

Detect groundwater flowing from riverbed using a drone

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Estimate the direct flow of groundwater to river is an important step in understanding of hydrodynamics in river system. Function of groundwater in river system does not limit to the mass of water. Continuous supply with thermally stable water from riverbed produces a space with unique condition, which provides various functions for organisms inhabiting in river as a shelter avoiding large shift of temperature, or to maintain productivity for small scale ecosystem by supplying nutrient rich groundwater if it gushes out from the riverbed in a deep pool of river. This may contribute to biodiversity of river system. Such function of groundwater is more significant for rivers run in island and in mountain zone.

To evaluate the function of groundwater flowing from riverbed we first try to find such site by using a drone equipped with a sensitive thermo-camera to detect water surface temperature. In the examined area temperature of the groundwater doesn't change much throughout a year at around 15 to 16 °C, while surface temperature of the examined river fluctuates from below 10 °C to over 25 °C throughout seasons. By using this difference in temperature between groundwater and river water we tried to find site where groundwater comes out from the riverbed. Obviously winter when surface temperature becomes below 10 °C is an appropriate season to find groundwater as it comes up to the surface of river with depth ranging from 1 to 3 m.

Trial flight surveys of drone were conducted in Kano-river in Izu Peninsula located at southern foot of Mt. Fuji in central Japan. Employed drone was Inspire1 (DJI, China) equipped with a Thermal camera (Zemuse XT ZXTA 19 FP, FLIR, USA) and operated by Kazuhide Juta (KELEK Co. Ltd., Japan) and Mitsuhiro Komiya (TAM.Co.,LTD). In contrast to the former cases with employing airplane for taking aerial photograph, drone takes photo while flying at a low-altitude. When it flies at 40m above the water surface of river, resolution is at an order of "cm". We show how we found the possible sites where groundwater flowing from the riverbed by the photo and video.

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