# Shape of plume conduits advected by large-scale mantle flow: Fixed-source and moving-source models

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It is widely regarded that at least some mantle plumes originate at the base of the mantle. However plume conduits may be tilted due to large-scale mantle flow, hence the source region is uncertain. The location of the plume source relative to regions where subducted slabs may have been deposited is expected to influence the composition of plume material. Here a numerical model (Steinberger and O'Connell, 1998) is used to predict the shape of plume conduits and their source location for two different assumptions:

(a) the source is moving with the horizontal flow component at source depth, and

(b) the source is fixed, as recently proposed (Jellinek and Manga, 2002; Davaille et al., 2002).

The large-scale flow model is dominated by large convection cells. Since viscosity evidently substantially increases with depth in the mantle, the inward flow towards upwellings is rather broad, whereas the outward flow is concentrated in a shallow zone of low viscosity. Hence, for the fixed source, the conduit is mostly tilted *towards* the upwelling, and the tilt is strongest at its base. In the case of a moving source, the source itself tends to move fastest towards the upwelling, hence the conduit tends to be tilted *away from* the upwelling. Intermediate models, involving a slowly moving source, are also conceivable; in this case a conduit can remain almost vertical. Results for different cases will be compared with recent tomographic images of plumes. Differences between model and observation can help to infer smaller-scale flow structure not predicted in the large-scale flow model.

## References:

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# Transport and atmospheric processes PCBs in the subtropical atmosphere of Eastern Mediterranean

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Although the production and use of polychlorobiphenyls (PCBs) were banned by the mid-1970s, these chemicals are ubiquitous pollutants in nearly all environmental compartments. By performing a field study, in which PCBs and OH radicals were measured, we achieved an extended study of atmospheric transport and loss processes of PCBs in eastern Mediterranean.

Air, deposition and sediment trap samples were collected between April 1999 and August 2002 at a background marine site in the eastern Mediterranean Sea and analyzed for PCBs. Atmospheric OH concentrations were measured at the sampling station. The average concentrations of total PCB congeners (∑PCBs) in the gas and particulate phase of the atmosphere were 68.1±28.8 pg/m$^3$ and 2.3±1.8 pg/m$^3$, respectively. The lack of seasonal variation for the atmospheric concentration of individual congeners and ∑PCBs and the shallow slopes obtained from the Clausius-Clapeyron plots for several PCB congeners indicated that long-range transport is the main factor controlling the atmospheric levels of PCBs in this area. Most of the episodes with elevated concentrations of ∑PCBs concurred with air transport from Western and Central Europe.

The variation of PCB total concentration showed a diurnal pattern inversely related to that of OH. The diurnal variation of PCBs observed in our study, suggested that the daytime depletion observed for the PCBs should be attributed to their reaction with OH radicals.

Calculations based on field data have shown that 1,000 kgy$^{-1}$ and 200 kgy$^{-1}$ are eliminated from the atmosphere through wet and dry deposition respectively. Air-sea exchange is responsible for the elimination of 700 kg y$^{-1}$, while PCB losses via hydroxyl radicals in the atmosphere may be responsible for the elimination of 4,000 kg y$^{-1}$. Sediment traps deployed in the same area have shown fluxes for total PCBs from 1.1 - 0.9 ng m$^{-2}$ d$^{-1}$ (depth: 250-2820 m).