



Fig. 6. Eigendecomposition of the non-dimensional covariance of the initial profile residuals, i.e., of the differences between the profiles available on Sept. 15 (Fig. 4a) and the initial T , S fields (Fig. 5). The top panel shows the normalized cumulative variance as a function of the eigenvalue number. The covariance $\mathbf{C}_{\text{trc}}^z$ is $[40 \times 40]$. The first T , S vertical EOF explains 32% of the variance, the second 30%, the third 12% and the fourth 7%. These top four EOFs are plotted below, as a function of the level numbers. They are described in the text. They account for 81% of the variance, the top 18 EOFs for 99%.

tracer variability covariance $\mathbf{E}_{\text{trc}} \mathbf{\Pi}_{\text{trc}} \mathbf{E}_{\text{trc}}^T$ is obtained. Several of the dominant 3D eigenvectors or modes, columns of \mathbf{E}_{trc} , are illustrated by Fig. 7. At a given depth, the non-dimensional amplitudes and signs of the T , S anomalies depend on the specific horizontal/vertical combination. The modes 1 to 10 are Kronecker products of the first vertical EOF (Fig. 6) with the dominant horizontal eigenvectors 1 to 10, respectively. The associated T and S anomalies are therefore in phase (partial compensating effects in density). However, modes 11 and 12 illustrated on Fig. 7 correspond to Kronecker products of the second vertical EOF with the two dominant horizontal vectors (not shown): the T and S surface anomalies are then in opposition. As plotted on Fig. 7, it is extremely encouraging that the three dominant modes of 3D tracer variability correspond to the dominant features subjectively, but independently, identified by Robinson et al. (1998b): mode 1 correspond to the Adventure Bank Vortex (ABV), mode 2 to the