Advancing Ocean Data Visualization Through Augmented Reality Technology

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The application of augmented reality (AR) technologies to applications in oceanography are fairly basic and often used solely for artistic or visually recreational applications. Outside of military application, AR has yet to become a trusted visual analysis tool in the Ocean Sciences. The technology to apply real-time data streams to an augmented experience, either through a viewing device or phone, is currently not available. One of the major difficulties lies in obtaining accurate position coordinates using publicly available GPS systems as the Earth's magnetic field fluctuates and the error in georegistration exceeds the needs for effective AR overlay. Computer vision methods can help reduce the noise using visual tracking clues to known real-world points. Terrestrial examples include the use of horizon silhouettes or mountain peaks; neither of which are available in many oceanic environments. The emerging technologies supporting remote observation of ocean processes include investments in automated underwater vehicles (AUVs) or remotely-operated ones (ROVs) that collect and stream data to ship and shore-based computers. This access to continuously observational sensors as well as cloud-based archives of research cruise sample stations offers new opportunities to envision tools for data visualization and interpretation. The challenge facing ocean scientists and educators involved in science communication is to design and build solutions in data visualization that facilitate data exploration without the need for formal education in the marine sciences. For this project, tides and sea-level predictions are used to design and build a simple and comprehensible overlay of data, merged with cost-effective hardware, suitable for visualization in an AR framework. The goal is to support real-time data streams augmented with simple indicators of anomalous or rare conditions for an experience based upon smart phones or wearable devices. Progress to date compares both hardware and software options for a set of carefully selected design goals, methods for the conversion of existing data for the AR environment, and a prototype application focused on experiences along Puget Sound shorelines. AR in Ocean Science has the potential to make comprehensible the overabundance of information already existing and to visually simplify the data exploration experience so as to communicate this knowledge to a larger audience. For AR to become a standard tool in science communication, AR must change convoluted graphs and uninteresting CSV files into an integrative experience that transforms the educational aspect and experience with the environment.