To examine the effect of these three treatments on the posterior fluxes, we consider a simple analytical inversion with two observations of an inert species and two optimized flux grid cells. We assume a uniform prior with fluxes and uniform relative prior errors . In the buffer case, the prior errors in the first grid cell are scaled by a factor of . In all cases, observing system errors are assumed constant. Off-diagonal terms for both error covariance matrices are set to zero. We apply a uniform boundary condition perturbation so that the system is in steady state. In this case, a mass balance approach can be used to derive the Jacobian matrix. In the standard case, the Jacobian matrix is lower diagonal with entries equal to the lifetime of the species in a single grid cell multiplied by the prior fluxes . In the correction case, a column giving the boundary condition is appended to the standard Jacobian matrix.

In each of the four cases, we solve for the effect of the boundary condition perturbation as described by equation (7). In all cases, the resulting effect can be written in the form

where is a polynomial function of all inversion parameters. The inverse dependence of on results largely from the matrix inverse taken in the calculation of the gain matrix (equation 5).