Review of “Effect of tidal stream power generation on the region-wide circulation in a shallow sea”, by G. I Shapiro. Submitted to Ocean Science Discussions (OS-2010-47).

The paper discusses the efficiency of a tidal stream farm and its effect on the regional circulation of the north-eastern Celtic Sea. The paper shows that the efficiency of a farm located in the open ocean, where the circulation is fully three-dimensional, can be significantly reduced compared to the efficiency of farms placed in fjords and estuaries, where the circulation is quasi-two-dimensional. The paper is well written and its science is mostly sound. I recommend that it be published after a few points have been addressed. These are as follows (ordered by page and line numbers in the manuscript).

1787-10. For the physical oceanographers among the readership, it might be helpful to use the mechanical dissipation of tidal energy in the ocean as a reference. This is estimated at ~4 TW (75% on the shelves and 25% in the deep ocean; Egbert and Ray, 2000). This is 44 times larger than the 800 TWh/year (~0.1 TW) quoted in the Sorensen and Weinstein (2008) paper, but comparable to the 19,771 Twh/year (~2.25 TW) of world electricity consumption.

1787-12. Rogue full stop after 2008.

1791-14 & ff. As the author states, linear Rayleigh friction is one of a number of ways of parameterising friction. It is adequate for slow flow past an obstacle, but probably less so for flows fast enough to generate turbulence as they go through, or circumvent, and object. In this case, a quadratic friction law would be more appropriate. I would encourage the author to run parallel experiments with a quadratic friction law and to report on the differences between linear and quadratic friction results if these differences are found to be significant.

1793-16. The geometry of the farm seems rather awkward. The highest friction coefficients occur at the centre of the farm. Assuming that all turbines have equal efficiency, the friction coefficient reflects the density of turbines. It seems strange to put the higher density of turbines in the centre of the farm, where screening, as demonstrated in the numerical experiments, is quite strong. In my opinion, this work would greatly benefit from a more thorough study of how the farm geometry influences efficiency. The numerical simulations with POLCOMS demonstrate that the distribution of Rayleigh coefficients in the numerical experiments is probably far from optimal to achieve efficiency. Maybe the author could be persuaded to carry out a few additional experiments in which the impact of the spatial distribution of turbines (Rayleigh friction) on energy extraction is investigated. It is tempting to anticipate that a line of turbines oriented in a direction perpendicular to the tidal flow would often be the optimal arrangement.

1794-24. “...some springs are stronger than the other.”?

1794-25. Figure 3a. I would be more interested in seeing the kinetic energy integrated over the area where the tidal stream farm is going to be located.

1805. Figure 2. Please, indicate the location of the farm in this figure.

Figures 3, 5, 6 and 7. Text and numbers are tiny and not easy to read. Please, increase the size of the figures and the fonts.