The authors would like to acknowledge additional travel funding from SAEON and the US Office of Naval Research.

Background
Topographically driven upwelling inshore of the Agulhas Current, centred around Port Alfred (33.6°S, 26.9°E), has been identified as an important source of cold, nutrient-rich water for the shelf regions of the Agulhas Bank (Lutjeharms et al. 2000; Lutjeharms 2006). However little is known of the variability of this upwelling activity and its sensitivity to changes in the nature of the Agulhas Current itself. Recent studies suggest that the Agulhas Current core and variability are changing in response to basin-scale wind changes (Backeberg et al. 2012) and that this may be causing an intensification of upwelling at Port Alfred (Rouault et al. 2010). This study uses in-situ and remote sensing measurements to explore the variability of upwelling activity off Port Alfred.

The nature of upwelling off Port Alfred

- Inshore: 31m depth, 3.6 km from coast
- Midshelf: 76m depth, 23 km from coast
- Offshore: 175m depth, 42km from coast

Data from 3 hydrographic cruises provides insight into the nature of these upwelling events.

- **May 5th**: Current in offshore position (small meander), limited shelf upwelling, 12°C water on shelf up to 50m, little outcropping at the surface.
- **September 9th**: Current touching shelf (marked by salinity max), no shelf upwelling, in the wake of meander event. Shelf water from previous upwelling event outcropping at surface.
- **April 10th**: Current visible inshore but not touching shelf, large bolus of < 12°C water upwelled onto the shelf, little surface outcropping.

An analysis of depth-binned currents, bottom temperatures and along-shelf current profile at the offshore mooring during a Natal Pulse event. Note the double reversal of currents.

The same event at the midshelf mooring shows more barotropic current reversals, possibly due to coastal trapped waves (Schumann & Brink 1990).

Conclusions

- Shelf upwelling is more prevalent than previous studies suggest.
- The main mode of variability appears to be the Natal Pulse, however the shelf’s interaction with these is complex.
- Upwelling wind events are important for the outcropping of upwelled water.
- There is evidence of the passage of coastal trapped waves on the Midshelf and Inshore sites.
- The position of the Agulhas Current in relation to the shelf appears to be important for the activation or cessation of shelf upwelling in the bottom layers.