Using small unmanned aircraft systems for high spatial and temporal resolution characterizations of harmful algal blooms

Deon van der Merwe and Kevin P. Price

Harmful algal blooms (HABs) are of toxicological interest because several genera of cyanobacteria, also known as blue-green algae, have the ability to produce potent toxins that affect people, livestock, pets, and wildlife. Risk assessments based on traditional sampling methods are hampered by the sparseness of data points, and delays between sampling and the availability of results. These shortcomings of traditional sampling methods are highly significant when there is a need for actionable information at the spatial resolution of animal or human interactions with specific areas of a lake surface or lake shoreline, and within a timeframe that is relevant given the rapidly changing spatial distribution of algal blooms. Small unmanned aircraft systems (sUAS) provide a means of collecting spatially high resolution data on the surface densities of algae. Digital color-infrared image data collected by an sUAS can be rapidly processed into information useful for risk assessment and risk management by converting image data into an index of algae density. In a proof-of-concept project, color-infrared aerial images were collected using an sUAS fitted with a color-infrared sensor, at three time points, from a section of Lake Centralia in Kansas, during a HAB formed by *Microcystis aeruginosa* cyanobacteria. The results revealed a high level of spatial and temporal variability in the HAB, and it clearly demonstrated the applicability of sUAS-based aerial imaging to HAB characterization, at spatial and temporal resolutions relevant to localized and timely risk assessments.