Data available in Barcelonnette

FRENCH OBSERVATORY ON LANDSLIDES - OMIV

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

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FRENCH OBSERVATORY ON LANDSLIDES - OMIV

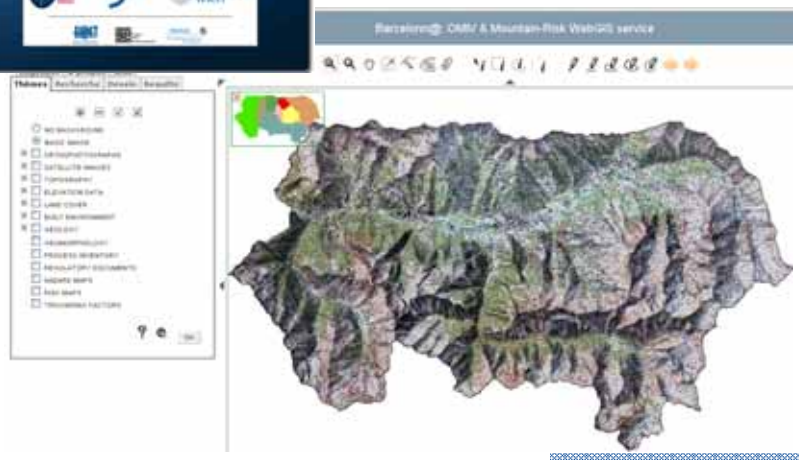

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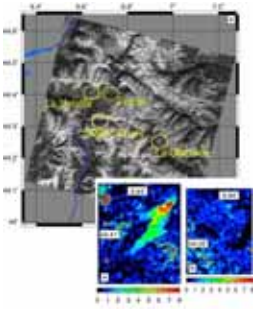
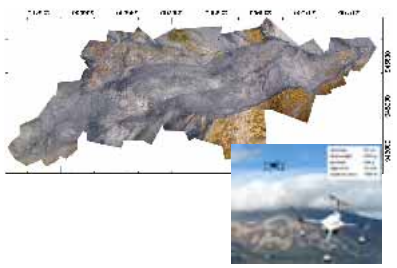
IMAGE DATA

Type of images	Resolution of original data	Dates	Product derived and resolution (e.g. DEM 2x2m)	Available (or ordered) or planned
Landsat ETM+ Landsat ETM+ Landsat ETM+	TM30m+P15m TM30m+P15m TM30m+P15m	28.08/ 2000 20.09/1988 23.07/1984	Landuse Landuse Landuse	Available Available Available
Quickbird	0.61 m	July 2006		Available
Rapid Eye	5 m	July 2009		Available
ALOS AVNIR-2 ALOS PRISM ALOS AVNIR-2 ALOS PRISM ALOS PRISM	10 m 2.5 m 10 m 2.5 m 2.5 m	26/06/2008 26/06/2008 16/07/2009 16/07/2009 29/09/2009		Available Available Available Available Available
SPOT 5 P	2.5 m	19/09/2003 19/03/2004 22/08/2004 30/06/2005 05/07/2005 01/08/2005 20/08/2006		Available Available Available Available Available Available Available
SPOT 4 P	10 m	17/10/1994		Available
PLEAIDES	0.7 m / 2.8 m	Acquisition planned in 2011		Ordered by CNES (ORTEO Geology)
Airborne LiDAR	1 pt/m² 30-60 pts.m²	22/04/2007 18/07/2009 Acquisition planned in July 2011 (budget already avail).	DTM 1 x 1m DSM + DTM 0.5 x 0.5m	Available Available Planned
Airborne Radar	3.4 m	July 2009	DSM / DEM	Available
SAR ERS 1-2	Full resolution	1991 - 1999 (several dates)		
Terrasar X	TX images	25 scenes of TX images to be bought in 2010-2011. Agreement received from German Aerospace Center (DLR) – Copur price.		Ordered by BRGM
Orthophotos	1:20.000 1:15.000 1.20.000 1.20.000 1.20.000 80 cm 50 cm 50 cm 30 cm 5 cm	- 1956 (b/w) - 1974 (false color & ir) - 1982 (false color & ir) - 1988 (b/w) - 1998 (b/w) - 2000 (color) - 2004 (color) - 2007 - 2009	Orthorectified Orthorectified Orthorectified Not orthorectified Orthorectified Orthorectified Orthorectified Orthorectified Orthorectified Orthorectified	Available Available Available Available Available Available Available Available Available Available
Orthophotos from UAV flights	1.5 m 50 cm 30 cm 30 cm 30 cm	- July 1999 - May 2006 - July 2008 - October 2008 - October 2009	Orthorectified Orthorec. In progress Orthorectified Not orthorectified Not orthorectified	Available Available Available Available Available





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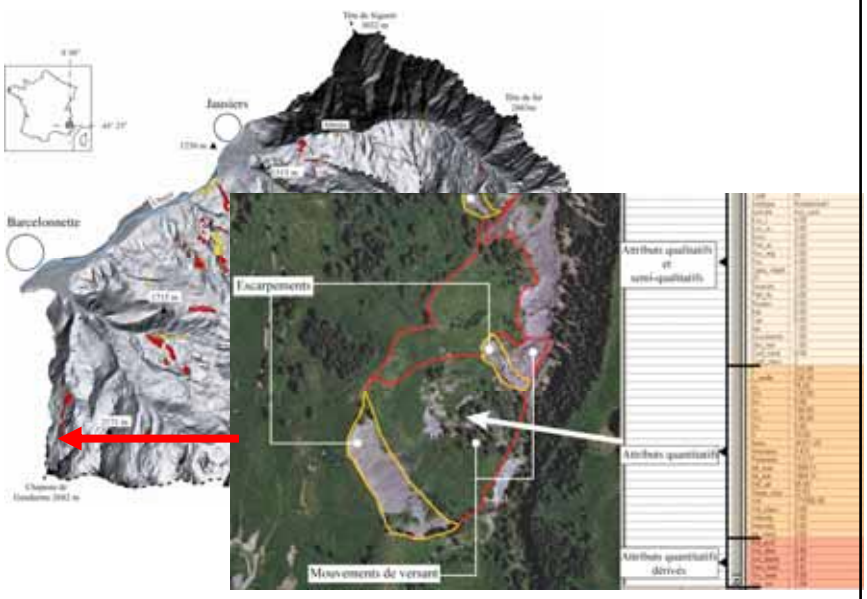
INVENTORY - 1



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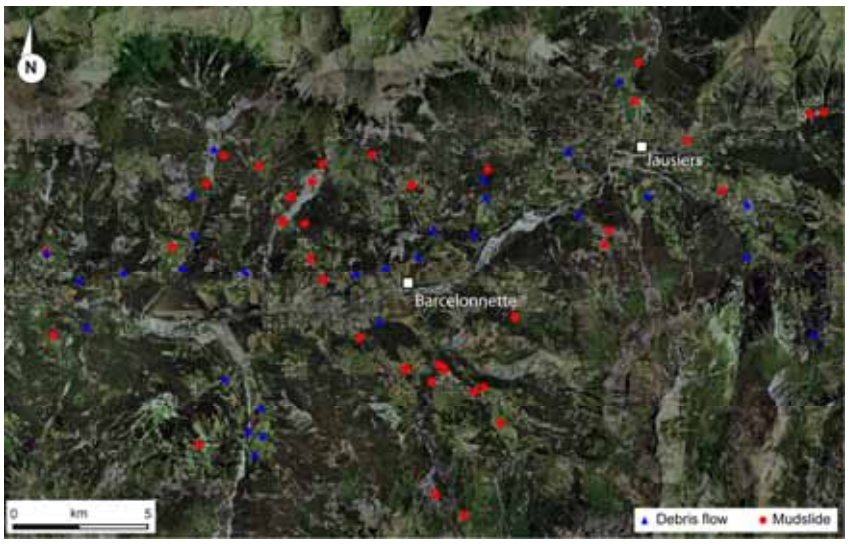

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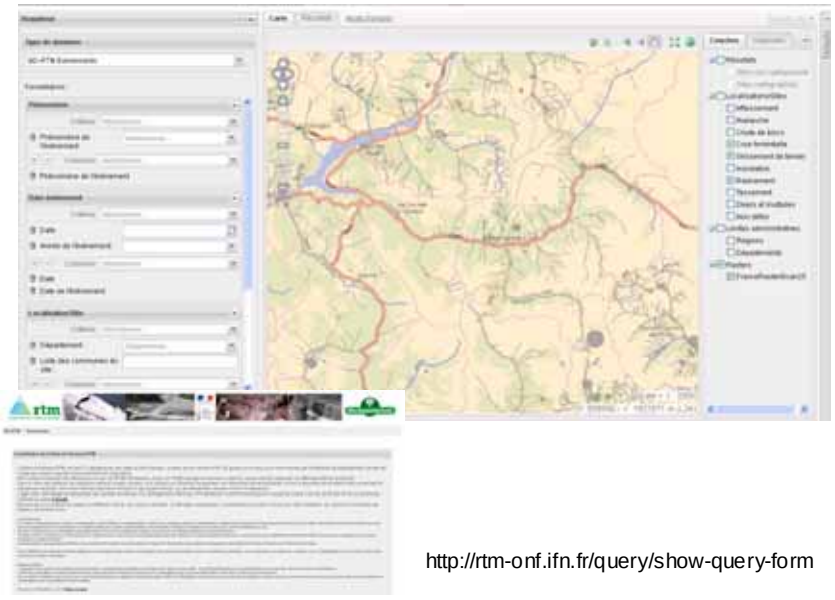
INVENTORY - 3



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

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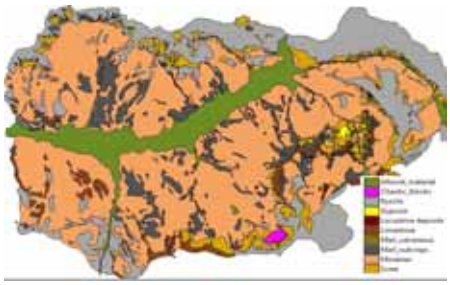
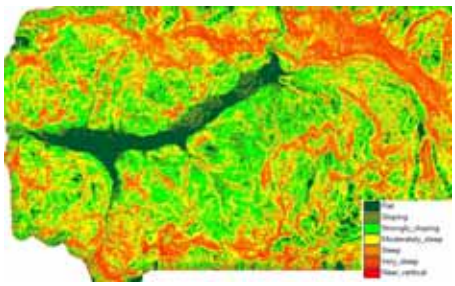
PREDISPOSING FACTORS





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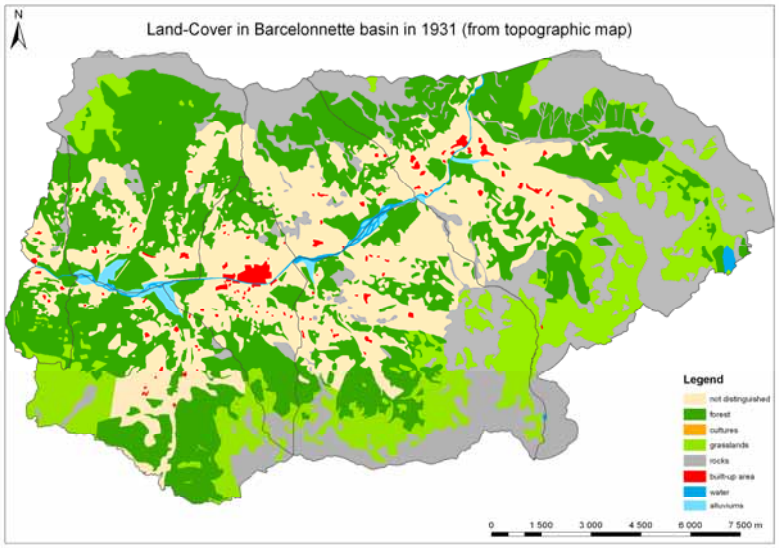
PREDISPOSING FACTORS



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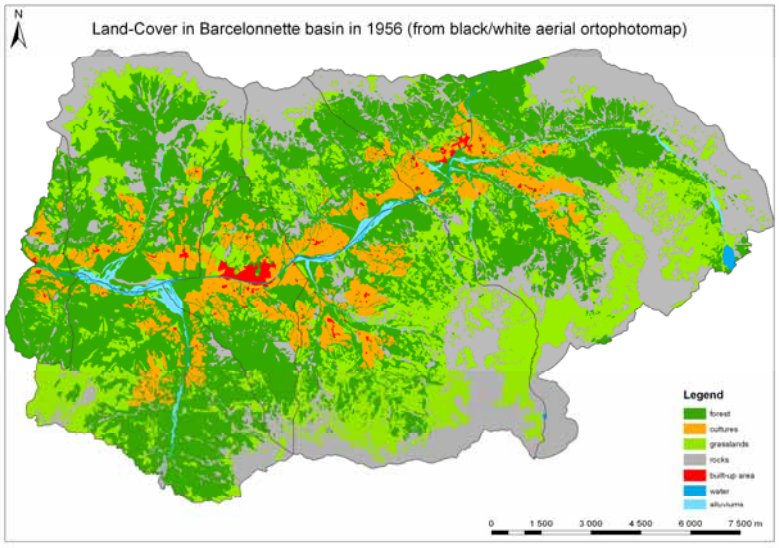
PREDISPOSING FACTORS



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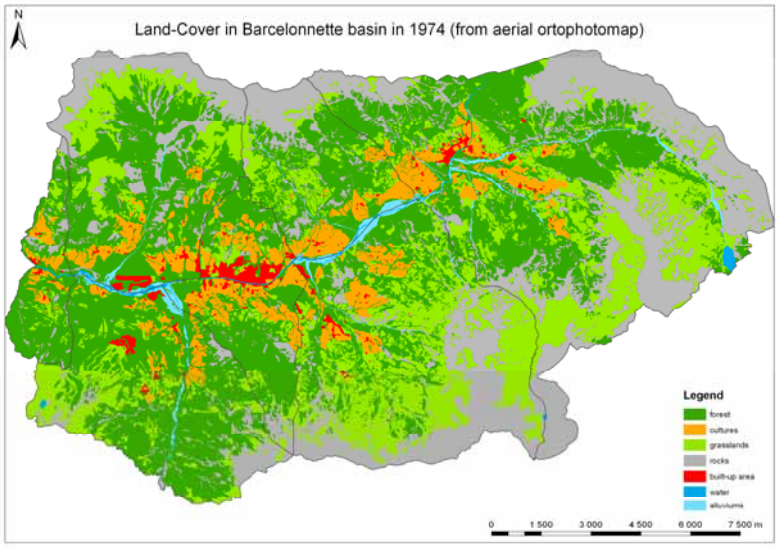
PREDISPOSING FACTORS



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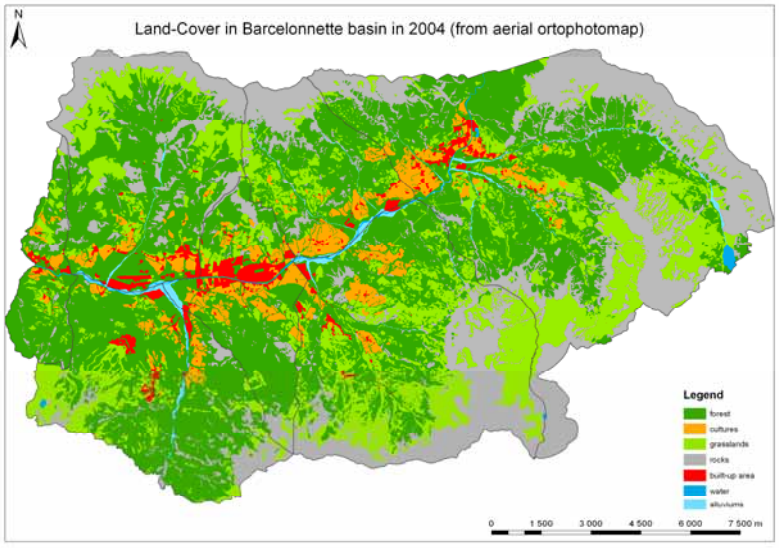
PREDISPOSING FACTORS



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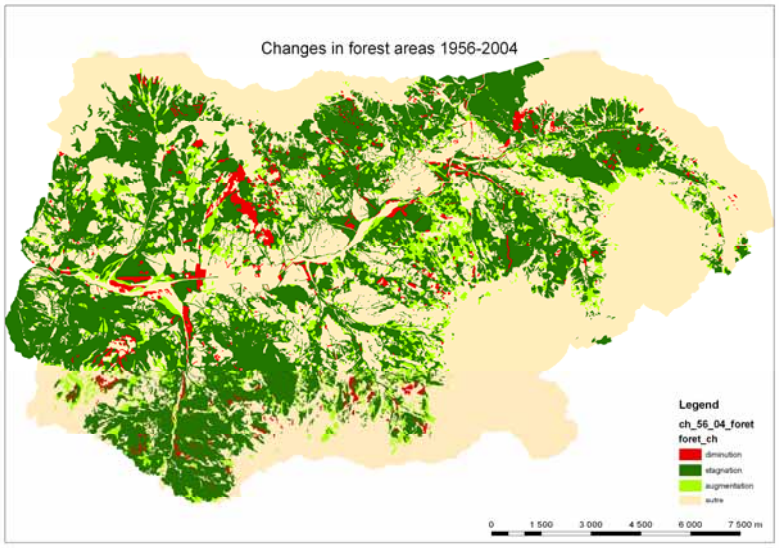
Observed changes in the Barcelonnette 1956 - 2004



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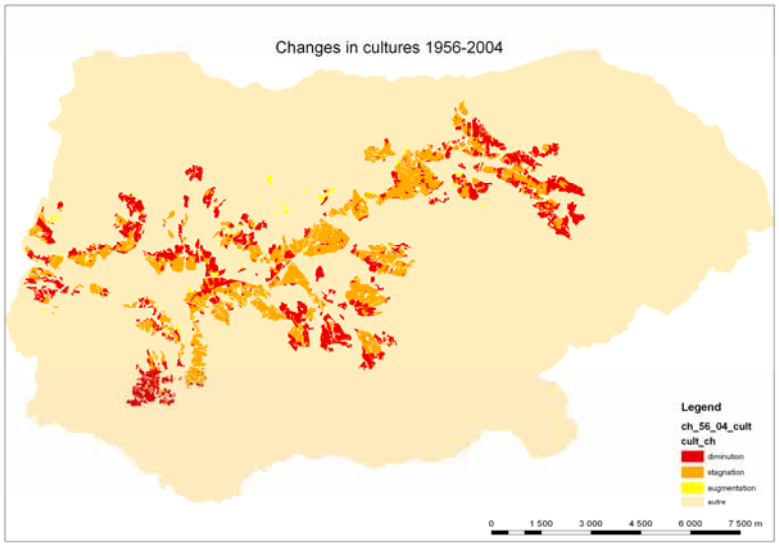
Observed changes in the Barcelonnette 1956 - 2004



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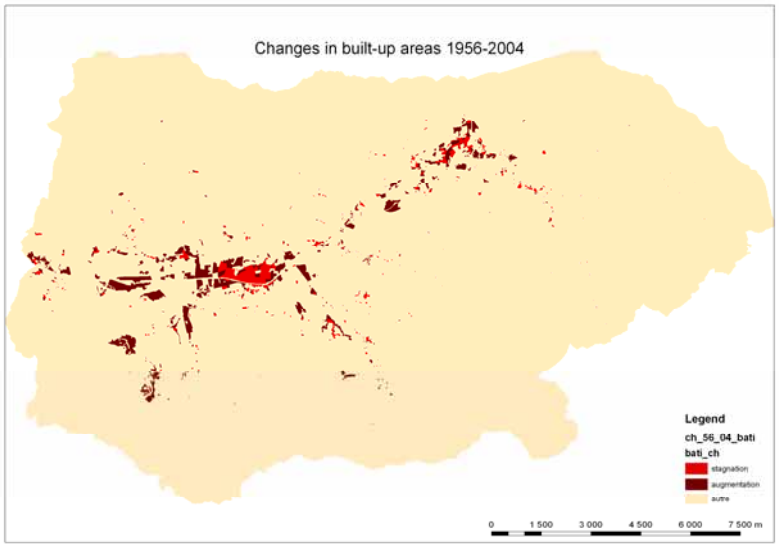
Observed changes in the Barcelonnette 1956 - 2004



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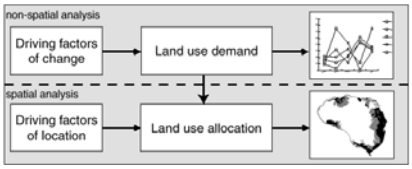
PREDISPOSING FACTORS

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

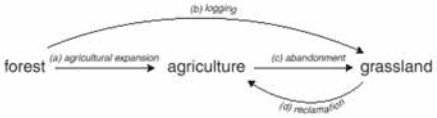
Approach: CLUE dynamic model - http://cluemodel.nl/

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 landuse change sequences and transition rules and application of a logistic regression model

Land use change sequence



$$Log\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_{1,i} + \beta_2 X_{2,i} \ldots\ldots + \beta_n X_{n,i}$$

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

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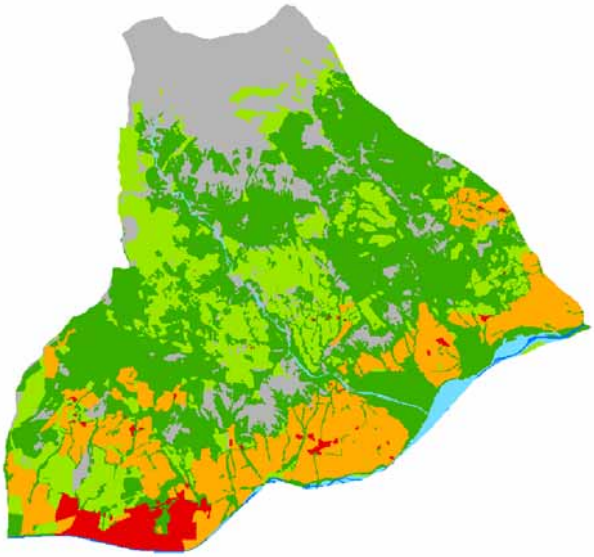
PREDISPOSING FACTORS

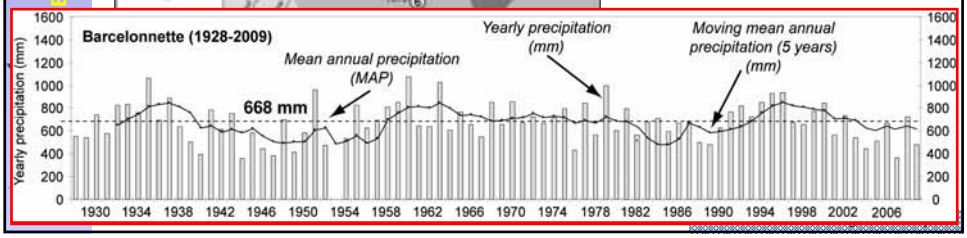
Results of simulation



TRIGGERING FACTORS

- Almost 10 climatic stations

- Great local variability because of orographic influences / topoclimate



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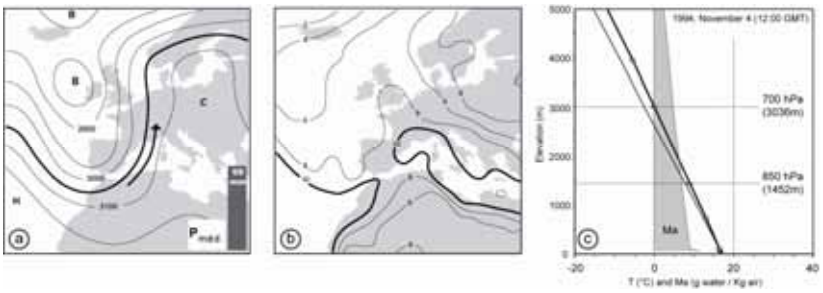
SYNOPTIC SITUATIONS TRIGGERING LANDSLIDES



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 ha	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
Pm	7	0	7	17,5	15,1	5,2	-6,9	1320,7	2862,4	7,4	4,4	2,7	16,4
Pm 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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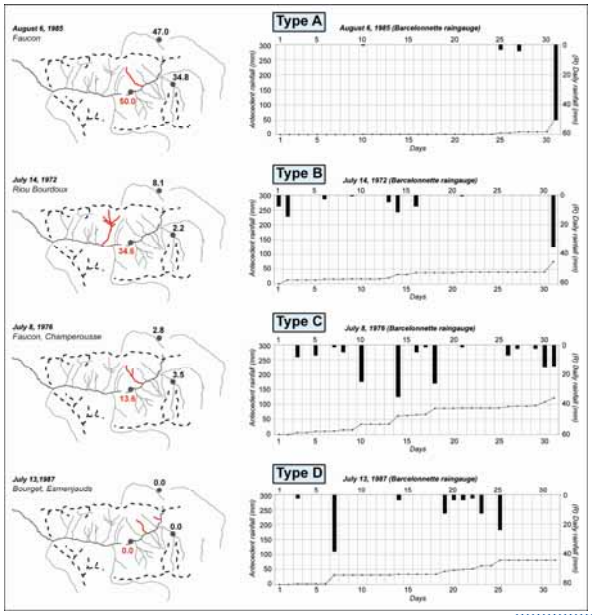
TYPOLOY OF RAIN EVENTS TRIGGERING LANDSLIDES



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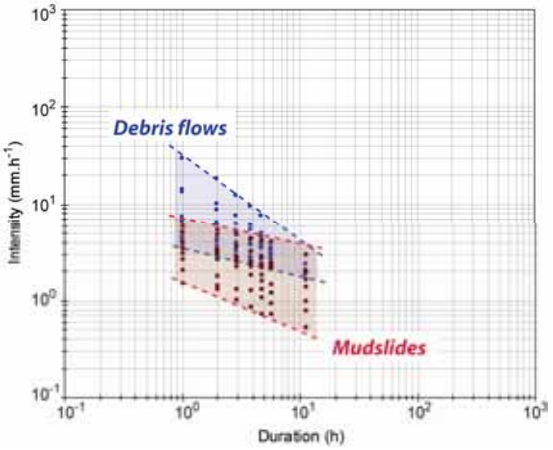
POSSIBLE RAINFALL THRESHOLDS, intensity/duration



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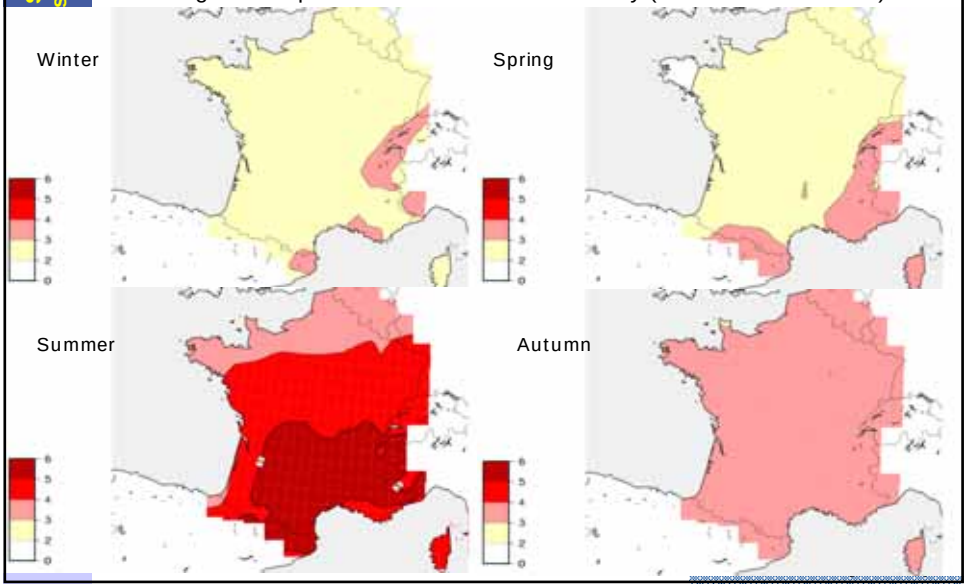
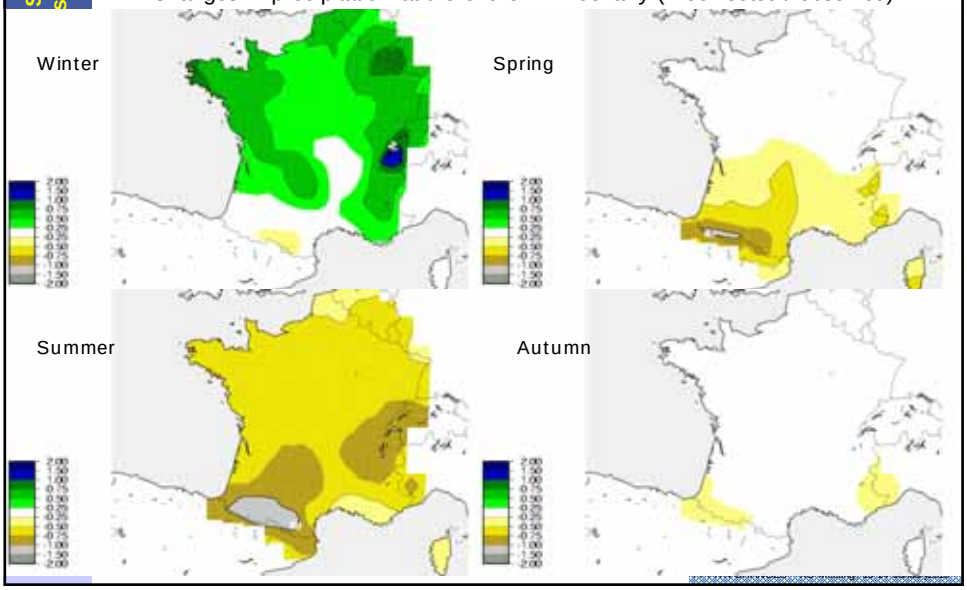
CLIMATE SCENARIOS

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



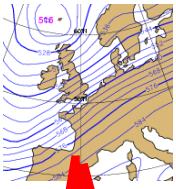
CLIMATE SCENARIOS

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

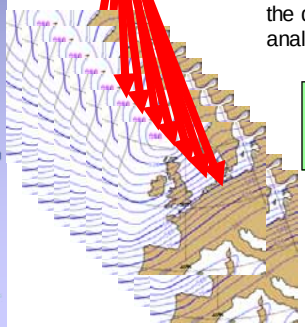


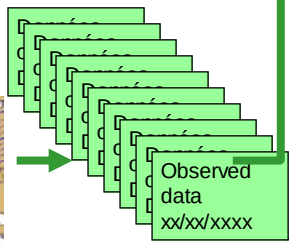
CLIMATE SCENARIOS

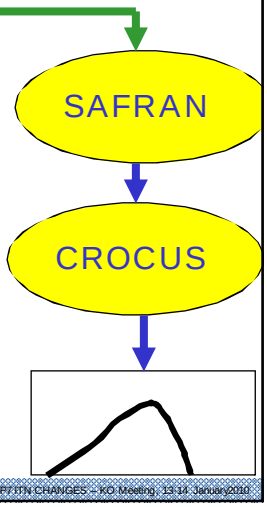
Method of regionalization



- 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







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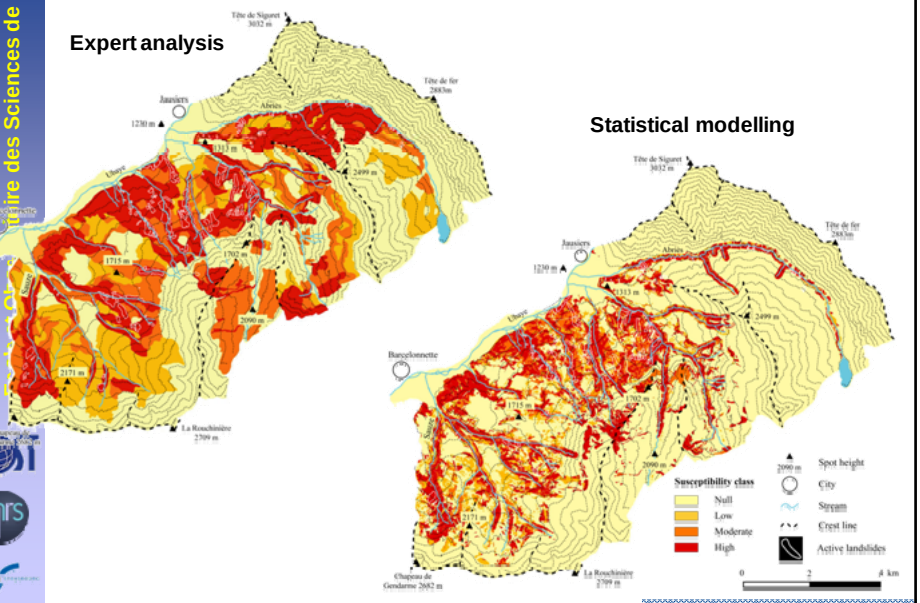
LANDSLIDE SUSCEPTIBILITY / HAZARD MAPS

Expert analysis

Statistical modelling



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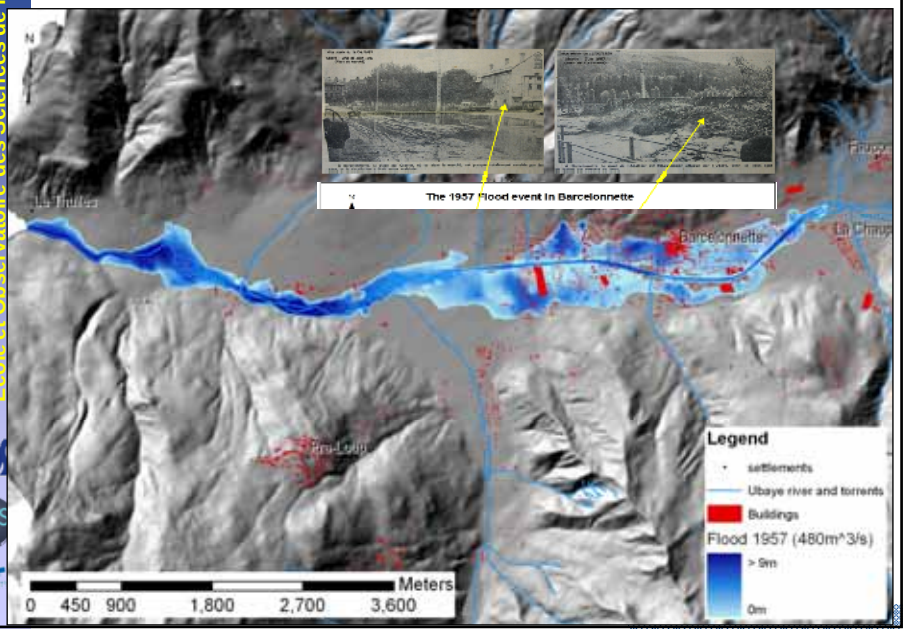
FLOOD HAZARD MAPS



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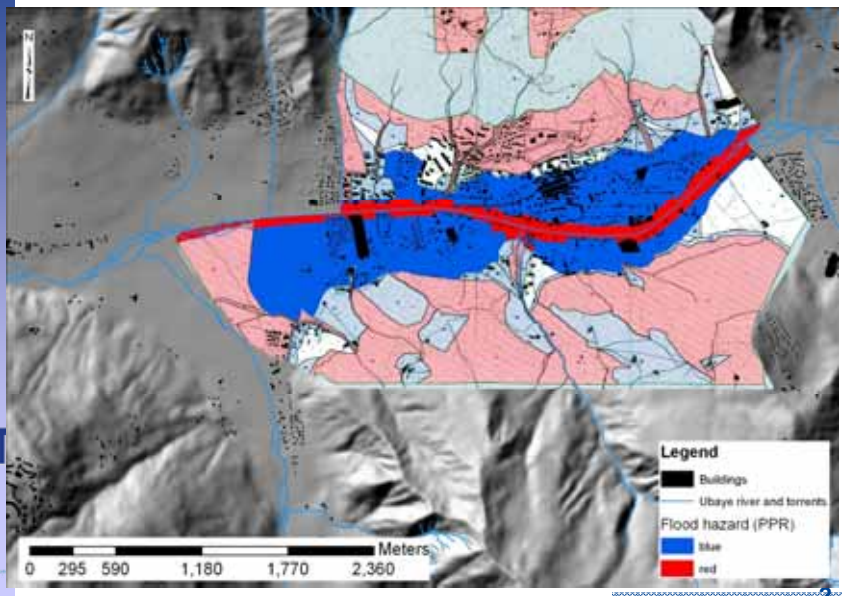
FLOOD HAZARD MAPS



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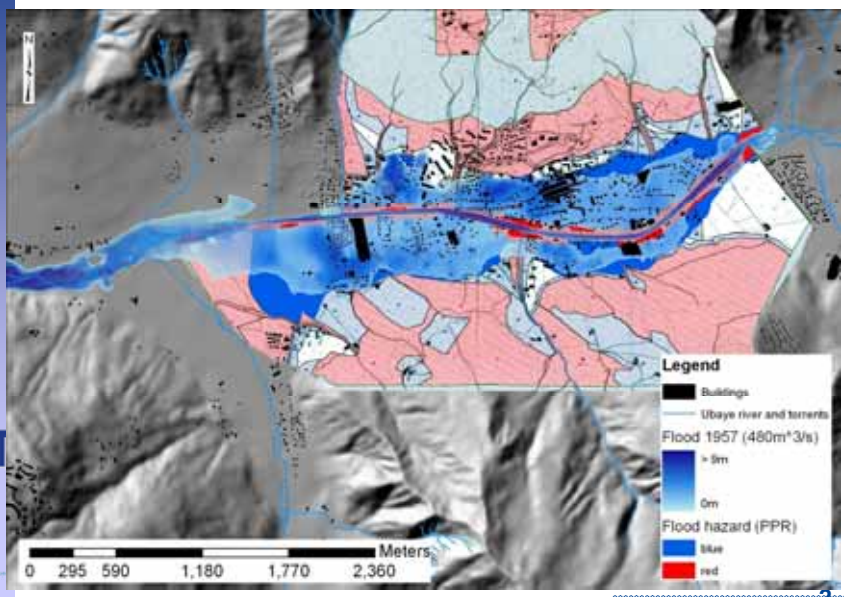
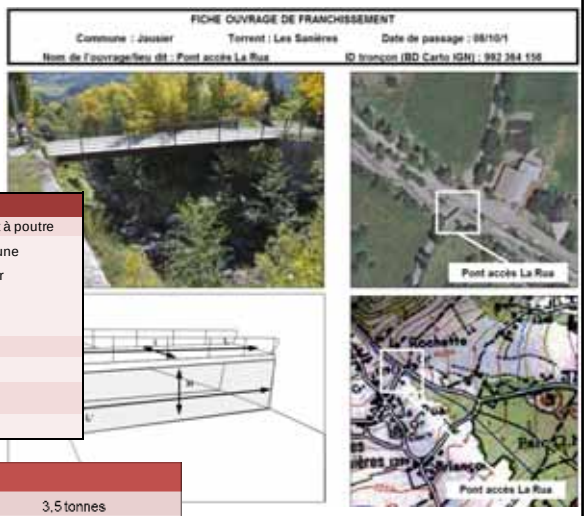
FLOOD HAZARD MAPS



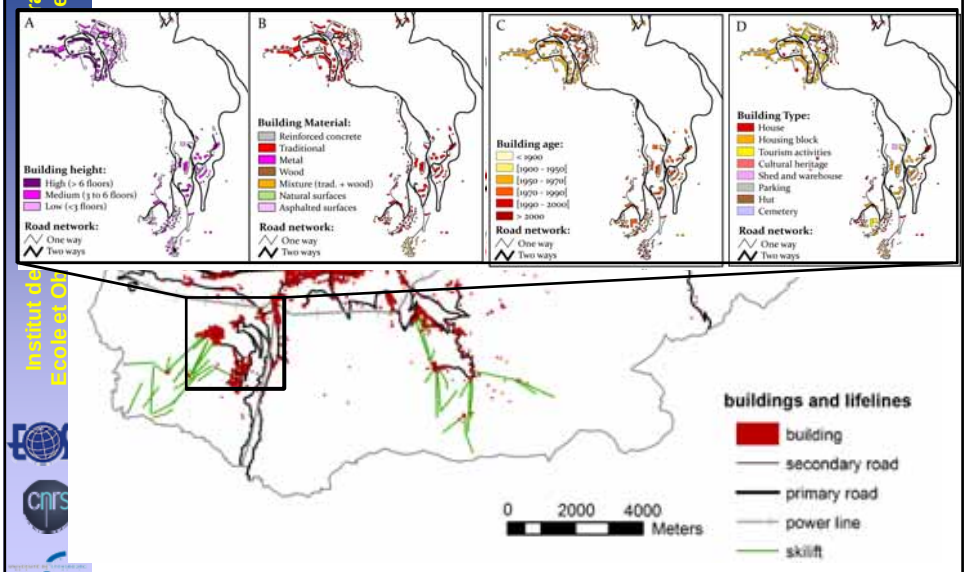
ELEMENTS AT RISKS



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

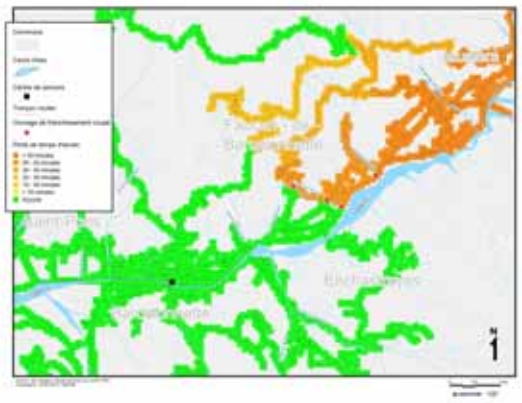
Valeur fonctionnelle	
Limitation poids	3,5 tonnes
Limitation vitesse	Non Communiquée
Nombre de bâtiments isolés en cas de coupure	
Longueur du plus court chemin pour contourner ce pont	

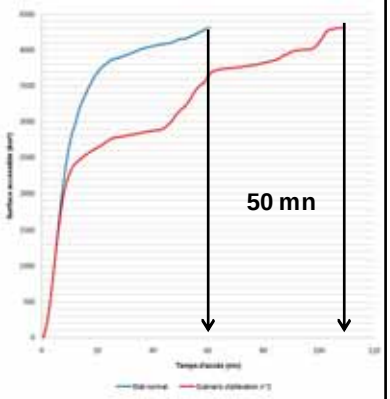
ELEMENTS AT RISKS - BUILDINGS



ELEMENTS AT RISKS - NETWORKS

Accessibility to shelters in case of blockage





THANK YOU FOR YOUR ATTENTION

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Ecole et Observatoire des Sciences de la Terre

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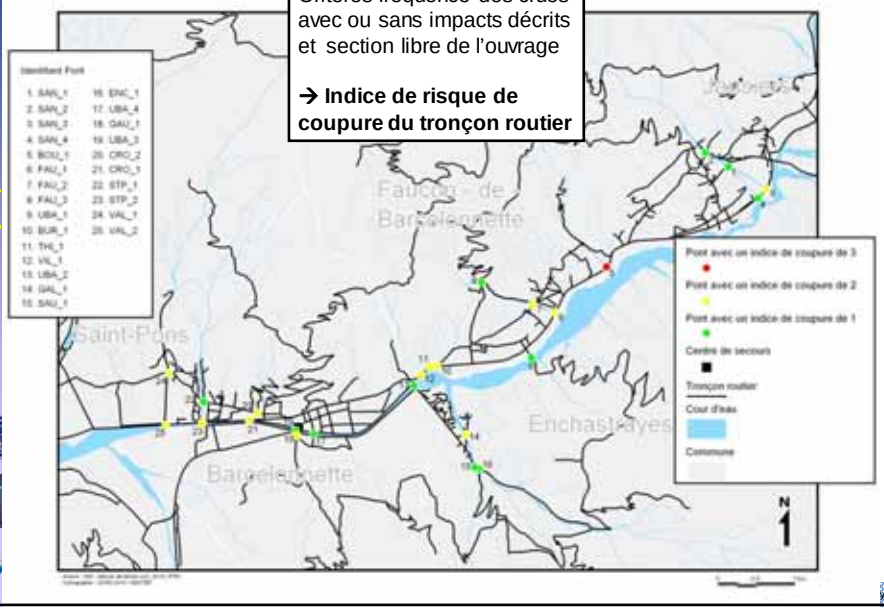
Critères fréquence des crues avec ou sans impacts décrits et section libre de l'ouvrage

→ **Indice de risque de coupure du tronçon routier**