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Flocs, turbulence, and biological activity: The seasonal mood-swings of a UK estuary

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Both turbulence and biological activity have been shown to be important mediators of floc characteristics. Low turbulence promotes collisions and flocculation, while high levels may result in shear-induced rupture, literally tearing flocs apart. Because of this, turbulence parameterisation is key to understanding the relationship between turbulence and particle size. In addition, biological polysaccharides and other substances have been shown to increase collision efficiency, collision strength, and the strength of the resultant flocs.

The results of a measurement campaign undertaken in a hypertidal UK estuary from February-March and May-June 2009 are presented utilising a combination of acoustic and optical instruments, moorings, and CTD stations. The data displays a seasonally varying flocculation signal in which a seasonal regime shift occurs: winter is turbulence-controlled with evidence of flocculation at high and low water under low turbulence conditions and breakup occurring during the higher turbulence conditions of the flood and ebb tides. Conversely, the summer regime is biologically-controlled and dominated by stronger, more shear-resistant flocs that do not break up under the high-turbulence conditions of the peak flood and ebb tides. Instead, the summer regime is dominated by a resuspension signal in which both particle size and concentration increase during the flood and ebb tides. This shift appears to be the result of the presence of biological polysaccharides during the summer months which increase both the floc size, and floc strength through an increase in the collision strength and collision efficiency of the particles, making them more resistant to turbulence-induced shear effects.