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The Influence of the Climate Change on Landslide Disasters in Western Japan -Hiroshima's case-

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In last year 2014 and 2012, tremendous landslides due to heavy rainfalls occurred in western Japan. Especially in August 2014, serious landslide disasters induced by the extremely heavy rainfall caused over 70 people's death in Hiroshima. Most of them were caused by debris flows from shallow landslides on granite forest slopes on August 20. In Hiroshima, long-term increase in rainfalls was not obvious, while this trend was found in other area such as Kyushu district. However, in western Japan, the influence of climate change emerged in the increase of vapor concentration caused by rising water surface temperature in East China Sea and that brought the extreme rainfall. The landslide (debris flow) disasters in Hiroshima have distinctive characteristics in terms of followings:
(1) the source of debris flows (directly flowing down from mostly shallow landslides),
(2) their usual equivalent friction coefficient "Mf" i.e. relative travel distance for Granite (values between 0.174 and 0.554).
(3) the peculiar meteorological condition of frontogenesis with vapor convergence on the stationary front and around the Pacific high pressure that can generate the heavy precipitation (above 101 mm/hr, total 256 mm).
(4) Contrary to Mf values above, they caused heavy disaster at downstream area with the urban development on hillside slopes. We found that the Mf becomes bigger (relatively short travel distance) as the return period of disasters"Tr"becomes shorter as evaluating in the next formula: Mf = 0.278 Tr(-3.32). If the return period becomes shorter due to climate change (it is possible), Mf may become bigger. However, the cities such as Hiroshima, Kobe or Nagasaki in western Japan which have the urban area at hillside will be more prone to severe debris flow disasters.
(5) Also, theoretically, we may have more slope failures and debris flows per area "N/A" if the rainfall increment "dR" increases. The "increasing ratio in N/A" is given by next equation: (N/A)/(N0/A)=((R0 + dR) / R0)(7.58). N0: landslide or debris flow frequency (event number) before the rainfall increased. Considering "the increasing rate of effective maximum rainfall"in western Japan (in Kyushu: 7.28 mm/day/year), landslide or debris flow frequency may increase at most 6.67 times than present situation, after a decade, in Hiroshima. In this perspective, we should prepare against the sediment related disasters or landslide disasters cautiously, especially in the area such as Hiroshima.