

Interactive comment on “Effect of tidal stream power generation on the region-wide circulation in a shallow sea” by G. I. Shapiro

Anonymous Referee #3

Received and published: 14 December 2010

General Comments

The premise of the paper, i.e. that a 3D baroclinic tidal resolving model can be used to investigate the impact of tidal energy extraction, is sound and will provide useful understanding for the development of tidal energy schemes. The paper would benefit from some improvements to the experimental design and needs some tidying/improvements with respect to the quality of the text and figures.

Specific Comments

The assumption of linearity in the friction term does not seem justified or necessary, especially given the Bjorn et al and Wu papers cited do not seem to be relevant to this case. A more realistic quadratic equation (6) would negate the argument in the

C581

last paragraph of section 2 that efficiency would decrease with increasing flow as the Power and KE terms would both be proportional to U^3 . The fig 1 power curve would also seem to be fitted better by a cubic, not quadratic.

Equation 8, which describes the Rayleigh Coefficient and therefore represents the tidal energy extraction intensity seems a strange function to use. A more realistic option would seem to be to have constant coefficient where there are sites, zero elsewhere. It would also be helpful to experiment with different shapes/sizes of the installation. An installation that is a line of turbines placed perpendicular to the major axis of the tidal ellipse would seem an obvious choice. A cup shape to catch more of the refracted tidal wave would also seem an interesting test.

Fig 6 shows the depth averaged KE, which is a useful measure. Another more useful parameter for diagnosing the potential environmental impact might be the bottom stress, with particular attention paid to a threshold value for critical stress for bed erosion.

Technical corrections

Section 1, line 12 – Weinstein, 2008). Rogue space, full stop.

Section 1, line 25 – world (2010) – reference needs inclusion correctly.

Section 4, line 9 – the subscript M is used where H is meant for the Rayleigh Coefficient.

Fig 2 – please mark the tidal energy site.

Fig 5 - 7 –difficult to read axes and other text.

Interactive comment on Ocean Sci. Discuss., 7, 1785, 2010.