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## A study of the morphology of winter sprites in the Hokuriku area of Japan in relation to cloud charge height

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Continuous observations of sprites in the Hokuriku area of Japan were performed from two optical sites during the three winter periods. The purpose of this observation is to study the major effect in appearance of sprites and in determining the morphology of sprites (columns or carrots). Detailed analysis is performed based on the estimation of the height of -10°C at the time of sprite occurrence. When the height of -10°C is lower than 1,800m, the occurrence of sprites is infrequent, and the dominant shape is column. Then while when it is increased (1,800 to 3,000m), a new situation takes place; that is, the occurrence of sprites is very enhanced and more spectacular shapes like carrots tend to be frequently observed in addition to column sprites. These sprite characteristics are first compared with those of parent lightning in the Hokuriku area and with our latest computer simulations on sprite initiation.

Keywords: sprites, winter lightning, Hokuriku area, cloud charge height