Monitoring the State of the Environment in the Areas of Influence of Industrial Enterprises by Remote Sensing in Order to Identify the Risk of Pollution

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ABSTRACT

The work is devoted to the use of unmanned aerial vehicles for monitoring the zones of impact of industrial enterprises. Such zones have a rather large area and the use of unmanned aerial vehicles is well suited for monitoring such objects. This paper will provide an overview of examples of the practical application of UAVs with outboard equipment for monitoring the geo-ecological state of various objects in different countries of the world. A team of authors from the Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, used UAVs to monitor Adliswil territories that are undergoing urbanization. Adliswil– a city near Zurich (Switzerland) was chosen as a thematic area mainly because it is a typical, fast-growing city (about 20,000 inhabitants) that needs up-to-date elevation data for use in other urban drainage studies. Six areas in Adlisville were initially reviewed and evaluated for UAV operations.

The results show that unmanned aerial vehicles can significantly improve ground flow modeling by increasing the detail of the terrain, as well as their inherent flexibility to update existing altitude data sets. The very high resolution that can be obtained using the UAV DEM is also an advantage for the modeling of urban ground flows and flows. In addition to DEM generation, UAV images can also be used to create other very interesting datasets for urban drainage modeling applications based on image classification. This, for example, identification of permeable / impermeable sections (Tokarczyk et al., 2015), automatic identification and location of sewer holes and wells, as well as other artificial features.

In the summer of 2007 and 2008, a group of employees from Quantalab, Instituto de Agricultura Sostenible (IAS), University of Cordoba, Spain conducted remote sensing of vegetation from lab platforms using light multi-spectral and thermal sensors, obtaining thermal images in the 7.5-13 μm (spatial resolution 40 cm) and narrow-band multispectral images in the spectral region 400-800 nm (spatial resolution 20 cm).Based on these parameters, the products of the image of the leaf area index, the content of chlorophyll (Cab) and the determination of stresses in water (based on the photochemical reflection index and flashlight temperature) were obtained and successfully verified. GPS / INS data from an autonomous navigation system was used in aerial triangulation for geo-referencing collected images, requiring only a minimal number of ground control points. And in their work they showed that the results obtained using an inexpensive UAV system for monitoring vegetation give comparable estimates, if not better, than the results obtained using more traditional manned air sensors.

Photogrammetric models obtained with UAVs by Slovak scientists to study the suitability of digital elevation models obtained using photogrammetry for assessing the stability of slopes (using the landslide in St. Anton, Slovakia as an example) provide significant potential for studying landscape geodynamic phenomena, and they give such the same high-precision spatial data as orthophotomosaic and terrain models. While UAV photogrammetry is most suitable for modeling low vegetation zones, the resulting point cloud estimate can

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filter vegetation cover and buildings. High-precision models of heights are necessary in engineering geology to assess the stability of slopes, especially where profiles of the heights of deformation of slopes are included in the analysis, as in the GEO 5 software from FINE. Direct import of the generated profiles into the software environment from CAD and GIS systems is possible. The new version of the available software, including the calculation of stability in three-dimensional space, opens up new possibilities for assessing the stability of landslides, since it emphasizes the importance of accuracy in the formation of terrain models included in the calculations.

Scientists from the Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf used UAVs for thermal imaging, in order to study the temperature distribution in the forests, which is usually completely unknown and less distinct than in urban or industrial areas where metal structures and surfaces give high contrast and sharp edges to the information. They studied the effect of the orientation of the inner chamber, the coordination of anchor points and ground control points on the resulting accuracy of beam tuning and the formation of a dense cloud with the typical use of a photogrammetric workflow for thermal imaging UAVs in natural conditions.

At the Khankala field in the city of Grozny of the Russian Federation, two test aerial photographs were carried out in the infrared range using UAVs on the territory of the Khankala geothermal station, operating in two different modes: during and without the use of reverse injection of used geothermal water. For experiments, an unmanned aerial vehicle Geoscan 201 was used, equipped with digital (Sony DSX-RX1) and thermal imaging (Thermoframe-MX-TTX) cameras. In addition to various images of the geothermal station obtained from the survey, 13 thermal anomalies were revealed. The analysis of their shape and temperature contributed to the determination of their sources: fires, heating systems, etc., which was confirmed by field surveys. The results of the study demonstrate the high potential of using unmanned aerial vehicles using thermal imagers for environmental and technical monitoring of exploited geothermal deposits.

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