Lightning Statistics in Switzerland, Revisited

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The main goal of this M.S project is to make a comprehensive study of lightning activity in Switzerland during an 8-year period from 1999 till 2006, using data obtained from the European Lightning Location System (LLS), namely EUCLID (European Cooperation of Lightning Detection). This study has been done for the first time in Switzerland and is of salient importance because there is still no such a comprehensive study of lightning activity in Switzerland available. The limited lightning parameters that are available today are very old, they are limited to the lightning detection technology of their time and they have always used the data of local instruments or networks rather than a combined network at European scale. Thus considering the fact that many important industries use these old lightning parameters for Switzerland, an update of statistics for lightning parameters in Switzerland is necessary. Industries and organizations interested in lightning statistics include industries involved in the design and development of lightning protection systems for various electric and electronic installations, bodies involved in the development of lightning protection standards, owners and operators of electric production, transmission and distribution facilities, Swiss meteorological services, and insurance companies.

Statistical maps and graphs have been generated for different lightning parameters in Switzerland during this 8-year period using EUCLID's lightning database. The results are mainly composed of the most important statistics for various lightning parameters, including flash density, flash multiplicity and flash peak current. In general, the most important conclusions of the analyzed data are briefly presented below:

-The flash density in Switzerland is highest in the region of Tessin and south of the alps. This is because of the blocking effect of the Alps on thunderstorm cells that come to Switzerland from the northern of Italy.

-There is a large number of hotspots in the lightning flash density map that are located in various parts of Switzerland including the region around the Ständis tower as well as around some transmission towers near Luzern, Biel, Basel, Zurich and Bern.

-Our detailed study around the Ständis tower shows that the highest lightning activity in Switzerland occurs in this region. The telecommunications tower on the top of this mountain exhibits a particularly high lightning activity as the tower initiates a large number of upward discharges. We have observed flash densities exceeding 100 flashes per year on the Ständis Tower.

It should be noted that lightning parameters are usually considered time-invariable. Considering the importance of the global warming today, possible correlations between lightning activity and climate changes in Switzerland have also been investigated in this study. This investigation has a unique character because, to the best of our knowledge, it represents the first correlation analysis ever performed in local geographical areas (overall Switzerland, Geneva

and Ständis) and it uses the LLS for lightning parameters and local meteorological services as data source.

On the other hand, an original technique is presented for the indirect estimation of the ground conductivity of a given region using data obtained from LLS. Based on the proposed method, a Matlab simulation code has been developed and applied to specific data to show the feasibility of the technique. The knowledge of the ground conductivity can be used in telecommunication applications and for improving the performance of LLS itself.

Finally, a detailed analysis of correlation between lightning and climate changes in Switzerland is presented. The analysis confirms that there should be a tight relationship between temperature variations and lightning activity in Switzerland. As a result, important temperature variations, e.g effects of greenhouse gases and global warming, will also affect the lightning activity. For example, any long term increase in temperature because of greenhouse effect in Switzerland will result in more lightning activity in Switzerland. This result is of paramount importance because it shows that the global warming should be seriously taken into account in the design of lightning protection.