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### EXTREME FIRE WEATHER CONDITIONS FOR WILDLAND FIRES IN ALASKA

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In 2004 and 2005, many large-scale fires occurred in Alaska. Their burnt area encompassed about 26,700 km<sup>2</sup> (the largest burned area since 1956) and 19,000 km<sup>2</sup> in 2005 (third-largest fire year). The total burned area comprised about 10% of the Alaskan boreal forest in just two years.

To clear the cause of those severe wildland fires, comprehensive analysis using various data such as hotspot, fire, weather, satellite imagery, and so on, was carried out. Analysis results clearly showed Alaskan wildland fires became active under high-pressure conditions induced by large jet stream meanderings near Alaska region. This extreme weather condition was found by introducing a new definition of “severe fire-period” derived from number of daily hotspots. Since 2002, when MODIS hotspot data accumulation started, top four severe fire-periods were found in 2004, 2005, and 2009. During these four severe fire-periods, two characteristic hotspot peaks were identified. In first hotspot peak, fires were activated under southerly and westerly wind. In the southwest of Alaska, wind direction was southerly and in the interior Alaska, westerly wind blew. In second peak, strong easterly wind related to Beaufort high made fires active. These two hotspot peaks of top four severe fire-periods were occurred in common under unique high-pressure system related to large jet stream meanderings near Alaska region. Firstly, upper high-pressure system over Alaska region was formed due to jet stream meanderings. At ground level, high-pressure system moved from south to north. Southerly and westerly wind started to blow along with this movement. Secondly, Beaufort high started to grow and supply easterly strong wind into the interior Alaska. This “extreme” fire weather conditions for Alaska could be firstly founded by introducing a concept of “severe fire-period” using daily hotspot data from 2002.

Largest number of daily hotspots was 5,191 occurred on August 14, 2005. This largest peak was second hotspot peak of severest fire period in August 2005. A few crown fire conditions were found in weather data measured at Caribou Peak. They were: relative humidity < 30% at noon time, average mean wind speed > 5 ms<sup>-1</sup>, and hourly maximum wind speed > 10 ms<sup>-1</sup>. These conditions lasted from August 13 to 15.

Totally additional six severe fire-periods were also identified in recent five fire years of 2002, 2004, 2005, 2009 and 2013. But their fire occurrence processes were different from the above-mentioned “extreme” fire weather conditions. Most of them occurred one step and just related to pressure difference between the interior Alaska and surrounding Alaska region.

Statistically, severe fires in 2004 and 2005 were very rare or one time more than 250 years. This implies we need longer Alaskan fire history than about 60 years present history data to evaluate severe fires in 2004 and 2005 properly. But severe fires in 2009 may occur every about eight years. We could and should prepare such severe fires by using results presented in this paper. Lastly, recent jet stream meanderings near Alaska region should be explained scientifically for an advanced fire forecast in Alaska.