3

Detecting Cold Water Fronts

How do we detect moving water fronts of upwelled water?

Luise Zeigermann, Anna Wünsche, Larissa Schultze, Jeff Carpenter, Hossein Mashayekh Poul

1. Upwelling water spreads in time and space and forms cold water fronts
2. Cold water fronts can be detected by sea surface temperature, provided by satellite data (Figure 1)
3. The vertical and horizontal structure can be measured by different instruments; here we present CTD (see poster 2) and Ocean glider data (Figures 2 and 3)

Ocean gliders move both horizontally and vertically (in zic-zac pattern) through the ocean measuring e.g. temperature.

They are controlled remotely via satellite connection to cross through the upwelling front measuring at high temporal resolution.

It can dive as deep as 1000 m and move horizontally at approximately 800 m every hour.

Glider at the surface

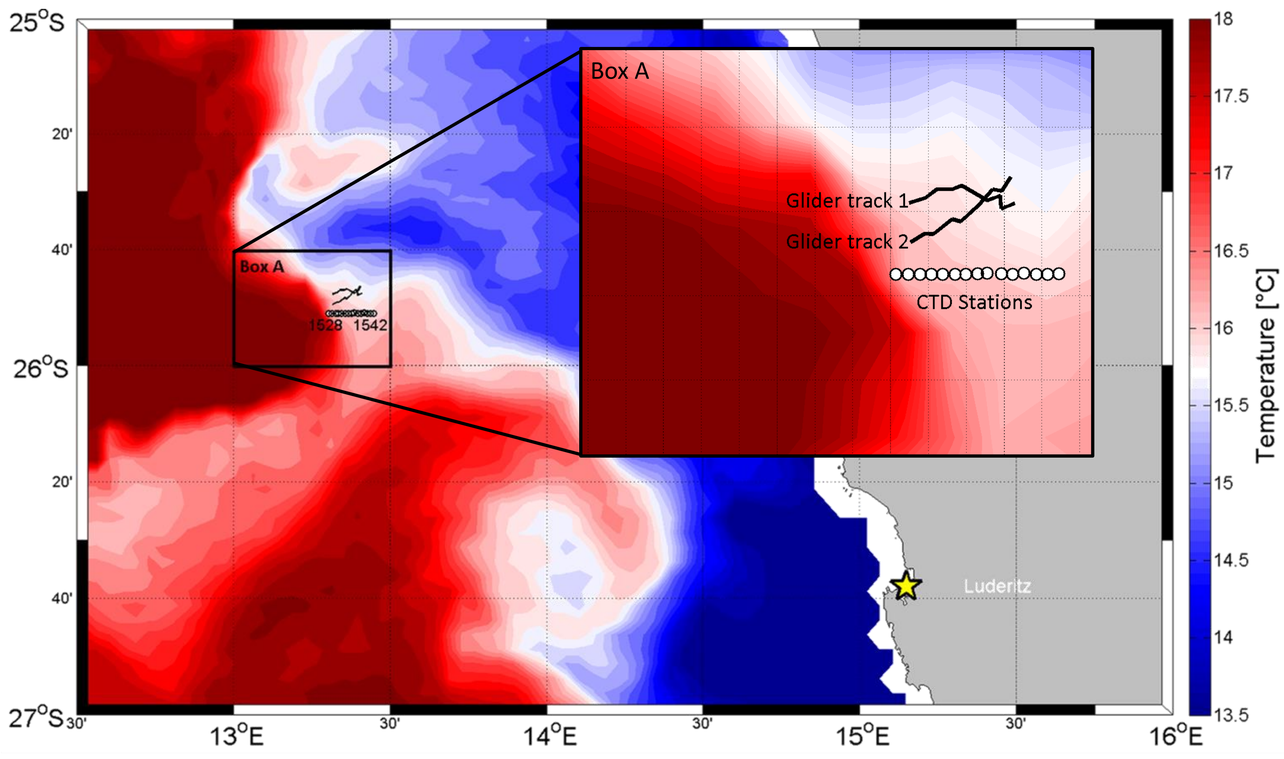

Figure 1: sea surface temperature (SST) from satellite data (MODIS) from 24th November 2016; showing locations of CTD stations (Figure 2) and glider tracks (Figure 3); the temperature field shows cold upwelled water (blue) at the coast off Namibia which spreads westward at the surface. Box A: zoomed map for CTD stations (white bullets) and glider tracks 1 and 2 (black lines)

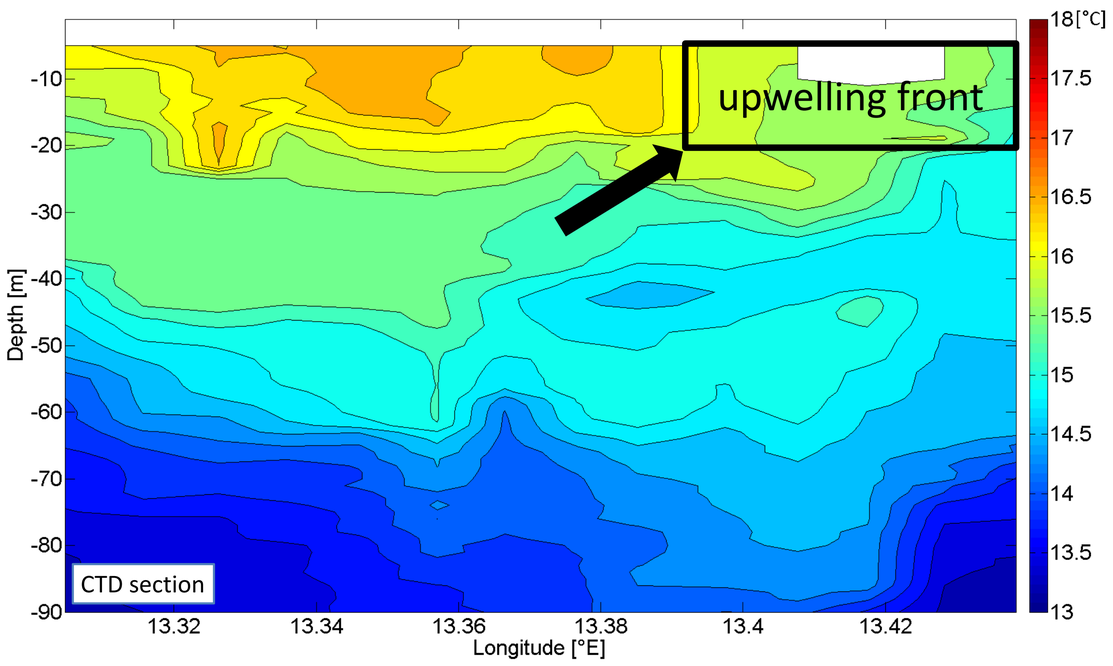

Figure 2: temperature field for the CTD stations, showing the vertical structure from the surface down to 90 meters

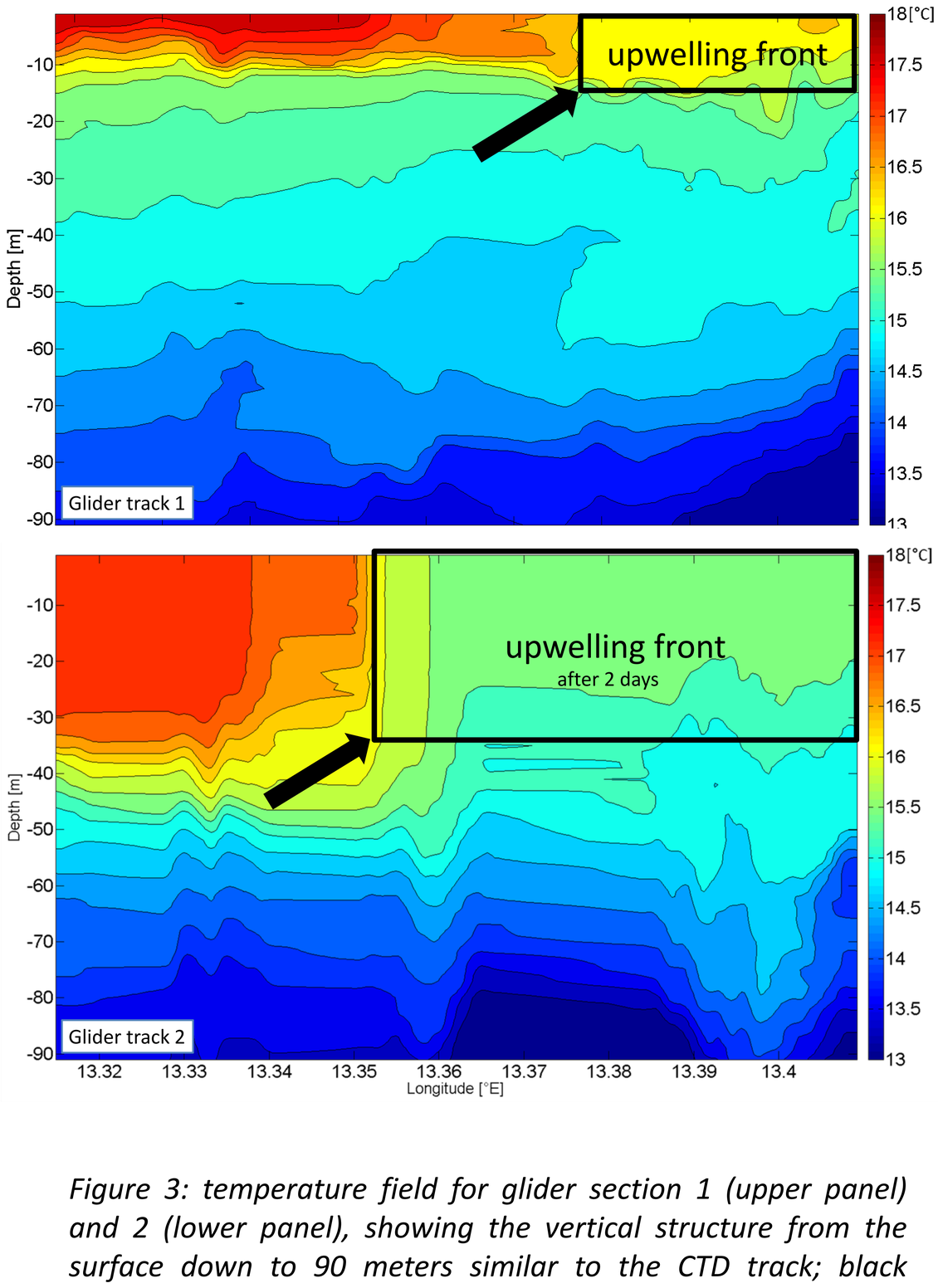

Figure 3: temperature field for glider section 1 (upper panel) and 2 (lower panel), showing the vertical structure from the surface down to 90 meters similar to the CTD track; black arrows show the cold water front with a time difference of about 2 days

Conclusion: A CTD provides data for a certain section at high vertical resolution whereas a glider provides data continuous in time. Both data sets detect the upwelling water which varies in time and space. The glider data shows that the cold water front propagates westward and deepens at the surface. The data gives information about the local heat energy budget which is still not resolved in climate models.

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