Assessment of Atmospheric Profile Retrieved from Satellite: Theory and Case Study

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A linear mathematical error model for the assessment of accuracy and precision of atmospheric profile retrievals (Environmental Data Records - EDR) is presented. The EDR Assessment Model (EDRAM) provides theoretical basis and practical tool for assessment of actual performance of the remote sensing satellite system while in orbit by comparing its measurements to some relevant data sets.

The satellite retrieved profile and the profile used for comparison are generally taken at different time and space. Moreover, they sample the atmosphere differently, i.e. they have different vertical resolution. All the above mentioned factors cause apparent difference between the compared entities. To make the assessment of the EDR accurate, the EDRAM accounts for those factors allowing one to separate them from possible bias (accuracy) and noise (precision) of the satellite system.

To account for time and space difference, the EDRAM uses statistical characteristics (mean value, covariance and correlation) of the ensembles of true atmospheric states on which the satellite system and the system used for comparison perform the measurements. To reconcile the difference in vertical resolution the averaging kernel formalism is implemented.

For the case study the model has been applied to a limited set of radiosonde temperature profiles taken over the ARM Southern Great Plain site and simulated AIRS retrievals. It has been demonstrated how unaccounted temperature difference/error between compared profiles depends on time interval separating them. In particular study, for two sets of profiles (107 profiles each) separated by less than six hours the mean unaccounted error is within 0.3 ± 0.2 K.

The EDRAM can be used for assessment and interpretation of the validation results when the above mentioned sources of discrepancies are significant, as well as for referencing the satellite EDRs from instruments such as CrIMS, IASI, and AIRS to other date sets for the use as Earth System or Climate Data Records (ESDRs or CDRs).

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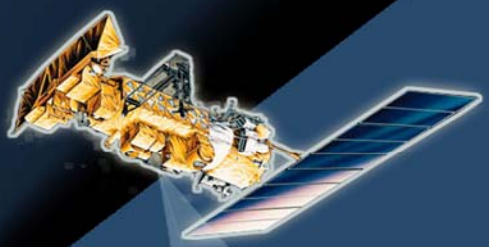

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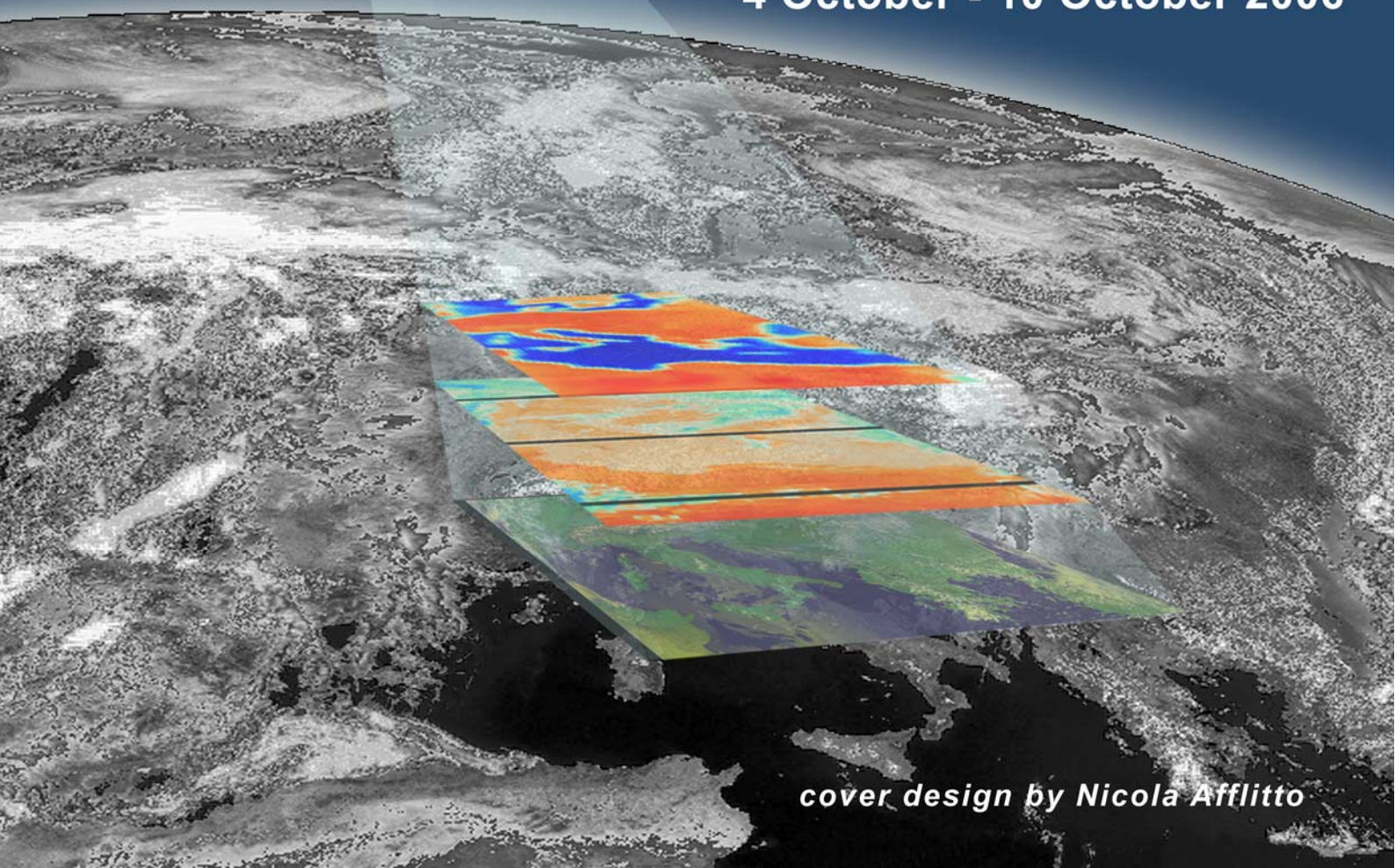

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