The Effect of Lightning Phenomena on Lightning Protection for Objects on the Ground

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When lightning strikes the transmission line or the distribution line, high voltage is generated between the wire and the earth, discharge occurs in the insulator, and power failure occurs. A high voltage is generated when the peak value of the lightning current is large. Also, as the wave front length of the current is shorter, a higher voltage is generated. On the other hand, the lightning rod fails to catch the lightning discharge and destroys the roof and wall of the building even with the low peak value of the lightning current. Furthermore, damage caused by lightning arrester burnout is not much affected by the length of wave front length, and it is greatly influenced by the duration (charge amount) of the lightning current. Table 1 shows the relationship between the types of lightning damage and lightning parameters. Since lightning properties related to lightning damage of ground structures depend upon the object, it is important to fully understand the lightning phenomena to take countermeasures against lightning damages. Moreover, it is also necessary to clarify the seasonal and local characteristics of lightning from the viewpoint of risk management because there are lightning with significantly different properties from ordinary summer lightning such as the Japanese winter lightning. In this paper I will explain the lightning properties necessary for countermeasures against lightning damage and consider the issues of lightning observations in the future.

Keywords: Lightning, Lightning Protection, Power Grid, Wind Power

表１雷被害と関係する雷のパラメータ

	電流波高値	雷撃距離	波頭峻度（波頭長の逆数）	波尾長（電流継続時間）		対策法	備考
絶縁破壊(碍子など回復可能なもの)	◎		○			架空地線、避雷器、SPD	統流の影響
絶縁破壊(半導体など)	◎					SPD,光ファイバ	
通過電荷量によるエネルギー被害(避雷器焼損、架空地線素線切れ)				○		避雷器（SPD）の容量増加	
オーミックロス（エネルギー）によるエネルギー被害（風車塔体内焼損など）	○			○		引下げ導体と受雷部などの接続部強固化	
送電線架空地線遮蔽失敗		○				架空地線の２条化	
建築物損壊（コンクリート、レンガ等）		○				避雷針（受雷部）の強化	
建築物損壊、着火（藁葺き屋根、桧皮葺き屋根）		○		◎		避雷針（受雷部）の強化	消火体制
ノイズ（EMC 的影響）	○		○			離隔距離の確保、信号線の電磁シールド	雷電流の通過による回路の誤動作など

