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To what extent are UAVs appropriate for remote sensing in small river basins?

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Due to the rapid development of unmanned aerial vehicles(UAVs) technology over the past decade, it has become possible to obtain high-resolution and real-time aerial images for photogrammetry, which had previously been a challenge in the field of remote sensing using airplanes. However, the utility of UAVs remote sensing has not been proven over all scales of survey coverage due to its technical and inherent limitations. First, the coverage of UAV remote sensing is constrained because of its short operation time of less than a half hour. Second, the cost for merging aerial images grows drastically as the area to be surveyed gets larger because UAVs remote sensing needs more aerial images rather than airplanes due to its less stability to turbulence. The purpose of this study is to analyze the appropriate coverage of UAVs remote sensing in consideration of the trade-off between the advantages and disadvantages of UAVs compared with airplanes.
According to their improved accessibility and cost-effectiveness, UAVs can be applied to the daily management of small river basins for surveillance and initial response to disturbance such as flood or drought. For example, UAVs can deliver life jackets to those who are endangered through real-time monitoring of flood risk. However, it is hard to apply UAVs to the river basin management practically because little research has been conducted on the feasible coverage of UAVs. Previous studies have focused on the algorithms for optimal UAV path planning, and they are insufficient to propose the appropriate coverage for actual decision-making.
We chose to study small river basins along the Han River, South Korea. Historically, the study area had suffered frequent floods and droughts, as well as eutrophication and estuary ecosystem disturbance caused by the recent construction of massive infrastructures. In order to conduct a feasibility analysis, the flight distance and time of UAVs within the study area was calculated by an automatic path planning software program. We estimated the cost according to the desired resolution based on a construction cost estimator created by the Korean government. As a result, the appropriate coverage of the UAVs was analyzed to be 23.98km2 when the resolution was 5cm/pix and 26.75km2 when the resolution was 20cm/pix.
This study is an introductory study quantitatively analyzing the optimal coverage of UAVs remote sensing for small river basins. Since more than 95% of river basins in the study area are smaller than the appropriate coverage area of the UAVs, management for almost all of the river basins can be maintained by only one UAVs. We suggest a standing UAVs deployment plan to adapt to disturbances in community level. This study can be extended to other countries and regions.