Fiche analytique – Mémoire de Master MUSE

A rendre au secrétariat lors de l'inscription à la soutenance du mémoire

* champs obligatoires

AUTEUR*	NOM : Meisburger	PRENOM : Elsa	
TITRE MEMOIRE*	Evolution of rockfall risk related to changes in its hazard and exposure components		
NUMERO MEMOIRE	596		
DATE SOUTENANCE	02/09/2024	Salle: 001	Heure: 11h
THEMATIQUE* (AFFILIATION)	Impacts climatiques		
VOLEE MUSE*	2021		
TITRE ACADEMIQUE* (par ex.: licencié en biologie)	Licenciée en Physique-Chimie-Environnement (2021)		
DIRECTION* / EVALUATION	Directeur de mémoire* Prof. Dr. Markus Stoffel	Co-directeur de mémoire* Dr. Manon Farvacque	Nom(s) du ou des juré(s)* Dr. Christophe Corona
STAGE (éventuel)	Organisme d'accueil : /	Maître de stage : /	
Projet de l'ISE (éventuel) auquel le mémoire est rattaché	/		
Bourse (éventuelle) reçue par l'étudiant	/		
COLLATION*	Nb de pages* : 80	Nb de figures* : 21	Nb de tableaux* : 8
TERRAIN D'ETUDE OU D'APPLICATION	Balmatten, Canton of Valais, Switzerland		
MOTS-CLES* (entre 5 et 10)	Quantitative rockfall risk; risk components; nonstationary conditions; cost-benefit analysis; Balmatten site.		
RESUME* (max 1500 car)	/		
SUMMARY* (en anglais)	Alpine topography limits the area available to their inhabitants, so most of them are concentrated in the valleys. Unfortunately, these spaces are often targeted by natural hazards such as rockfalls (Eckert et al., 2020). Rockfalls are a type of fast-moving landslide, subsequent to the detachment of a mass from an area of bedrock, that travels down a slope by movements of free falling, leaping, bouncing, and rolling (Erismann & Abele, 2001; Hungr et al., 2014; Rapp, 1960; Selby, 1982; Varnes, 1978). These gravitational phenomena may result in various consequences including financial loss, infrastructural damage or human casualties. Therefore, it is necessary to assess the risk people and dwellings are exposed to, in order to protect them through integrated risk management (e.g., mitigation strategies, lang-use planning, etc.). Due to their complexity, quantitative risk assessments (QRAs) have yet to become a common practice for rockfall risk evaluation, and rarely ever take account of nonstationary conditions (Farvacque, 2020; Eckert et al., 2022). However, the stationary hypothesis is no longer valid because the risk and its components are known to evolve overtime. This study particularly responds to the lack of nonstationary research by integrating socioenvironmental evolutions in the assessment of rockfall risk along a cantonal road in Balmatten, Switzerland, for past (1960), current (2010) and future (2060) conditions. Indeed, this thesis demonstrates how rockfall risk is impacted by changes in its hazard and exposure		

	components. This study site was not only selected for the exposure of the road to rockfall events, but also because it is highly traveled, due to its location in the Zermatt valley and the tourist attractivity that comes with it. After estimating the evolutions in (1) the hazard through the frequency, and (2) the exposure through the road traffic volume, the rockfall risk was computed for seventeen road sections, and expressed in monetary terms, for all three time periods: 1960, 2010, and 2060. Overall, the most at-risk section was in line with the one identified by the FOSD (1999) in 1999. Although the exposure plays an appreciable part in the future evolution of the risk, it is the hazard that was identified as the most influential component of the rockfall risk in Balmatten. Thus, mitigation strategies shall be oriented toward hazard reduction, in accordance with the protective structures (i.e. rockfall nets, dams) already in place on the Balmatten slope. The cost and benefits of different absorption capacity nets were subsequently evaluated through a cost-benefit analysis, a highly valuable tool for decision-makers. This analysis considered the installation of a 350-meter long rockfall net along the road in Balmatten for the 2010 and 2060 conditions. The optimal net capacity was found around 70kJ in the former conditions, and at 1500kJ in the latter conditions. The evolution between the 2010 and 2060 optimal capacities highlights the importance of nonstationary risk analyses, to plan for future risk management.
REMARQUES	/