Geophysical Research Abstracts
Vol. 20, EGU2018-4469, 2018
EGU General Assembly 2018

Viral dispersal in the coastal zone: a method to quantify water quality risk

Peter Robins, Kata Farkas, David Cooper, Shelagh Malham, and Davey Jones
(p.robins@bangor.ac.uk)

There is a risk to human health from estuarine and coastal waters via waterborne and foodborne enteric viruses. Improved understanding of the locations and periods of heightened risk can help target mitigation measures and reduce costs. In this paper, we model virus transport from point sources in a river, through an estuary, to the coast where bathing waters and shellfish beds are particularly sensitive areas to such risks.

Our application is to the Conwy estuary (North Wales, UK), which is sensitive to high frequency (i.e. hourly) variability in river flows and hence viral fluxes. The estuary can flush completely during high rainfall, exposing the surrounding coastal waters to terrestrially-sourced enteric viruses. We develop a coupled river-estuary-coast model to simulate the dispersal of enteric viruses over one year, driven by measured river flows carrying viral concentrations estimated from field measurements, in combination with tidal forcing. We show that under low river flow conditions the estuary acts as a holding reservoir for the virus, even when the source virus concentration was relatively high. However, during periods of high river flow (which did not noticeably show seasonal variations), significant concentrations of the virus were dispersed out of the estuary to the coast, modulated by the tidal state.

We designed a selection of idealised combined hazard scenarios to test the sensitivity of the modelled results to the key drivers (river flows, tides, and virus concentrations). We show that water quality for the Conwy is controlled by river flow magnitude and hydrograph shape. Moreover, the clustering of events has more than an additive impact in terms of viral export to the coast. Coincidence of peak river flow and tidal state (e.g. flood vs. ebb and spring vs. neap) also significantly influences viral transport.