

A Dense Observation of the Tokyo Metropolitan Area Convective Study for Extreme Weather Resilient Cities (TOMACS)

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It is recognized that large cities with populations of several million people are inherently vulnerable to severe weather, such as torrential rainfall, lightning, and tornados. An increase in the occurrence of torrential rainfall and strong typhoons, which can be caused by global warming, can cause extensive damage to large cities (Ishihara, 2013). The number of days with thunderstorms has been increasing in Tokyo in recent years, and the requirement of an advanced monitoring and forecasting system for extreme weather is becoming greater.

An unprecedented dense observation campaign and relevant modeling and societal studies have been conducted since April 2010 by the National Research Institute for Earth Science and Disaster Prevention (NIED), Meteorological Research Institute (MRI), and more than 25 national institutions and universities in Japan that target local high-impact weather (LHIW) in the Tokyo metropolitan area. The objectives of the project, the Tokyo Metropolitan Area Convection Study for Extreme Weather Resilient Cities (TOMACS), include the 1) elucidation of the mechanism of LHIW in urban areas (e.g., local torrential rain, flash flood, strong wind, lightening), 2) improvement of nowcasting and forecasting techniques of LHIW, and 3) the implementation of high resolution weather information to end-users through social experiments.

One of the unique features of TOMACS is the utilization of dense meteorological instruments in the Tokyo Metropolitan area, which is one of the most urbanized areas in the world. Their objectives are to target the tropospheric environment, boundary layer, initiation of convections and the lifecycles of thunderstorms. For the study of the mechanism of LHIW, data are used from the advanced observational instruments owned by participating organizations (including X-band and C-band polarimetric radars, a Ku-band fast scanning radar, Doppler lidars, microwave radiometers, a network of Global Positioning Systems (GPS), radiosondes and unmanned aerial vehicles), which are currently deployed in the Tokyo metropolitan area in addition to the operational observation networks of the Japan Meteorological Agency (JMA) and the Ministry of Land, Infrastructure, Transport and Tourism (MILT) of Japan. The intensive operational period (IOP) of the observations was set to the summers of 2011, 2012 and 2013.

During the IOP, several LHIW events occurred and have been energetically studied. In this topic, we briefly overview the necessity of this study, observation system, and results obtained so far.

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