Turbidity from space - Applications of remote sensing data in sediment monitoring

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Turbidity in Germany's waterways is continuously recorded by up to 100 in-situ measurement stations. But what happens in the river reach between the measure¬ment stations? How do rivers mix at confluences? What are spatial dynamics within estuaries where salt water is mixing with freshwater? These and other questions need to be addressed by spatially extensive data, which satellite images provide. Remote sensing offers in the field of sedimentology and morphodynamics significant benefits for monitoring and thus contributes to our understanding of spatial sediment transport processes.

Therefore, the project WasMon-CT uses the satellites Sentinel-2 and Landsat8 to retrieve spatially extensive information on turbidity for the federal waterways of Germany by an automated processing chain based on the algorithms from Nechad et al. (2009) and Dogliotti et al. (2015). In subsequent steps the derived data on turbidity is filtered for i.e. clouds, cloud shadows and land masses and is then calibrated and validated with the exceptionally high number of available in-situ data. So far, this could be finalized for the rivers Rhine, Elbe and the Elbe estuary. As an additional post-processing step and by applying a threshold, the standard neural network for lower turbidity values is combined with an extreme neural network for higher turbidity values.

The derived products, i.e. maps or longitudinal profiles, can for instance help to enhance the understanding of suspended sediment transport processes in Germany's waterways and will supplement the existing in-situ database. This is of great value to the environmental monitoring at system level and supports the federal consulting activities in the waterways of Germany. Exemplary results from first case studies will be presented.

References:
Dogliotti, A. I., Ruddick, K. G., Nechad, B., Doxaran, D., & Knaeps, E. (2015). A single algorithm to retrieve turbidity from remotely-sensed data in all coastal and estuarine waters. Remote Sensing of Environment, 156, 157-168. doi: http://dx.doi.org/10.1016/j.rse.2014.09.020
Nechad, B., Ruddick, K. G., & Neukermans, G. (2009). Calibration and validation of a generic multisensor algorithm for mapping of turbidity in coastal waters. Remote Sensing of the Ocean, Sea Ice, and Large Water Regions, Proc. of SPIE, 7473(74730).
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