

## Great Western Four+ Doctoral Training Partnership (GW4+ DTP)

### Remote sensing and deep learning for early warning of water hazards (DeepWater)

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**Background:** The latest generation of Earth observing satellites provide unprecedented optical and spatial resolution. This allows us to develop solutions to observe environmental problems in water bodies such as lakes, bays, and estuaries. This study exploits optical and radar satellite sensors to observe episodic storm events which can prompt harmful algal blooms, sewage overflow and poor underwater visibility.

**This PhD research** will develop image segmentation and object-based satellite image processing techniques for cases where water quality issues are evident. A successful monitoring solution would provide hazard warnings to affected companies and end-users (water companies, environment agency, aquaculture, recreational users). You will in particular focus on two cases:



River plumes in East Devon (left: Exe and Teign, Landsat8 pseudo-true colour composite; right: Teign, a Sentinel-1 SAR backscattering image).

Automated mapping of river plumes. Tracing river plumes from their source to their furthest extent (from optical and radar signatures) will reveal where river run-off has an impact on beaches, reefs, or ongoing exploitation activities. Discerning dynamic (algal blooms, river plumes) and stable features (shallow areas, rooted vegetation, moored structures) in coastal and inland water systems. You will use object-oriented mapping techniques to classify these features so they can be followed through time.

The project will make use of high resolution satellite imagery and advanced computing techniques which have not yet been applied to remote sensing of water bodies (e.g. deep learning, sub-pixel level endmember extraction methods, local parallelisation and distributed processing techniques). This study provides an excellent opportunity to explore a multidisciplinary topic with real applications. You will work at the High Performance Computing and Networking, Artificial Intelligence Group (Exeter) and interact frequently with the Centre for Water Systems, as well as project partners Plymouth Marine Laboratory (Earth Observation Science and Applications group) and Pixalytics Ltd (Satellite services, CASE partner). This is a highly experienced and complementary team. The project is linked to the H2020-EOMORES project, interacting with the UK Environment Agency and Scottish Environmental Protection Agency.

**Requirements and research environment:** We seek an enthusiastic student capable of independent and team work, willing to work across disciplines. Excellent numerical and computing skills will be essential with a background in computational sciences, physics, mathematics, or a related discipline. Candidates are encouraged to contact the lead supervisors ([C.Luo@exeter.ac.uk](mailto:C.Luo@exeter.ac.uk), [stsi@pml.ac.uk](mailto:stsi@pml.ac.uk)) for further information.

