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Monthly variation and the dependence on surface air temperature of morphology of winter sprites in the Hokuriku area of Japan

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Long-term and continuous observations of winter mesospheric optical emissions (sprites) have been performed from two optical sites, Shimizu and Chofu during the period of seven months from November, 2004 to May, 2005, with the target of specific winter sprites in the Hokuriku area of Japan (in the coast of Japan Sea). Two different analyses have been performed; one is based on the monthly data, and the second is event-basis. The correlation between the monthly percentage detection of different sprites types (columns, carrots and intermediates (including V-shaped sprites, coexistence of columns and carrots) and monthly variation of the -10 ºC temperature height has indicated a high negative value ($r \sim$ -0.8) for columns and a high positive value ($r \sim$ +0.7) for carrots. Further much more significant correlation is found by using the event-basis analysis (neglecting the seasonal variation) between the percentage detection of columns and surface air temperature exactly at the time of sprite event; the correlation between the two, amounts to r = -0.93. The main conclusion of this paper is the observational finding of the principal importance of charge height in the change in sprite morphology. That is, we expect only column sprites for smaller surface air temperature, and we expect the appearance of complicated structures like carrot and V-shaped sprites when the surface air temperature increases. Some discussions are also done.