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Cascading of high salinity bottom waters from the Arabian/Persian Gulf to the northern Arabian Sea

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Cascading (aka shelf convection) is a specific type of buoyancy driven current in which dense water is formed over the continental shelf and then descends down the slope to a greater depth. The cascades of dense water down continental slopes provide a mechanism for shelf–ocean exchange in many parts of the world's oceans (Shapiro et al, 2003). Dense water is formed on the shelf by a number of processes, with high evaporation, limited river discharge and low precipitation being the major processes in warm climates (Ivanov et al, 2004). The formation and outflow of high salinity waters in the near-bottom layer of the Arabian/Persian Gulf is an example of dense water cascading (Bower et al 2000). Despite of its importance for the self-cleaning and the state of the marine ecosystem in the Arabian/Persian Gulf, the properties of the outflow have so far mainly been analysed using climatologically averaged data or observations of a limited set of parameters (mainly temperature), see (Bower et al 2000).

In this paper we study the dynamics of the flow using a comprehensive set of observational data (temperature, salinity velocity and turbidity profiles) obtained during the GRASP (Gulf Reconnaissance And Selective Profiling) observational campaign in the Gulf of Oman, which are complemented by the results of numerical modelling of the area using a number of 3D ocean models, and some ARGO T/S profiles. The GRASP measurements were carried out using an Aqualog climbing moored profiler, which was equipped with a Seabird CTD sensor, a Nortek Aquadopp current meter and a Seapoint turbidity meter. The Ocean circulation models used in the study include PGM4 and IND12 (UK Met Office); and AS20 and AG60 (University of Plymouth). All models are based on NEMO (Nucleus for European Modelling of the Ocean) codebase with a resolution from 9 km down to 1.8 km. The models were calibrated and validated against ARGO float profiles in the area.

The study revealed the mesoscale and sub-mesoscale circulation patterns of the outflow, their spatial and temporal variability over time scales from a few days to seasonal.

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