

Masaru ISHII LAB.

[Winter lightning and upward lightning]

Department of Informatics and Electronics

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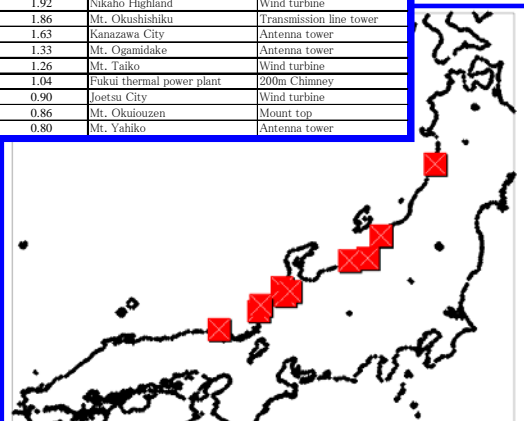
High Voltage Engineering, EMP

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The coastal area of the Sea of Japan is world-widely known for severe winter lightning. Since altitudes of charges in thunderclouds in winter is lower than those in summer, lightning discharges frequently start and extend upward from tall structures on ground in this area. Upward lightning in winter is frequently more energetic than most of downward summer lightning. As a result, a lot of transmission line faults and damages to wind turbines are experienced in winter.

Occurrence of upward lightning is related to temperature of upper air. Therefore, hazardous regions due to upward lightning can be identified by combining LLS (Lightning Location System) data and upper air-temperature data. LLS also reveals concentration of lightning discharges in winter around tall structures in the coastal area of the Sea of Japan.

No.	Lightning stroke density [discharges /month /knf]	Place	Tall structures
1	2.53	Mt. Kunimidake	Wind turbine
2	1.92	Nikaho Highland	Wind turbine
3	1.86	Mt. Okushishiku	Transmission line tower
4	1.63	Kanazawa City	Antenna tower
5	1.33	Mt. Ogamidake	Antenna tower
6	1.26	Mt. Taiko	Wind turbine
7	1.04	Fukui thermal power plant	200m Chimney
8	0.90	Joetsu City	Wind turbine
9	0.86	Mt. Okuiouzen	Mount top
10	0.80	Mt. Yahiko	Antenna tower



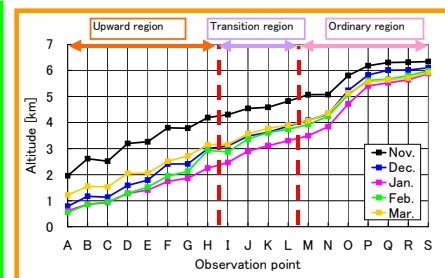
Locations of lightning hot spots observed along the coast of the Sea of Japan in winter.

(Dec. in 2001~2005 and Jan. in 2002~2006)

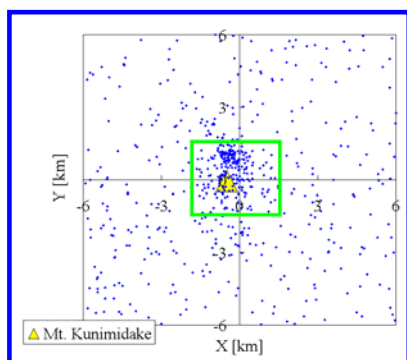


Upward lightning frequently observed in winter along the coast of the Sea of Japan

音羽電機工業株式会社 “雷”写真コンテスト
2004年 学術賞
撮影者 中坪 良三 様

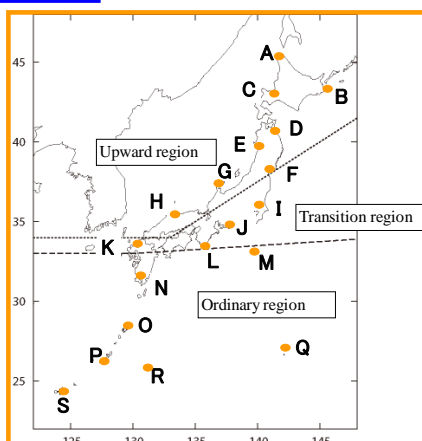


Monthly average heights of -10 °C temperature in cold season (6 winters from Nov. 2000).

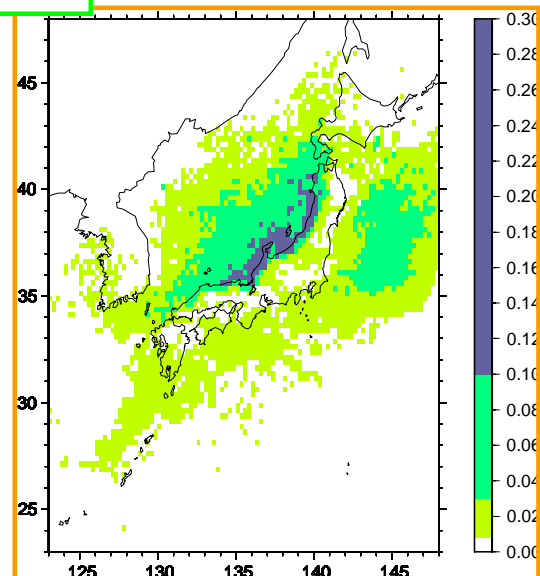


A lightning hotspot observed by LLS at wind turbines on Mt. Kunimidake in Fukui prefecture.

(Dec. in 2001~2005 and Jan. in 2002~2006)



Observation points of aerological data and three regions classified by lightning characteristics.



Risk map of high-current (over 80 kA) lightning hits on 100-m class structures through the year influenced by upward lightning.