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Mixing, internal waves, and plume dispersal at the Nibelungen hydrothermal site, southern MAR

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The plume of the Nibelungen field (8°16' S 13°32' W) is characterized by an unusual high degree of temporal and spatial variability. Large vertical excursions of temperature and density surfaces and the intermittent occurrence of homogeneous layers in the water column make for irregular patterns of biochemical properties in the plume and complicated pathways for hydrothermal products into the open ocean.

The off-axis location of the site, south of a non-transform ridge offset at the joint between the segments A1 and A2 of the southern Mid-Atlantic Ridge, is dominated by complex, rugged topography, and thus favorable to increased internal wave activity and strong mixing in the water column.

The data set used for this study comprises profiles of velocity and stratification with a high temporal and horizontal resolution as well as towed seesaw (tow-yo) transects, which have been obtained during the *RV* Meteor cruises M62/5 and M68/1 in December 2004 and May 2006. The velocity field has been surveyed with lowered Acoustic Doppler Current Profilers (LADCPs) which provide information about the horizontal flow field and the vertical shear thereof; the stratification and its variability was measured with a CTD system.

The role of vertical mixing caused by the internal wave activity in creating homogeneous layers and distributing the plume signature in the vertical is studied by means of diapycnal diffusivities calculated from the vertical shear of the velocity measurements and by observations of strain and inversions of the density field.

Heightened mixing (as compared to typical deep sea values) was observed in the whole rift valley, but especially elevated in the area close to the vent site. The strength of the mixing was modulated by the tidal phase of the flow, with maximum values during ebb tide up to four orders of magnitude above oceanic background. The mixing events were associated with increased internal wave activity with waves of more than 200 m amplitude and frequent occurrence of turbulent overturns which could be observed during the tow-yo casts.