Isentropic Dynamical Interpolation

The analysis is defined as the field which minimises the following quadratic penalty function:

$$\mathcal{J} = w_{\text{ap}} \int \left[\chi_t + \boldsymbol{u} \cdot \nabla \chi \right]^2 dA$$

$$+ w_{\text{num}} \int \left[c_1 \frac{\partial^2 \chi}{\partial t^2} + \nabla^2 \chi \right]^2 dA$$

$$+ w_{\text{obs}} \sum \frac{\left[\chi_i - \chi(\lambda_i, \phi_i, t_i) \right]^2}{\sigma_i^2},$$

where χ is the species mixing ratio, $\boldsymbol{u}$ is the horizontal wind taken from ECMWF operational analyses, χ_i and σ_i are the observations and noise estimates interpolated onto the sientropic surface. w_{ap}, w_{num}, c_1 and w_{obs} are constants.