Report about the research visit of Mrs. Sandra Melzner (Geological Survey of Austria, Austria) from November 14th to 25th 2016

Hosting institute: Istituto di Ricerca per la Protezione Idrogeologica del Consiglio Nazionale delle Ricerche, Perugia office, Italy

Purpose of cooperation

The analysis of the impact of mapping strategy on the completeness of rock fall inventories in Austria, USA and Italy.

Context

Rockfall inventories are commonly used by experts and decision makers to investigate spatial and/or temporal rockfall abundance of an area and/or to evaluate and validate susceptibility, hazard and risk assessments. Standards for the preparation of rockfall inventories and for their quality evaluation are lacking.

Assessment strategies for the preparation of rockfall inventories may involve a variety of different methods /techniques and different data sources and base data (Fig. 1). The choice of an assessment strategy highly depends on the research goal, the study area size and the available manpower.

Results

Several rock fall datasets in Austria, Italy and USA were analyzed according their statistical properties. Depending on the source of rock fall information and the method/technique used to prepare the rock fall database, the content and the level of details of the compiled inventory can vary significantly from another (Fig. 1).

Different statistical methods were used to analyse the statistical properties of the datasets in terms of completeness and their potential use for different applications in the hazard and risk assessments.

Different statistical approaches exist for the analysis of frequency-size statistics and temporal frequency of rockfall data (Fig.2). Frequency-size statistics analysis can be performed empirically or theoretically. Empirical analysis are commonly based on histogram estimations that require the definition of bins. The main advantages of theoretical approaches rely upon the more objective definition of frequency size distributions.

The scope of the statistical analysis was the description of rockfall volumes (Fig. 3) and rockfall time series (Fig. 4-5) in different lithological settings. The comparison with synthetic generated frequency distributions form the basis for recommendation for mapping strategies with respect to different applications.

The results of the study will allow giving recommendation for the collection of rock fall data. This may form the basis for definition of criteria and standards for the preparation of rock fall inventories or evaluation of their quality. The results will be published in the frame of a scientific publication.

Perugia, November 25th, 2016

Sandra Melzner

Figures

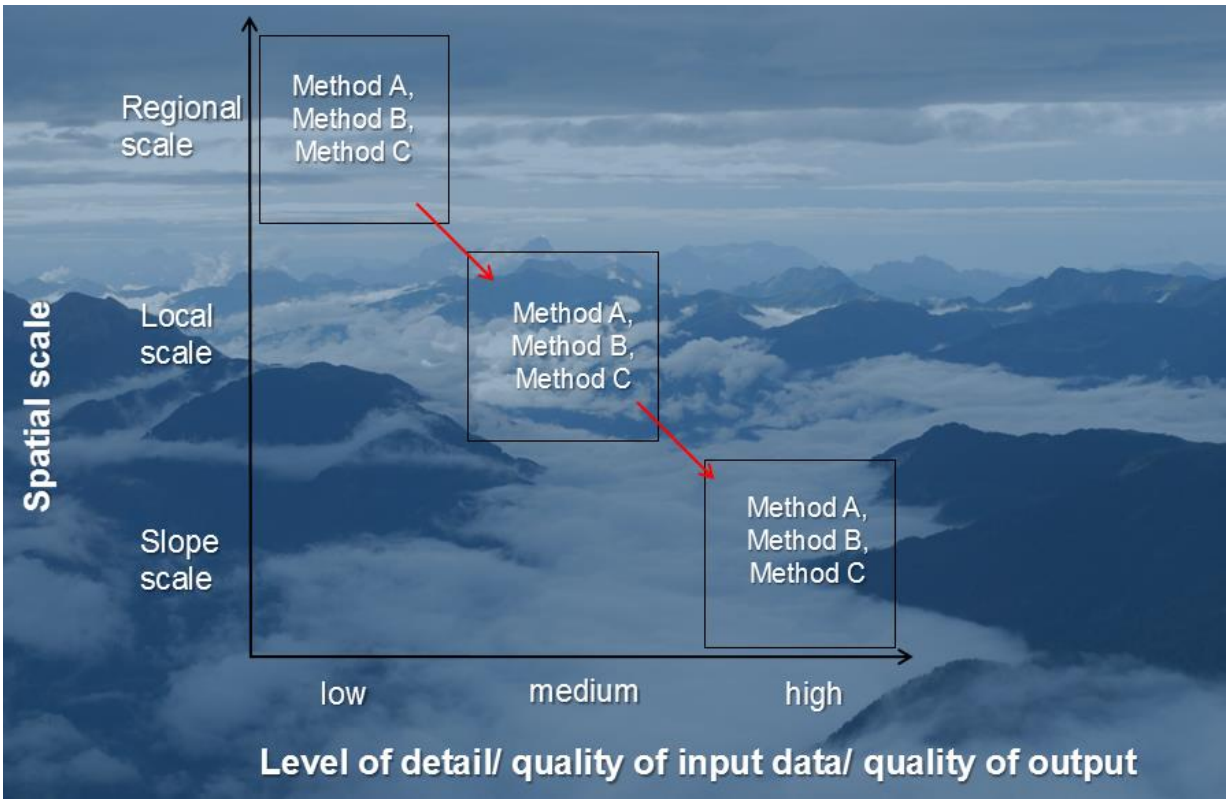

Figure 1. Choice of assessment strategy for the collection of rockfall data (Melzner et al. 2012).

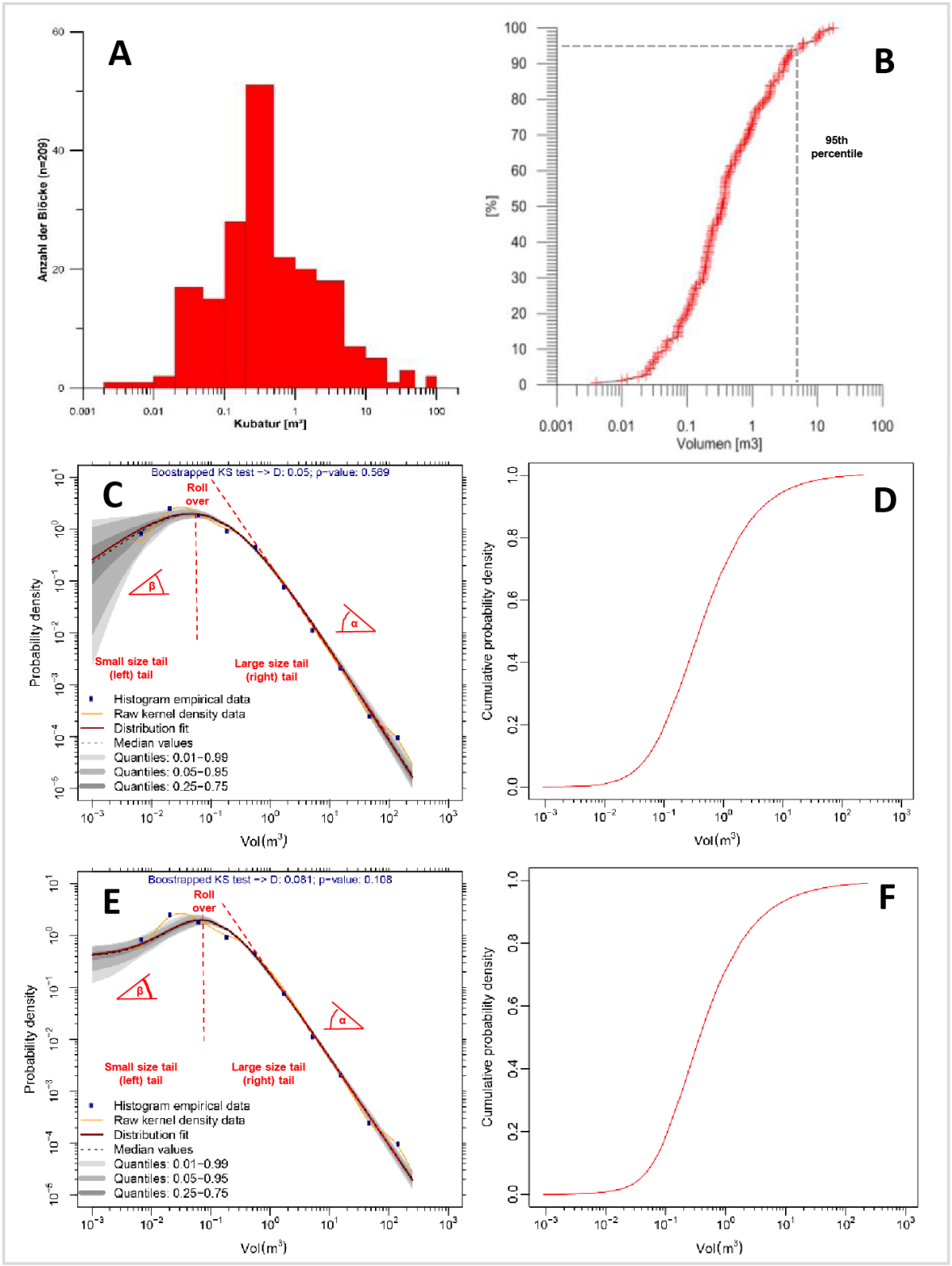

Figure 2. Overview about statistical analysis methods. (A) Frequency size distribution; (B) Empirical size distribution function; (C) Probability density function of rockfall size- PDF, double pareto; (D) Cumulative distribution function of size-CDF, double pareto; (E) Probability density function of rockfall size- PDF, inverse gamma; (F) Cumulative distribution functions- CDF, inverse gamma; see Rossi et al. 2012 for equations (Source: Melzner et al. in prep.)

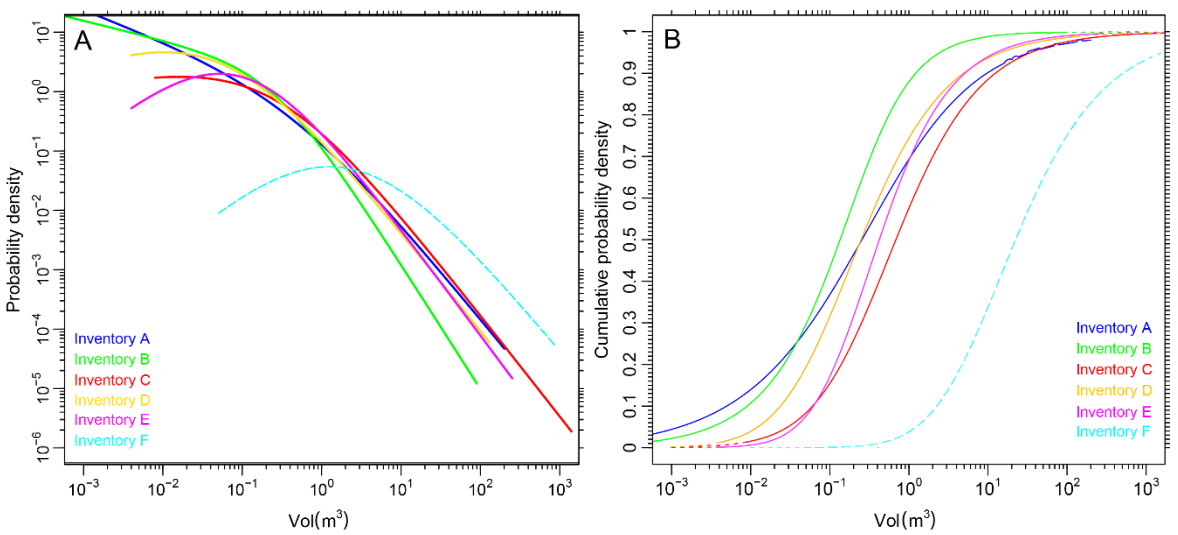

Figure 3. Influence lithology on frequency distribution of rockfall boulder size. Comparison of the probability densities of rockfall sizes (A) and cumulative distribution function of rockfall size (B) (Source: Melzner et al. in prep.).

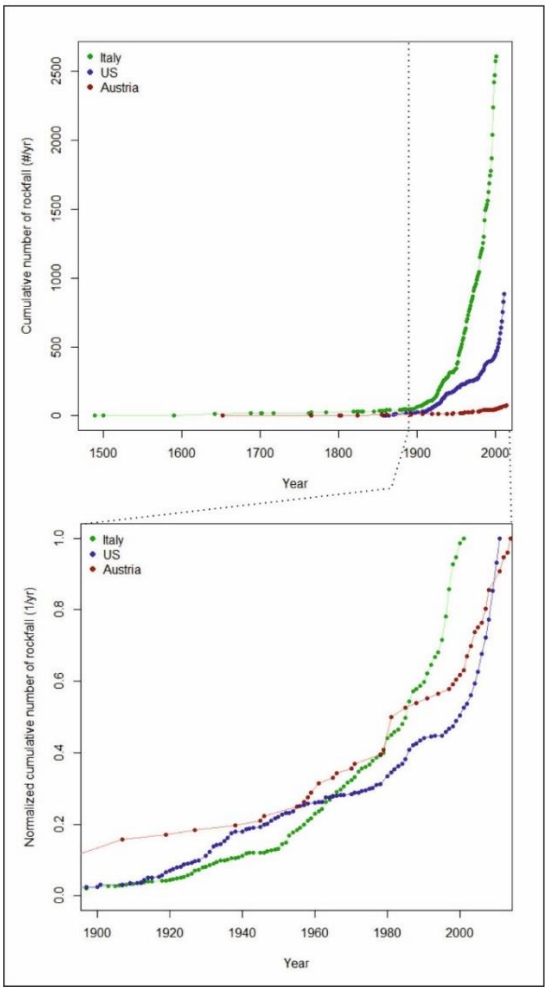

Figure 4. Influence of data collection method on historical rockfall time series. Cumulative number of rockfalls, N_{CR}, as a function of year for the historical rockfall catalogues from USA (blue curve), Italy (green curve) and Austria (red curve), for the periods (A) 1489-2001 -2014 and (B) 1890-2014. Different periods can be identified that have homogenous rates of reported number of landslide per year (Source: Melzner et al. in prep.).

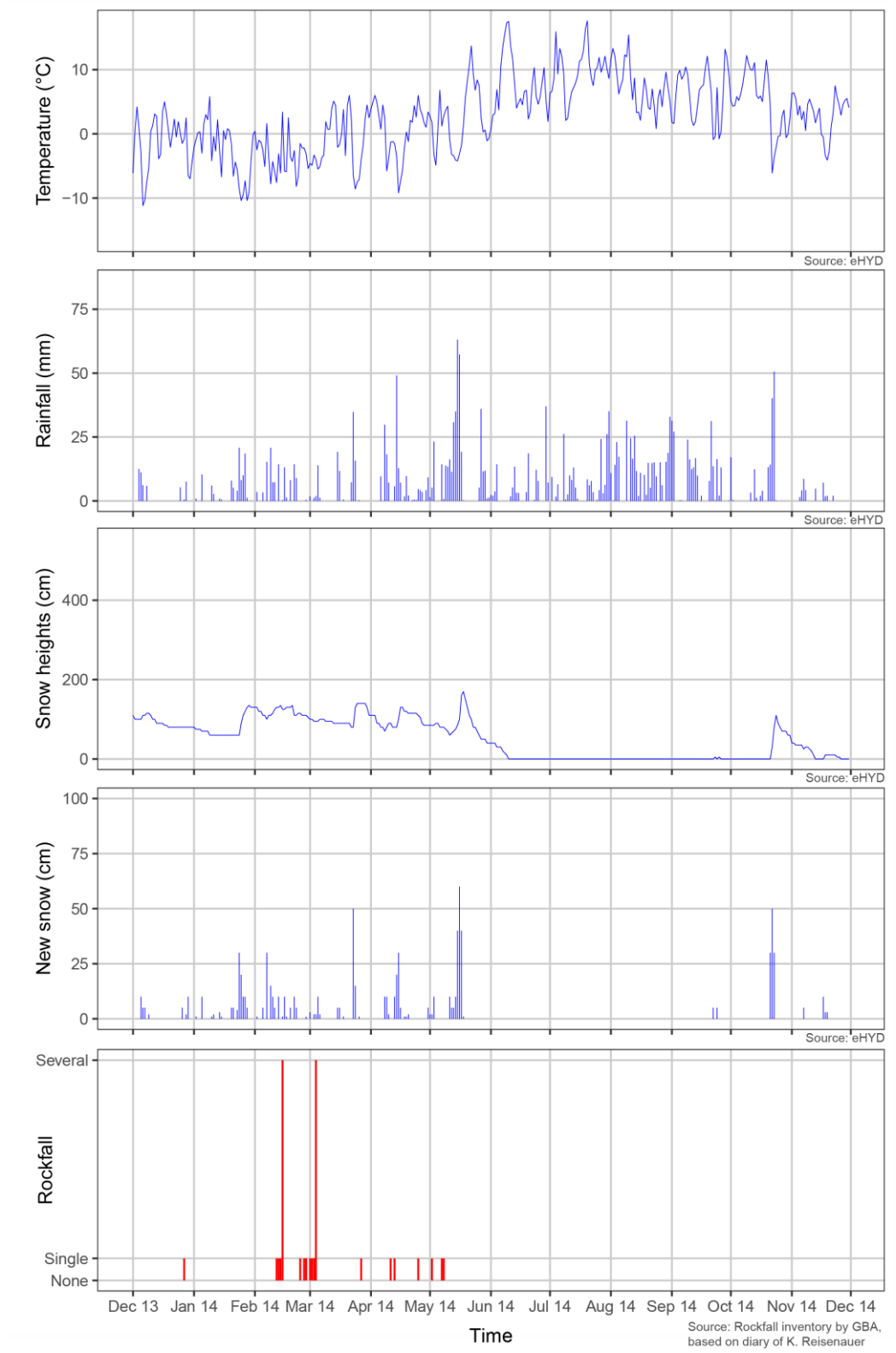

Figure 5. Analysis of correlation of rockfall time series with climatic factors. Low correlation indicates geologic predisposition responsible for the high, reoccurring rockfall failures (Source: Melzner et al. in prep.).