Linking remotely sensed reflectance to suspended sediment stratification in tidal channels in southwest Korea

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Satellite imagery can provide information on the spatial distribution of surficial suspended sediment over broad scales in coastal environments. An outstanding challenge is to determine the extent to which surficial sediment distributions can be linked to sediment processes occurring near the seabed. Recent research indicates that dense sediment suspensions at the bottom of tidal channels off the southwest coast of South Korea limit upward turbulent mixing of sediment to the sea surface. The goal of this project is to determine whether this sub-surface sediment process is detectable with reflectance at the sea surface measured by the Landsat 8 satellite. The overall hypothesis is that the magnitude and variance of sea-surface reflectance will be lower in channels than in ridges. This is due to the presence of dense suspensions in channels that limit vertical mixing. On the ridges, this process would not occur, because dense suspensions would flow into adjacent channels under the influence of gravity. As a result, reflectance would be higher and more variable. To assess this hypothesis, Acolite processing software was used to perform atmospheric corrections on Landsat 8 images, and sea surface reflectances at 655 nm and 865 nm were used as proxies for suspended sediment concentration in a total of 15 cloud-free images collected over the years 2013–2018. Reflectance in both bands was extracted over a tidal channel and over an adjacent tidal ridge using SeaDAS. The reflectances from these two points were assessed for statistical correlation with depth and with other environmental variables, including sea level, wind speed, recent precipitation levels, and stage in the tidal cycle. Results indicate that the depth exerts primary control on mean and standard deviation of the reflectances, consistent with my hypothesis. Secondary controls on reflectance are wind speed and sea level. I propose that higher windspeeds are associated with larger reflectances due to resuspension over fringing tidal flats and that the correlation of higher water levels with reduced reflectances is caused by sediment supply limitation.

Atlantic Geology, 2018, Volume 54
Atlantic Universities Geoscience Conference 2018 – 68th Annual Conference, November 1-3, 2018
doi:10.4138/atlgeol.2018.015