

Interactive
Comment

Interactive comment on “Flow dynamics around downwelling submarine canyons” by J. M. Spurgin and S. E. Allen

Anonymous Referee #2

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General comments The authors investigate the flow dynamics around downwelling submarine canyons. The paper is clearly written and the scientific methodology is standard and rigorous. The introduction contains many and appropriate references to previous works. The authors provide an extensive and reasonable analysis of their results and clearly demonstrate the key dynamical processes controlling the 3-D circulation around downwelling canyons based on various previous model experiments with different forcing/stratification characteristics and a few basic dynamic parameters such as the Rossby and Burger numbers and a new parameter measuring uniformity of stratification. The paper needs only a few minor improvements in order to be published in Ocean Science. My main concern is about the discussion section which I think it is not complete. The authors should enrich their discussion further by providing and discussing some quantitative results about the net downwelling/upwelling motion at

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steady-state in their various scenarios of downwelling canyons. Based on their results, the implications of flow dynamics around downwelling canyons for biological productivity should also be further discussed.

Specific comments

- page 1303 line 5. The reference Skliris and Djenidi, 2006 (Continental Shelf Research 26:1336-1358), involving a coupled hydrodynamic/plankton ecosystem model simulating the impact of canyon circulation on ecosystem dynamics in downwelling conditions, is also relevant here.

- 3.5.4 Density anomaly Patterns 1 and 2 cited in the text should be clearly defined as such in section 3.5.3

- The authors should provide a table with some quantitative results such as the steady-state net downwelling/upwelling velocity/transport and density anomaly values averaged over various regions e.g. over, upstream, and downstream of the canyon for the various scenarios. The authors should also discuss their relative importance with respect to the results of other studies considering left-bounded flows and upwelling canyons.

- The authors should discuss further their results regarding the impact of downwelling-case submarine canyons on biological productivity. For example field research in NW Mediterranean canyons (generally characterized by right-bounded flows and general downwelling motion) has shown that these regions are responsible for large inorganic/organic material accumulation (e.g. Alvarez et al. 1996, JGR 101:12043-12055; Granata et al. 1999, CSR 19:1249-1263) which may strongly stimulate biological production (e.g. Skliris and Djenidi, 2006, CSR 26:1336-1358).

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