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Reconstruction of missing data in satellite data sets using DINEOF with constraints to reduce spurious high-frequency variations in the temporal EOFs.

A. Alvera-Azcárate, A. Barth, D. Sirjacobs, and J.-M. Beckers
University of Liege, Astrophysics, Geophysics and Oceanography, Liege, Belgium (a.alvera@ulg.ac.be)

DINEOF (Data Interpolating Empirical Orthogonal Functions) is a method to reconstruct missing data in geophysical data sets, such as gaps originated by the presence of clouds in infrared satellite sensors. Based on Empirical Orthogonal Functions (EOFs), DINEOF uses an iterative procedure to calculate the missing values. DINEOF has been compared to Optimal Interpolation, showing that more accurate results are achieved, with up to 30 times less computational time (tests made with sea surface temperature of the Adriatic Sea, and validated with in situ data). Another advantage of this technology is that there is no need for a priori knowledge of the reconstructed data set statistics (such as covariance or correlation length). The technique can be applied to a broad range of data (physical, biological, chemical), and to a variety of platforms (satellite data, in situ data...).

Given the nature of the EOFs, it is not necessary that data sets are regularly distributed in time. Irregularly distributed data sets, however, may lead to discontinuities in the temporal EOFs calculated from them, and these discontinuities can affect in turn the quality of the DINEOF reconstruction. In satellite data, some images can present a large amount of cloud cover, and only a few pixels with valid data. EOF projection to such images can also lead to discontinuities in the temporal modes, as there might be an over-fitting to the scarce information present in those images. After briefly describe DINEOF and its applications, we present a study aiming to reduce these discontinuities by including a time constraint to the covariance matrix used in the EOF decomposition. The approach is tested with sea surface temperature data of the Black Sea, and the results are compared to independent data.