Debris Flow and Flash Flood. Risk, Vulnerability, Hazard and Resilience concepts						
					6 ECTS Credit Points	
Mentor:	A. Bateman					
Tuition form & study load:	*Topic*	*Contact hours*			*Study load [hrs]*	*Examination/weight*
		Lect -ure	*Exer cise*	*Work shop*		
	Debris Flow, concepts and modelling.	7	7	10	25	Exercises reports on five topics (15%)
	Flash Floods, concepts and modelling.	7	7	10	25	(15%)
	Drought concepts and modelling.	4	4	9	10	(10%)
	Vulnerability and Uncertainty.	4	4	9	10	(10%)
	Experimental works (Fluvial Morphodynamics Laboratory GITS)	2	2			(5%)
	Field Trip to a case study.				12	participation (5%)
	(total contact hours 86)				total 168	& exam (40%)
Pre-requisites:	Hydrology and Hydraulics; Fluid dynamics, information technology and computer science; Information management and numerical methods					
Learning objectives:	The principal objective of the present course is to introduce the student to new phenomena as the debris flow and flash flood. The students learn how to evaluate the debris flows and flash floods mathematics and how to delimitate flooded areas, and also to calibrate and create new models. The students learn and apply concepts as risk, vulnerability and resilience.					

Content:	Description of debris flow phenomenon and basic concepts are presented. Description and definition of flash flood assessment. This course transport to the student to new concepts on flood phenomena produces by debris or water. The student learns mathematical models adapted to both phenomena, learn how to apply different rheologies. Learn to create flood (debris or water) risk maps from simple and complex models. – Debris Flow theories, triggering variables, rheology, mathematical modelling. – Debris Flow modelling aspects, 0D, 1D and 2D numerical models. Delimitation of occurrence zones and run-off. Shalstab, Triggs, Sinmap, FLATModel (Gits-2d Model), GITS1D. – Flash Flood modelling and analysis. Simplified methods. – The socio economical aspects at the Maresme Basins, usually basins with high level of risk and FF events. – Translation of hydraulic models output variables into hazard – Spatial Planning. Structural risk analysis, bridges, streets, abutments, other elements in rivers, Scouring. – Translation of Drought models output variables into hazard – Translation of Debris Flow models output variables into hazard – Translation of coastal models output variables into hazard – Methodologies to evaluate vulneranbility as a quantitative values. – Application of uncertainty to risk assessment – Methodologies to evaluate uncertainity as a quantitative values. – Construction of Hazard Maps from DF & FF. Using GIS and different models (Hydraulic and Debris kinds) – Residual risk evaluation – Optimal design of structural measures. Economic appraisal of flood risk mitigation projects.
Course structure:	8. Conventional class activities 9. Optional seminars 10. Personal course work will consist in a selection, review and final report of a selected research paper regarding radar topic and application in hydrologic problems. The student may read, understand and redact a summary-report on the topic. Finally, the student will present the paper and the report in public. The amount of hours will depend on followed seminars. 11. Round table will be planned to discuss the results of the home work.
Didactics	Formal lectures; classroom exercises; home assignments; exercises & workshops in computer lab
Additional reading:	