The Relation between The Tendency of Filament Eruptions and The Characteristics of Filaments

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Filaments, the dense plasmas in the solar corona, often become unstable and erupt into the interplanetary space as coronal mass ejections (CMEs). The CMEs may cause geomagnetic storms that result in various social and economical impacts such as blackouts and satellite anomalies. From the space weather point of view, monitoring filaments as the progenitor of CMEs has following advantages: (1) it can be done by ground-based telescopes in H-alpha, and (2) we can monitor not only flares from active regions but also the eruptions from quiet regions that may also cause severe geomagnetic storms. The aim of this study is to investigate the characteristics of eruptive filaments that can be used as the precursor of eruptions. For this purpose, we examined the sizes, the locations, and the activations of filaments by utilizing the data from the observation of the full disk of the sun conducted by the SMART at Hida Observatory, Kyoto University, and the data from the observation conducted by the SDO/AIA. From the SMART data, we identified 166 events of “disparition brusque” in which the filaments suddenly disappeared from the H-alpha image. By examining the Doppler-shifted images of H-alpha from SMART as well as the He304 images from SDO/AIA, we determined if the disappeared filaments actually erupted into the interplanetary space, and how the eruption rate is related to the sizes and their locations associated with the active regions. As a result, the eruption rate of all the filaments (i.e., ratio of the number of erupted filaments to that of disappeared filaments) in this study is 34.9%, while the eruption rate for large (filament length > 7.3\times10^4 km), medium (7.3\times10^4 -- 4.1\times10^4 km), and small (< 4.1\times10^4 km) filaments are 50.9%, 33.9%, and 22.0% respectively. Those filaments that disappeared without eruption correspond to so-called “failed eruption”.

Hinode-10 Science Meeting