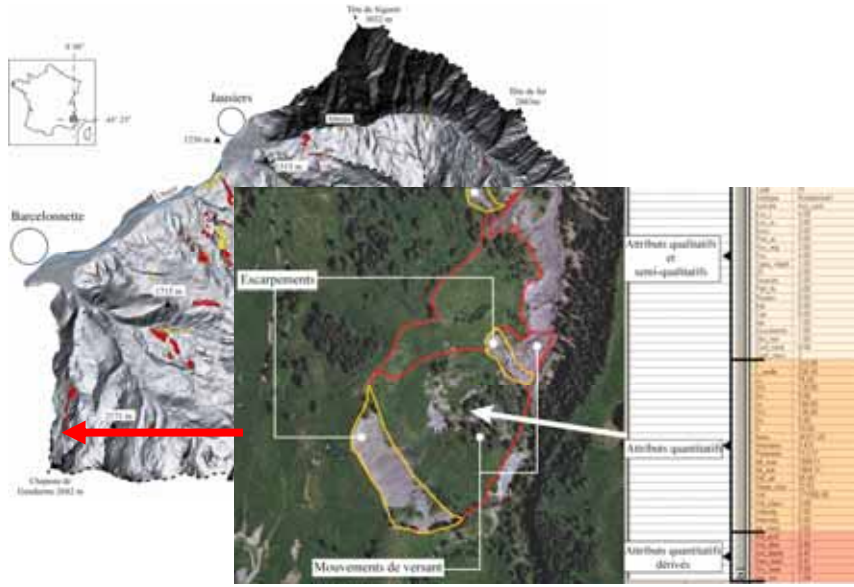
## IMAGE DATA

Type of images	Resolution of original data	Dates	Product derived and resolution (e.g. DEM 2x2m)	Available or ordered/planned
Landsat ETM+	TM30m-P15m	28/08/2000	Landsat	Available
Landsat ETM+	TM30m-P15m	26/09/1988	Landsat	Available
Landsat ETM+	TM30m-P15m	23/07/1984	Landsat	Available
Quickbird	0.61 m	July 2006		Available
Rapid Eye	5 m	July 2009		Available
ALOS AVNIR-2	10 m	26/06/2008		Available
ALOS PRISM	2.5 m	26/06/2008		Available
ALOS AVNIR-2	10 m	16/07/2009		Available
ALOS PRISM	2.5 m	16/07/2009		Available
ALOS PRISM	2.5 m	29/09/2009		Available
SPOT 5 P	2.5 m	19/09/2003		Available
		19/03/2004		Available
		22/08/2004		Available
		30/06/2005		Available
		09/07/2005		Available
		01/08/2005		Available
		20/08/2006		Available
SPOT 4 P	10 m	17/03/1994		Available
PLEIADES	0.7 m / 3.0 m	Acquisition planned in 2011		Ordered by CNES (ORFEO-Geology)
Airborne LiDAR	1 pts/m <sup>2</sup>	22/04/2007	DTM 1 x 1m	Available
	30-60 pts/m <sup>2</sup>	18/07/2009	DSM	Available
		Acquisition planned in July 2011 (budget already agreed)	DSM 0.5 x 0.5m	Planned
Airborne Radar	3.4 m	July 2007	DSM / DEM	Available
SAR ERS 1-2	Full resolution	1991 - 1999 (several dates)		
Terrascan X	TX images	25 scenes of TX images to be bought in 2010-2011. Agreement received from German Aerospace Center (DLR) - Copernicus.		Ordered by BRGM
Orthophotos	1:20,000	- 1974 (color color & n)	Orthorectified	Available
	1:15,000	- 1974 (color color & n)	Orthorectified	Available
	1:20,000	- 1982 (color color & n)	Orthorectified	Available
	1:20,000	- 1985 (color)	Not orthorectified	Available
	1:20,000	- 1985 (color)	Orthorectified	Available
	80 cm	- 2000 (color)	Orthorectified	Available
	50 cm	- 2004 (color)	Orthorectified	Available
	50 cm	- 2007	Orthorectified	Available
	30 cm	- 2009	Orthorectified	Available
Orthophotos from UAV flights	5 cm		Orthorectified	Available
	15 m	- July 1999	Orthorectified	Available
	50 cm	- May 2006	Orthorectified	Available
	30 cm	- July 2008	progress	Available
	30 cm	- October 2008	Orthorectified	Available
	30 cm	- October 2009	Not orthorectified	Available
	30 cm		Not orthorectified	Available



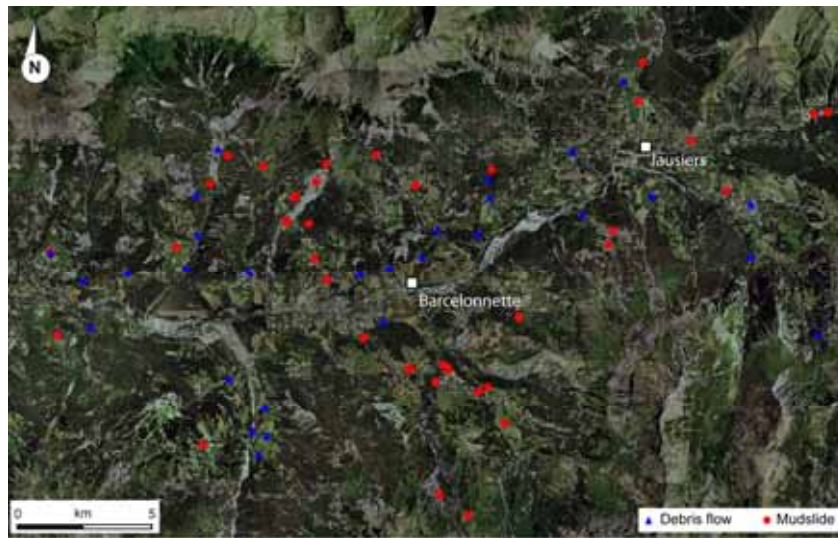
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### INVENTORY - 1



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### INVENTORY - 2



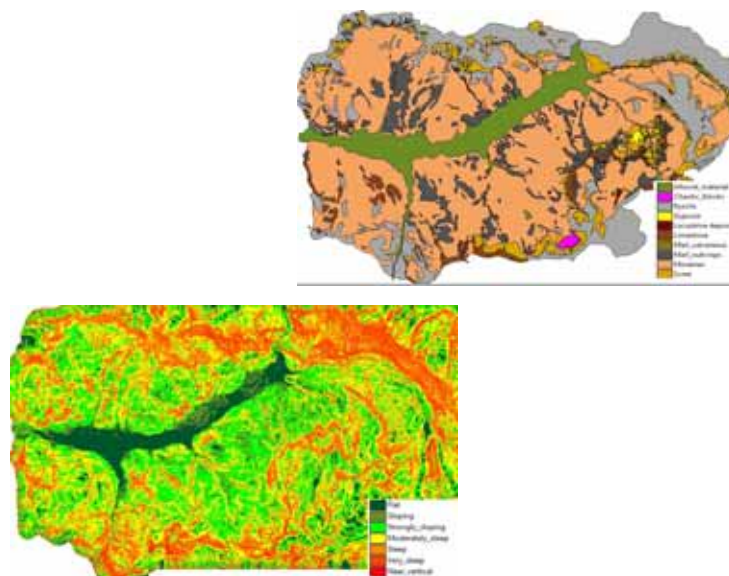
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### INVENTORY - 3

<http://rtm-onf.ifn.fr/query/show-query-form>

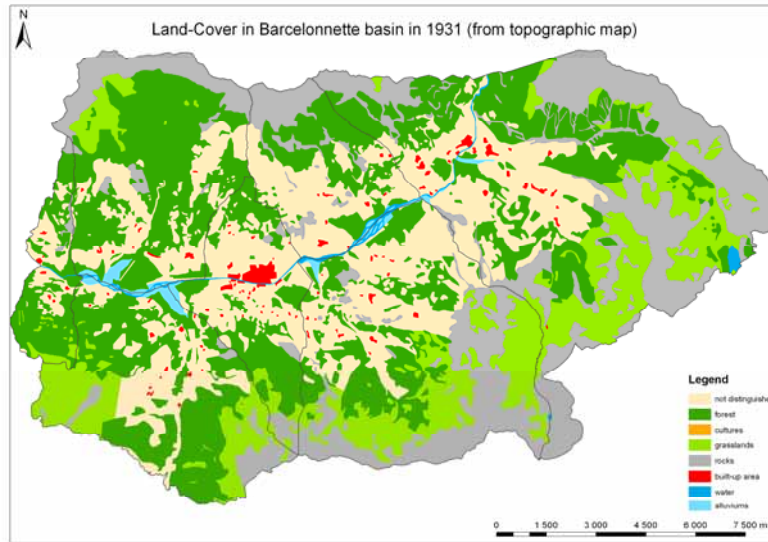
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### PREDISPOSING FACTORS

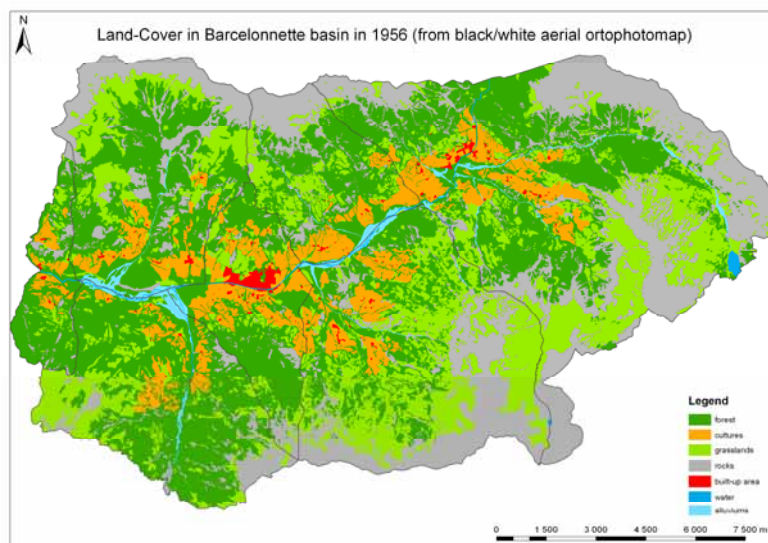


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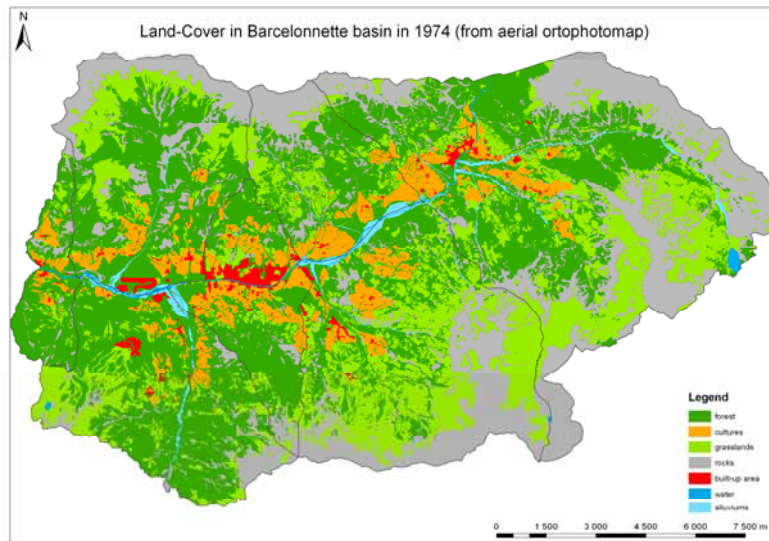
## PREDISPOSING FACTORS



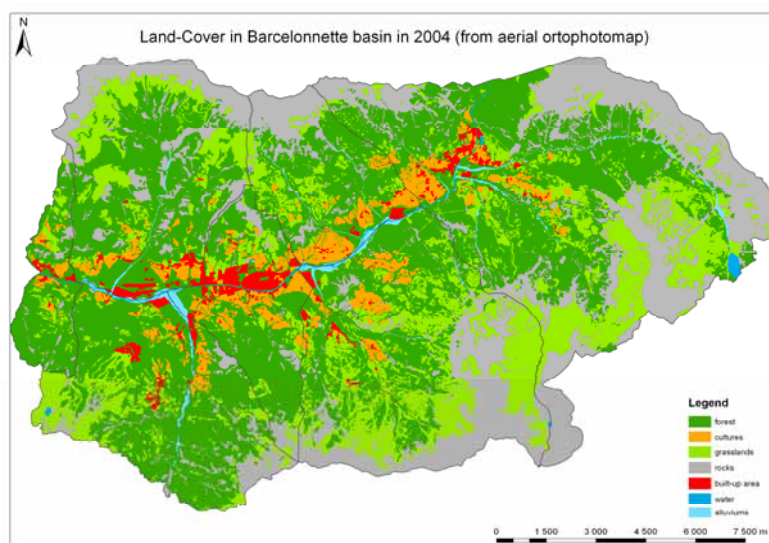
## PREDISPOSING FACTORS



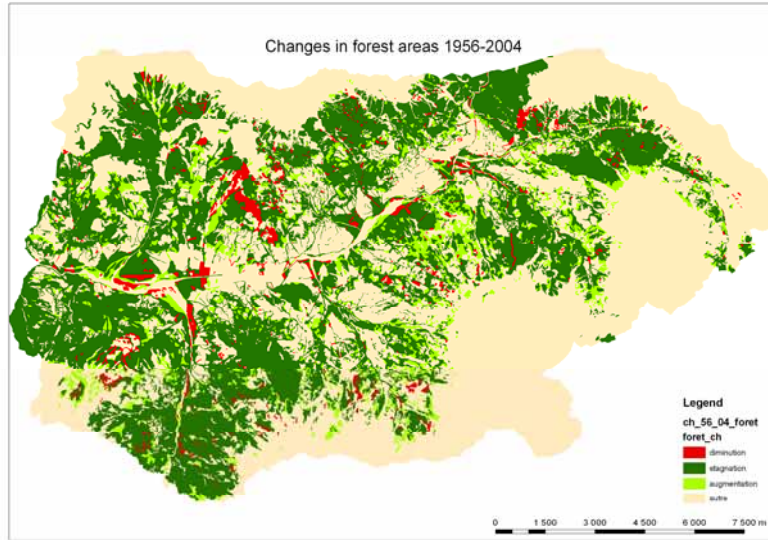
## PREDISPOSING FACTORS



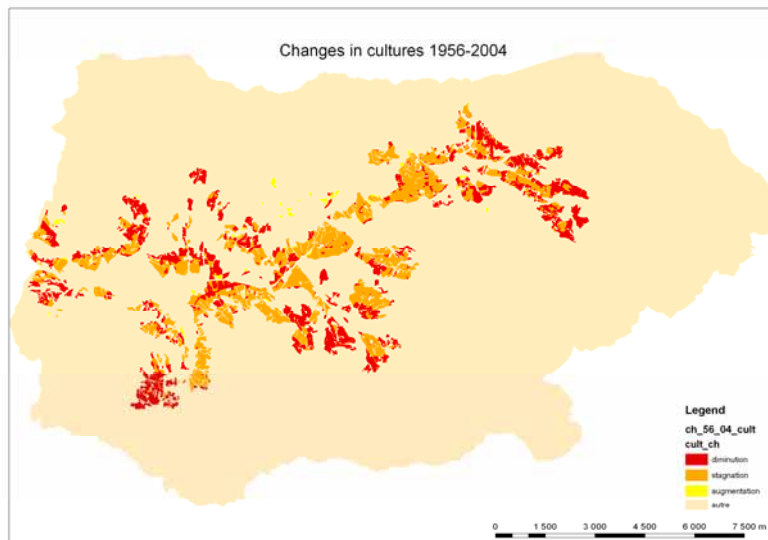
## PREDISPOSING FACTORS



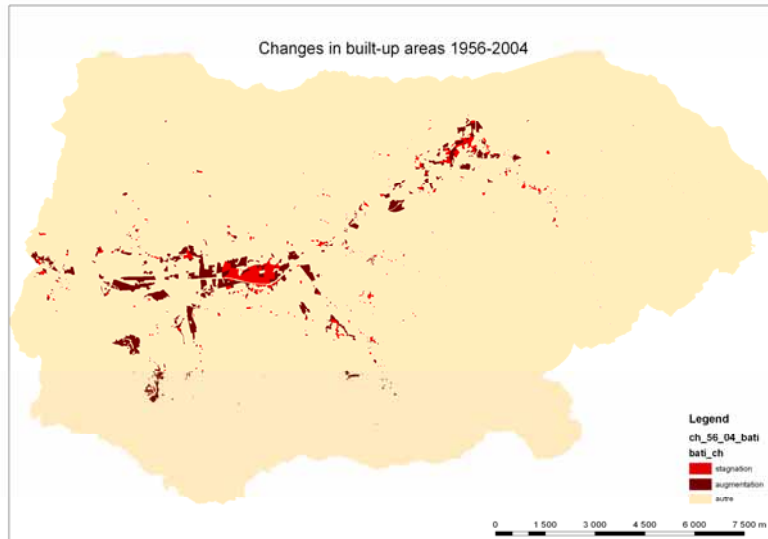
### Observed changes in the Barcelonnette 1956 - 2004



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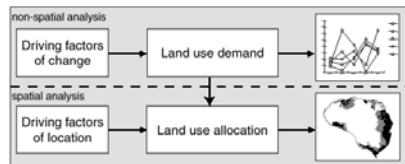


## PREDISPOSING FACTORS

### Modelling landcover changes in the Barcelonnette Basin at very high resolution (MsC Thesis in progress, A. Moravek & A. Puissant)

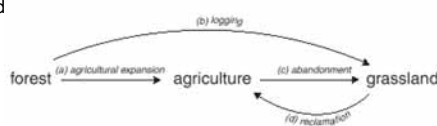
Approach: CLUE dynamic model - <http://cluemodel.nl/>

Verburg, P.H. and Overmars, K.P., 2009. Combining top-down and bottom-up dynamics in land use modeling: exploring the future of abandoned farmlands in Europe with the Dyna-CLUE model. *Landscape Ecology* 24(9): 1167-1181.



**Basic concept:**  
identification of land use change sequences and transition rules and application of a logistic regression model

#### Land use change sequence



$$\text{Log} \left( \frac{P_i}{1-P_i} \right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni}$$

#### Land use conversion matrix

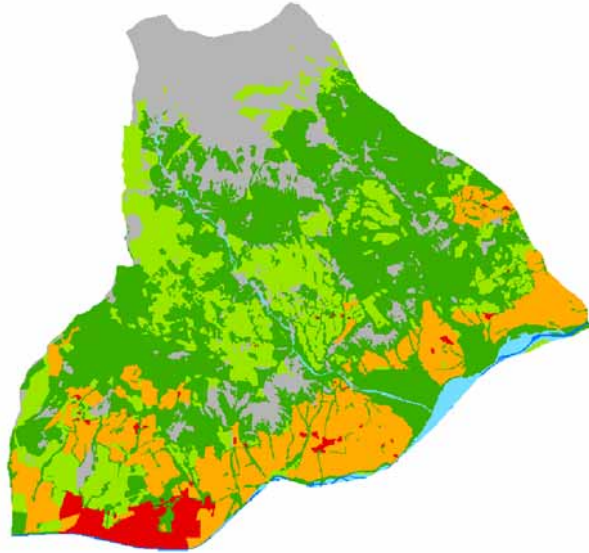
future land use \ present land use	Forest	Agriculture	Grassland
Forest	+	+(a)	+(b)
Agriculture	-	+	+(d)
Grassland	-	+(e)	+

+ conversion possible  
- conversion not possible



## PREDISPOSING FACTORS

Results of simulation



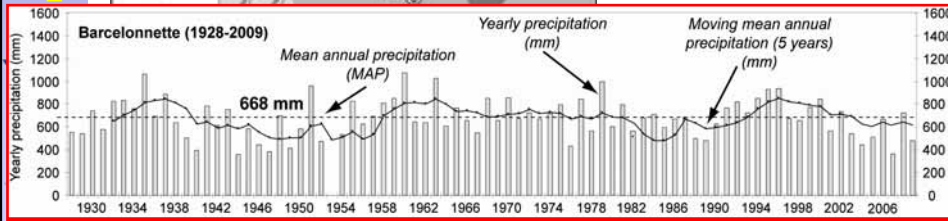
1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010

## TRIGGERING FACTORS

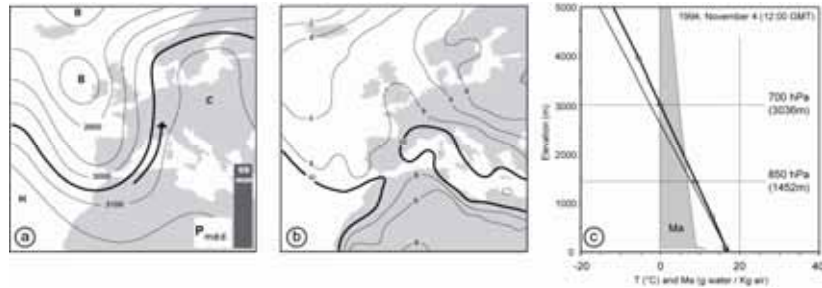


-Almost 10 climatic stations

-Great local variability because of orographic influences / topoclimate



## SYNOPTIC SITUATIONS TRIGGERING LANDSLIDES

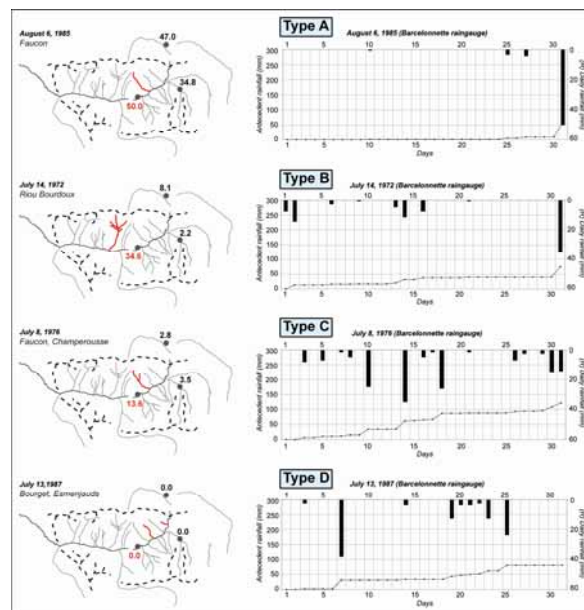


Mean characteristics of air-mass type associated to landslides triggering in the Barcelonnette basin for the 1975-2004 period.

Air-mass	Number of landslides	Number of debris flows	Number of mudslides	P (mm)	Temperature at Nîmes (°C)			Altitude (m)		Atmospheric moisture (g water / Kg air)			
					ground	850 hPa	700 hPa	850 hPa	700 hPa	ground	850 hPa	700 hPa	total
P med	5	3	2	35,5	18,0	8,2	-0,8	1464,6	3043,2	11,1	6,7	4,2	27,4
Fm	7	0	7	17,5	15,1	5,2	-6,9	1320,7	2862,4	7,4	4,4	2,7	16,4
Fm d	8	6	2	20,5	18,9	8,9	-0,8	1487,4	3054,8	8,1	3,9	3,1	19,3
T cont	3	3	0	18,8	31,2	16,7	4,3	1558,7	3182,7	11,5	7,0	5,2	32,6
Tm	5	3	2	26,3	23,0	12,1	4,3	1479,8	3086,5	11,9	6,2	5,2	27,8
T med	2	2	0	31,3	22,8	12,8	3,8	1473,0	3076,0	9,9	7,3	4,8	30,6

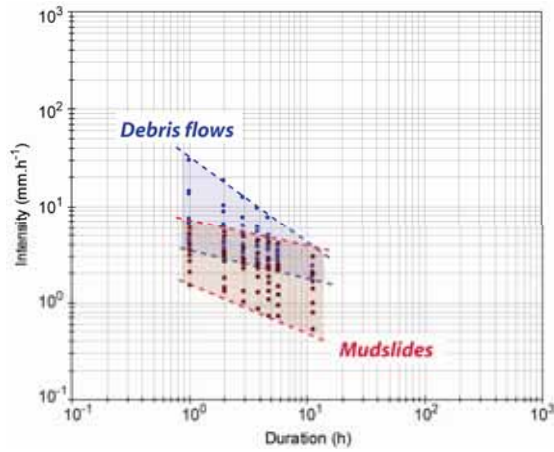
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## TYPOLGY OF RAIN EVENTS TRIGGERING LANDSLIDES



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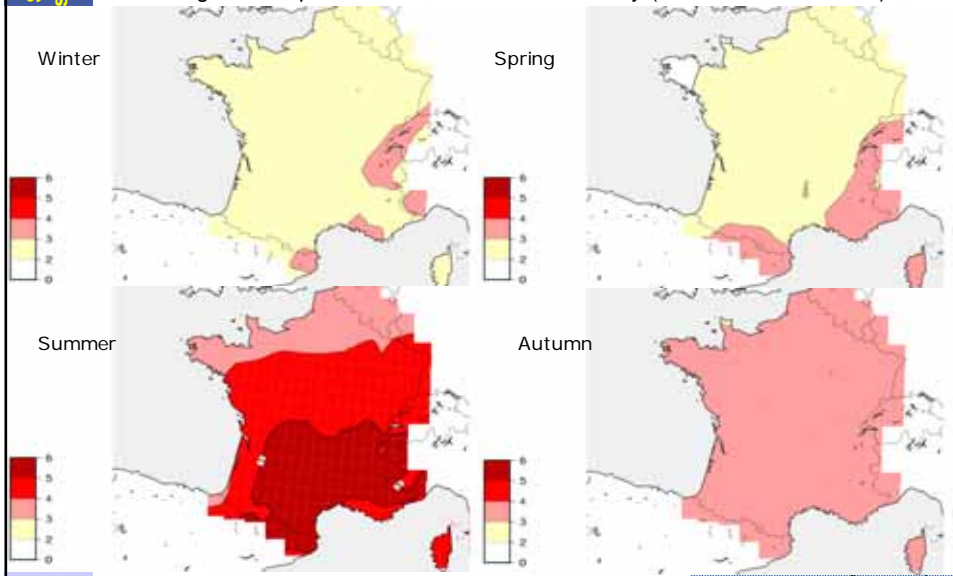
## POSSIBLE RAINFALL THRESHOLDS, intensity/duration



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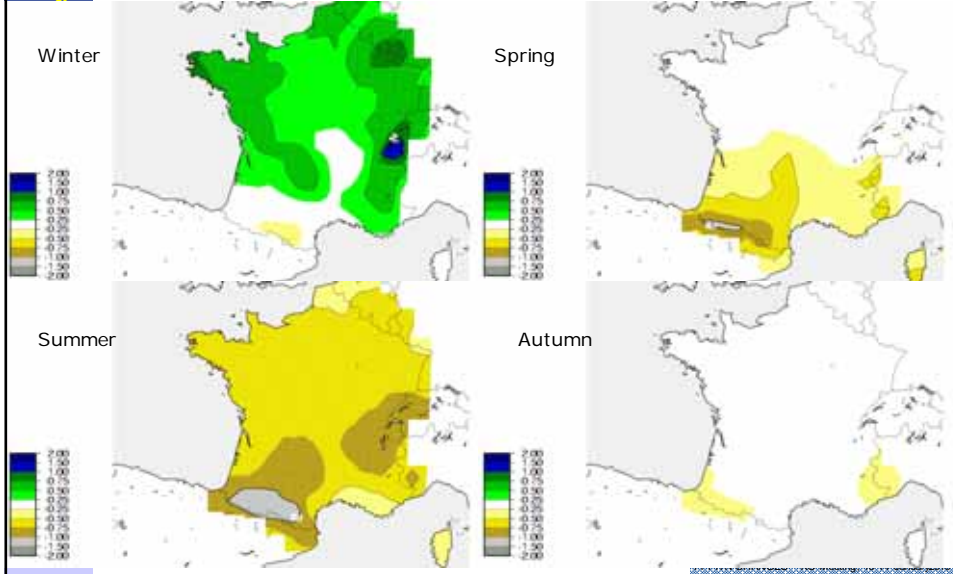
## CLIMATE SCENARIOS

Changes in temperature at the end of XXI century (+ corrected / observed)



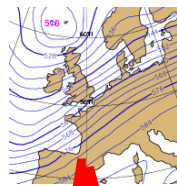
## CLIMATE SCENARIOS

Changes in precipitation at the end of XXI century (+ corrected / observed)

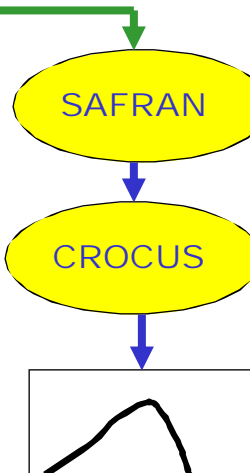
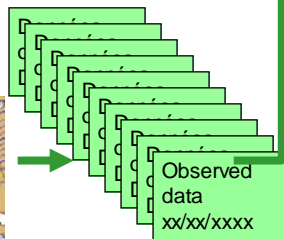
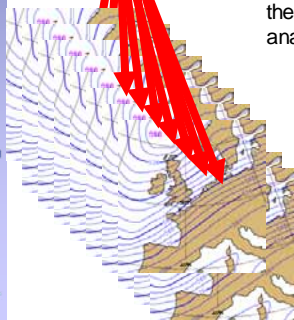


## CLIMATE SCENARIOS

Method of regionalization

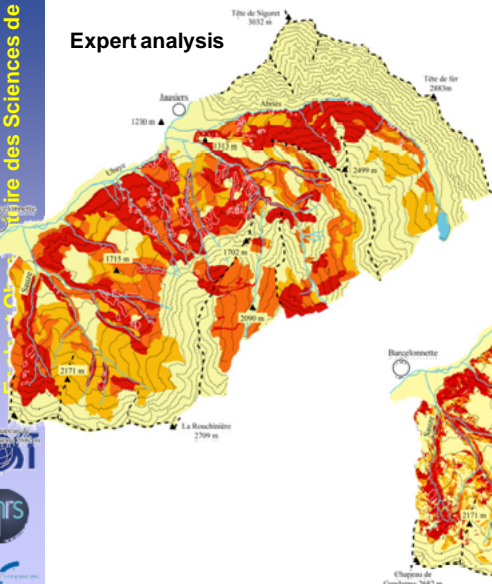


- Search for a climate analogue (pressure field 700 & 500 hPa normalized) in the CC model
- Use of Safran model with all the daily data of the analogous day

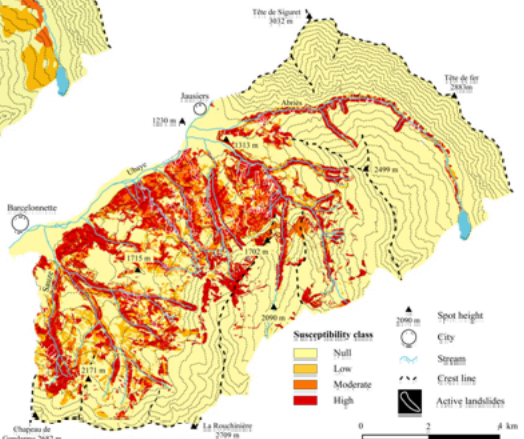


## LANDSLIDE SUSCEPTIBILITY / HAZARD MAPS

Expert analysis

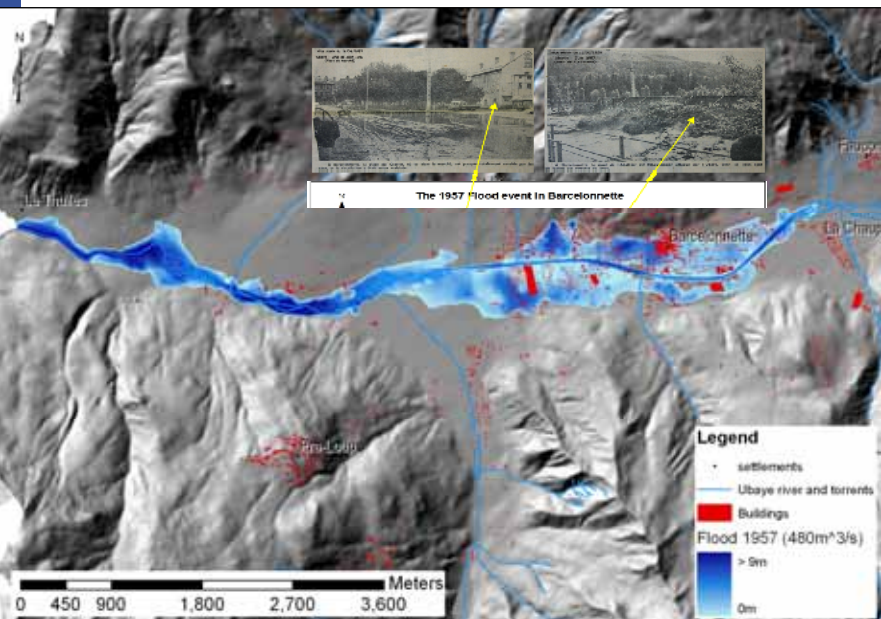


Statistical modelling

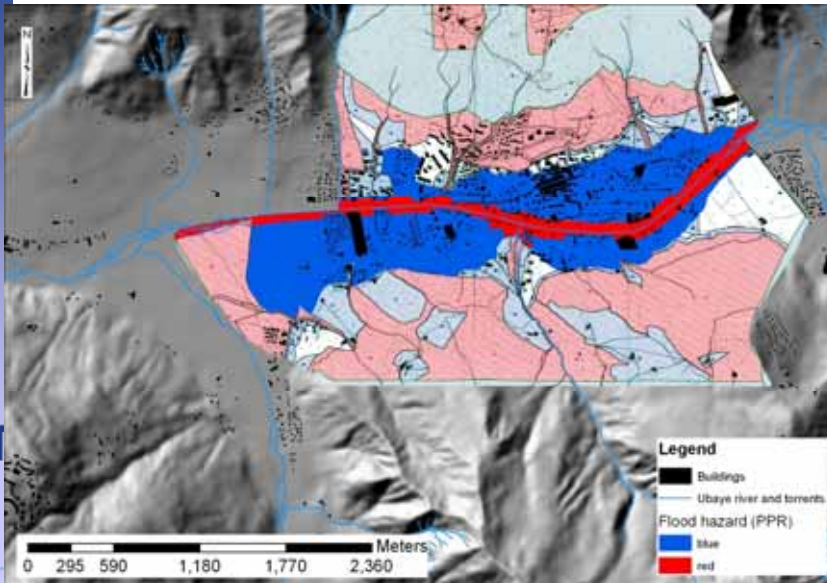


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## FLOOD HAZARD MAPS

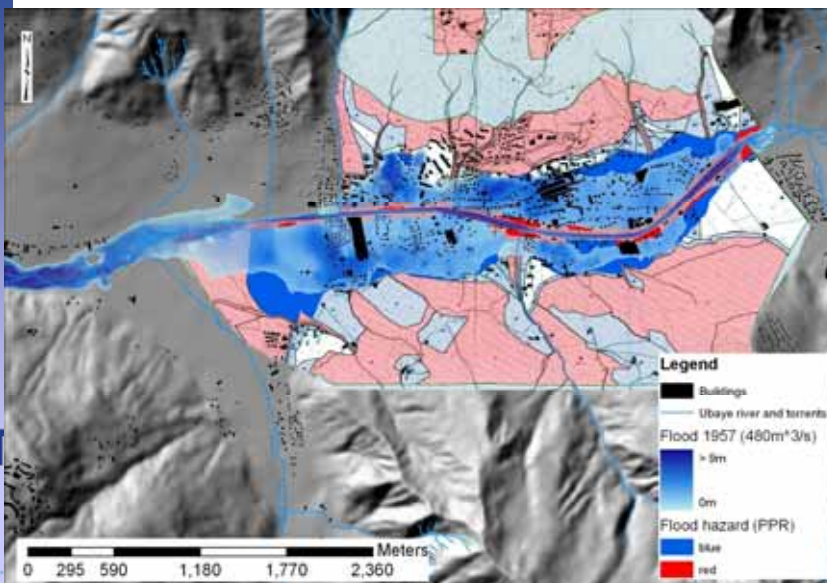


## FLOOD HAZARD MAPS



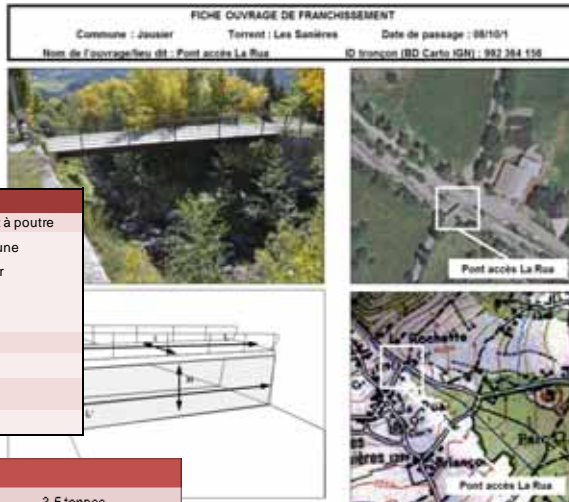
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## FLOOD HAZARD MAPS



PPF, TN CHANGES - KO Meeting - 13-14 January 2010

## ELEMENTS AT RISKS

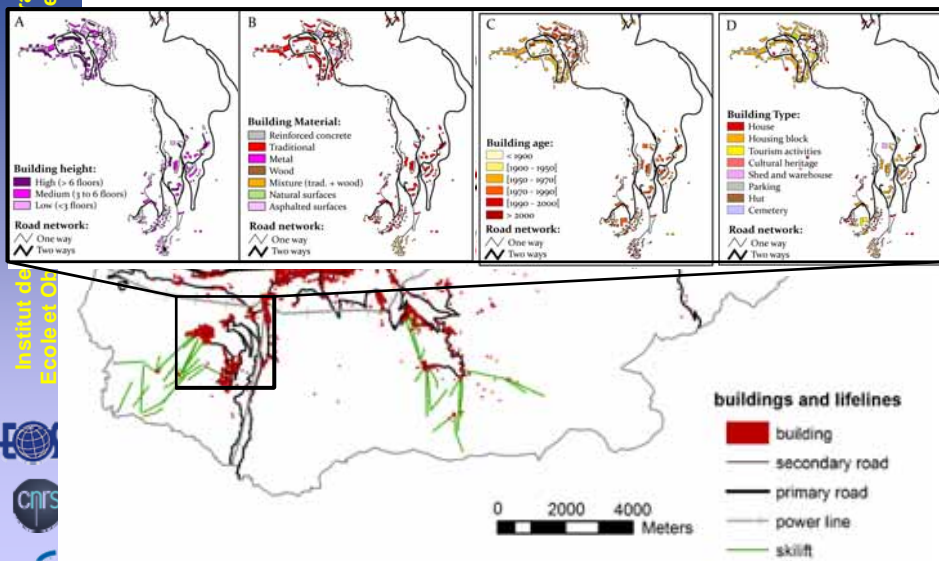


Caractéristiques physiques	
Type de pont	Pont à poutre
Nature des piles	Aucune
Nature du tablier	Acier
Revêtement	Bois
Ouverture totale L (en mètre)	15
Longueur tirant d'air L' (en mètre)	14
Largeur ouvrage l (en mètre)	4
Hauteur tirant d'air (H, en mètre)	7
Aire du tirant d'air (en gris) (m²)	105

Valeur fonctionnelle	
Limitation poids	3,5 tonnes
Limitation vitesse	Non Communiquée
Nombre de bâtiments isolés en cas de coupure	
Longueur du plus court chemin pour contourner ce pont	

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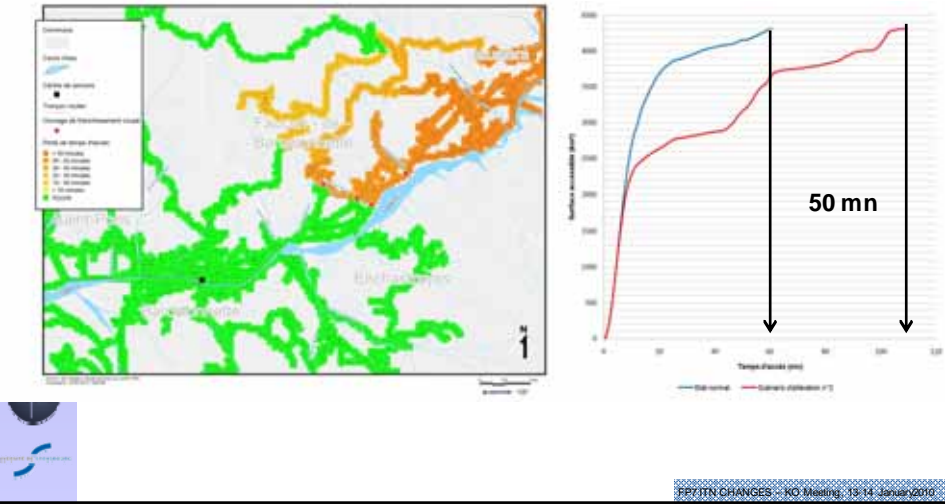
## ELEMENTS AT RISKS - BUILDINGS



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## ELEMENTS AT RISKS - NETWORKS

Accessibility to shelters in case of blockage



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**THANK YOU FOR YOUR ATTENTION**



Institut de Physique du Globe de Strasbourg,  
Ecole et Observatoire des Sciences de la Terre



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Institut de Physique du Globe de Strasbourg,  
Ecole et Observatoire des Sciences de la Terre



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Identifiant Pont	
1. SAN_1	16. ENC_1
2. SAN_2	17. UBA_4
3. SAN_3	18. GAU_1
4. SAN_4	19. UBA_3
5. BOU_1	20. ORO_2
6. FAU_1	21. ORO_1
7. FAU_2	22. STP_1
8. FAU_3	23. STP_2
9. UBA_1	24. VAL_1
10. SUR_1	25. VAL_2
11. TH_1	
12. VAL_1	
13. UBA_2	
14. GAU_1	
15. SAN_1	

Critères fréquence des crues  
avec ou sans impacts décrits  
et section libre de l'ouvrage

→ Indice de risque de  
coupure du tronçon routier

