Raspberry PI Camera for high resolution 3D modelling in remote areas. Case study in South-West Niger

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Unmanned Aerial Vehicles (UAVs) have become an invaluable tool in surveying activities, especially in critical areas, where traditional survey endangers safety health of operators, such as post natural hazards assessments. Moreover, UAVs facilitate data collection in remote areas, overcoming natural barriers and accelerating the surveys in the field. One of the reasons of their increasing employment in many fields, including geosciences, is the possibility of integrating different sensors. The technology of UAV is rapidly improving (increasing speed, duration and height of flight) and UAV-integrated sensors must keep up with it. This paper studies and compares UAV-integrated radiometric sensors and their performances in the detection of temporary surface water bodies in two villages of Tillaberì region (Niger). A low-cost (<100€ NRGB (Nir, Red, Green, Blue) sensor was created with a Raspberry PC and two Raspberry PI 2 cameras: a regular RGB (Red, Green, Blue) and a NoIR. The device was programmed to take pictures automatically from both cameras and mounted on a fixed-wing UAV. 150 hectares were interest by the flights. The photos taken were calibrated, and high-resolution orthophotos and Digital Elevation Models (DEMs) of the study areas were generated. The models were georeferenced using information collected with two GNSS receivers in a RTK survey in master-rover modality. The data collected with the receivers were processed performing the PPP (Precise Point Positioning) technique in order to overcome the lack of geodetic infrastructure in the area. The same flights and elaborations were realized with a commercial camera, Sony (ILCE-5100) and the results obtained compared with the one of the Raspberry. Temporary surface water bodies were detectable from both orthophotos and the DEMs of both cameras provided reliable results. The raspberry camera showed good accuracy results and providing four bands information allows the application of multispectral analysis. The size and the weight of the raspberry camera did not interfere with the flight of the UAV proving to be an interesting low-cost alternative to commercial radiometric sensors.