Research on Technology for Real-time Flood Monitoring

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Keywords: flood monitoring, real time, private-sector probe data, big data

1. Trends and needs for flood monitoring technology

In the event of a flood due to overflow from a river, etc., information from real-time monitoring of actual conditions, as well as flood prediction, is very important for accurate evacuation guidance, flood control measures, prompt recovery, etc. In 2013, many places in Japan suffered damage from flooding as seen in the Yamaguchi-Shimane Heavy Rain (July) and Typhoon No. 18 (Sep.). It is, therefore, urgently required to develop technology for monitoring floods in real-time in order to reduce damage.

In the development of flood monitoring technology, various measures have been previously studied and some of them have actually been developed, including the use of CCTV, installation of flood detection sensors and flood level gauges, and a system for transmitting and receiving flood observation information using mobile phone lines or existing optical fibers. However, all of these technologies have issues, including how to manage investment and maintenance costs, ease of introduction, tracing of time changes in flooded area, and detection of flooded areas. This paper reports on a study on detecting flooded areas using private-sector probe data without new observation equipment.

2. Study on the feasibility of using probe data

(1) Characteristics and advantages in using private-sector probe data

Private-sector probe data refers to automotive traffic information obtained by private-sector companies, which is one of so-called "big data." All of the approaches already discussed directly observe flood water, but this study takes an indirect approach focused on the movement of goods susceptible to the effects of flooding. This approach uses technology that was developed to provide information on traffic congestion, etc. under normal conditions, and has the potential to monitor the expansion of flooded areas to a high degree of accuracy in urban areas where roads are densely arranged.

(2) Availability of private-sector probe data

In this study, spatiotemporal changes in the travel speed on each route obtained from probe data were examined using speed data as an indicator of automotive traffic characteristics, covering the areas flooded by the heavy rains that hit Nagoya City in September 2013 (originally estimated by integrating results of hearings from related organizations, SNS information, etc.) and surrounding areas. The figure shows an example of the study results. The right image shows traffic in the 17:00 - 19:00 time period when heavy rain or flooding occurred, while the left image shows the traffic in the same time period under normal conditions. Looking at the travel speed (time average) under normal conditions and flooding, a clear trend of decline is recognized in the flooded areas (estimated) and surrounding areas. With this data, it is found that traffic conditions are susceptible to flooding, etc. and those conditions are reflected in private-sector probe data.

3. Conclusions

The potential for using private-sector probe data for flood monitoring technology was obtained from this study. We will continue to examine ways to upgrade indicators, etc. by considering the effect of impassable cars at certain points I order to enhance the reliable of flood monitoring.

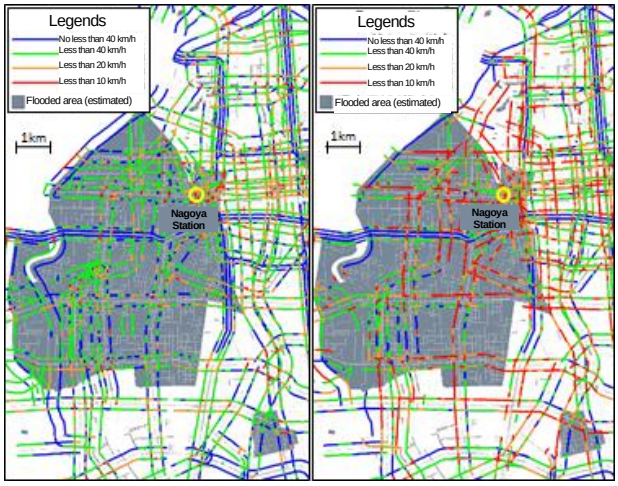

Figure: Comparison of Travel Speed under Normal Conditions (left) and Flooding (right)