INTRODUCTION OF INTERPOLATION AND COINCIDENCE ERRORS

The CDF formula can be modified to account for the interpolation and coincidence errors by replacing $s_i$ with

$$s_i = \mathbf{a} - \mathbf{A}^{-1} (\mathbf{C} - \mathbf{R C}^{-1} s),$$

where $\mathbf{C}$ and $\mathbf{R}$ are the sampling matrices from a fine grid, that includes all the levels of the fusion grid ($f$) and of the $S$ grids ($i$), to the grids ($i$) and to the grid ($f$), respectively, and $\mathbf{A}$, with

$$\mathbf{S} = \mathbf{S}_x + \mathbf{S}_\text{interpol},$$

where $\mathbf{S}_x$ accounts for the dispersion of the true profiles, and, therefore, depends on the coincidence criteria.

TESTS WITH THE UPGRADED METHOD

The tests of fusion 2 and 3 were repeated with the modified method. For case 3 we used a CM $\mathbf{S}_\text{interpol}$ equal for both TIR and UV measurements, obtained considering an error of 5% of the a priori profile and a correlation length of 6 km.

In Figures 4 and 5, we report the noise errors, the interpolation errors and the coincidence errors related, respectively, to case 2 and case 3, for both TIR and UV measurements.

In both tests, the modified method provides residuals that are significantly smaller than those obtained with the original CDF method. These tests show that the upgrade of the CDF method solves the problems which occur when either the fusing profiles are retrieved on different vertical grids or they refer to different true profiles. The modified method is a generalization of the CDF that allows its application to a wide range of cases.

REFERENCES


CONCLUSIONS

The study showed that the CDF algorithm works well when the fusing profiles are represented on the same vertical grid and refer to the same true profile, otherwise the algorithm provides products of degraded quality. To address this shortcoming, a generalization of the CDF method, which takes into account interpolation and coincidence errors, was presented. This upgrade overcomes the encountered problems and provides products of good quality when the fusing profiles are retrieved on different vertical grids and referred to different true profiles.

UPGRADED METHOD

The test cases of fusion 2 and 3 were repeated with the modified method. For case 3 we used a CM $\mathbf{S}_\text{interpol}$ equal for both TIR and UV measurements, obtained considering an error of 5% of the a priori profile and a correlation length of 6 km.

In Figures 4 and 5, we report the noise errors, the interpolation errors and the coincidence errors related, respectively, to case 2 and case 3, for both TIR and UV measurements.

In both tests, the modified method provides residuals that are significantly smaller than those obtained with the original CDF method. These tests show that the upgrade of the CDF method solves the problems which occur when either the fusing profiles are retrieved on different vertical grids or they refer to different true profiles. The modified method is a generalization of the CDF that allows its application to a wide range of cases.