



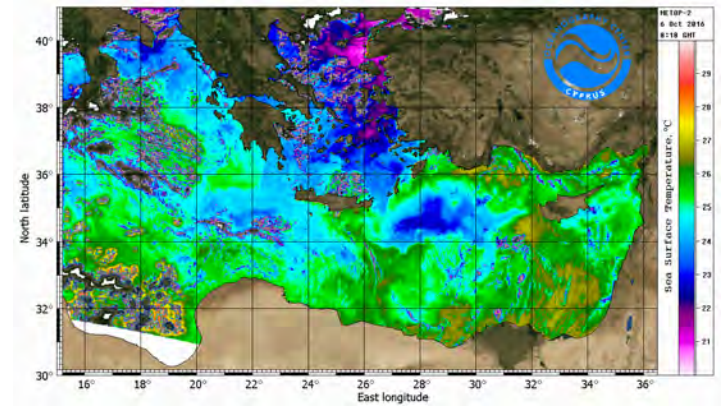
DINEOF daily cloud-free SST for the Eastern Mediterranean and Black Sea

^{a,b} Andreas Nikolaidis, ^b George Zodiatis, ^{c,b} Stavros Stylianou, ^b Georgios Nikolaidis, ^d Elena Zhuk, ^a Evangelos Akylas

^a Cyprus University of Technology Department of Civil Engineering and Geomatics, ^b Oceanography Center of the University of Cyprus, ^c Cyprus University of Technology Department of Environmental Science and Technology, ^d Marine Hydrophysical Institute RAS (Russian Federation)

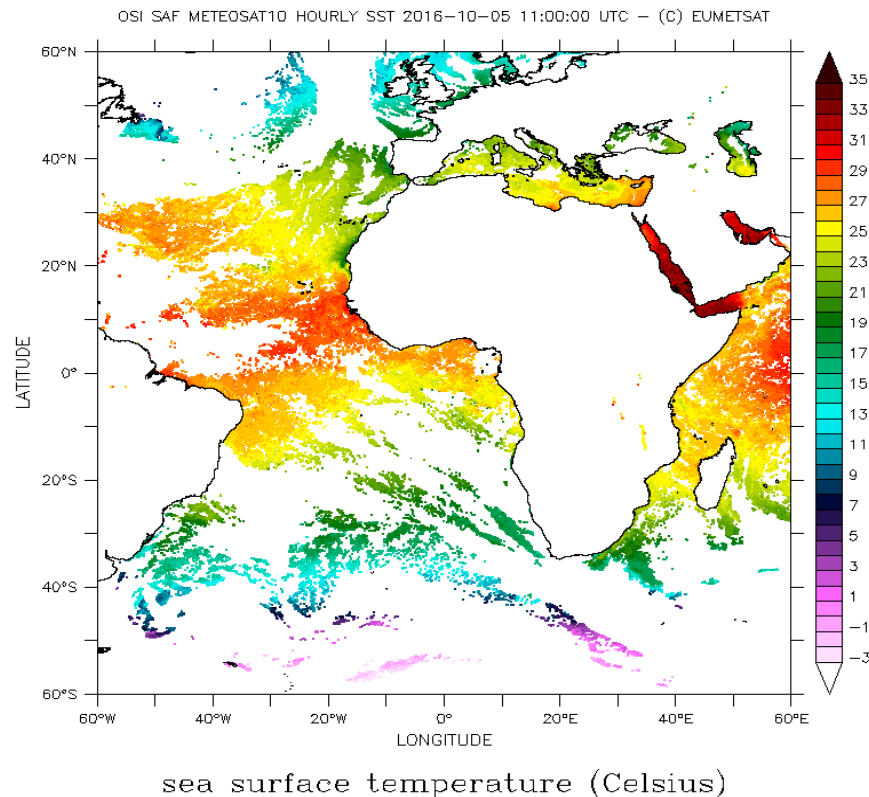
Introduction

- ▶ Hourly cloudy SST data collected by EUMETSAT, have been used in order to reconstruct the missing SST fields in the Eastern Med and then avail them online, both as maps and as binary (netCDF) files at the <https://emed-bsea-sst.github.io/Data/>.
- ▶ The Data INterpolating Empirical Orthogonal Functions (DINEOF) has been used, and is an EOF-based technique to reconstruct missing data from satellite derived SST data.



Data source

- ▶ Daily downloaded satellite data (product MET SST) from <http://www.osi-saf.org/> for the latest seven (7) days, covering 60S-60N and 60W-60E, at 0.05° regular grid, are processed for the Eastern Med and Black Sea.
- ▶ Data source is Meteosat-10/SEVIRI and is copyrighted (2016) by EUMETSAT Satellite Application Facility on Ocean & Sea Ice id:SEVIRI_SST-OSISAF-L3C-v1.0

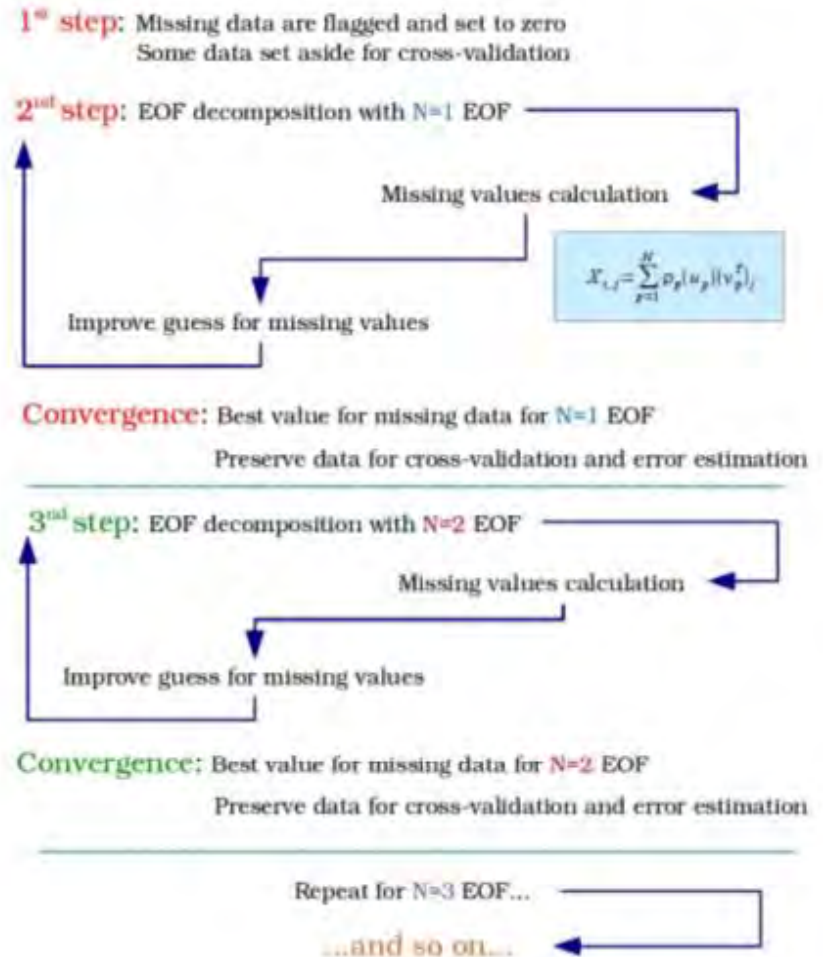


The DINEOF method

► Data Interpolating Empirical Orthogonal Functions (DINEOF) interpolates missing values via an iterative SVD (singular value decomposition) algorithm.

► Missing values are initially filled by an unbiased guess, then the data matrix is decomposed via SVD and a reconstruction is calculated based on the 1st EOF. Repeated SVD iterations and the resulting EOF reconstructions continuously modify the gap values until convergence of the Root Mean Square (RMS).

► The same procedure is repeated for the 2nd, and then for subsequent EOFs. The resulting interpolated matrix will no longer contain gaps.



The web page

- Depending on the availability of the EUMETSAT data, daily updates contain approximately 168 hourly time-steps, covering 19E-42E and 30N-48N at 0.05°

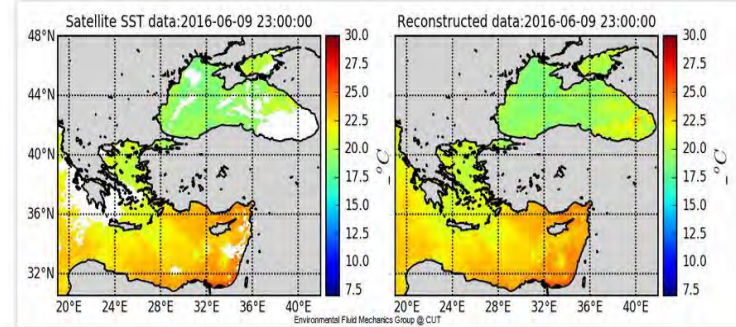
About

Image Gallery

Download

Links

We are providing reconstructed sea surface temperature (SST) satellite images and data, covering the Eastern Mediterranean and Black Sea regions.



Cloud-free data were produced by applying the DINEOF algorithm over the EUMETSAT five (5) km grid Level 3 data on daily basis, for a seven (7) days period of hourly steps.

Caution!

The use of these product is granted to every user, free of charge. The Department of Civil Eng. & Geoinformatics of Cyprus University of Technology offers no warranty and accepts no liability in respect of these products. CUT neither commits to nor guarantees the continuity, availability, or quality or suitability for any purpose. Downloading and using these products imply agreement of acceptance of these terms.

EMed & Black Sea SST

About

Image Gallery

Download

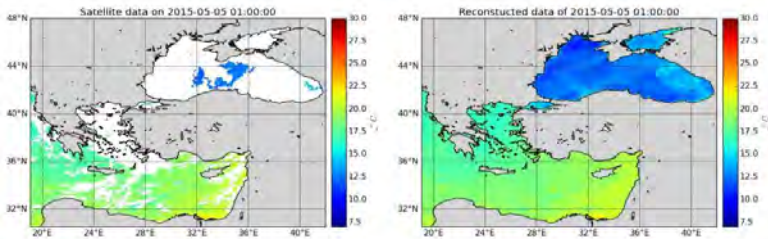
Links

galleries Recent

Recent

Inside...

► The ‘Image Gallery’ (up) or the ‘Download’ (down) menu option provide the directions for obtaining the relevant data.



► Images supplied in pairs (middle) showing the “before-after” reconstruction conditions.

EMed & Black Sea SST

About

Image Gallery

Download

Links

2016-07-07_SST_06.nc.gz

2016-07-07_SST_07.nc.gz

2016-07-07_SST_08.nc.gz

2016-07-07_SST_09.nc.gz

2016-07-07_SST_10.nc.gz

2016-07-07_SST_11.nc.gz

2016-07-07_SST_12.nc.gz

2016-07-07_SST_13.nc.gz

2016-07-07_SST_14.nc.gz

2016-07-07_SST_15.nc.gz

2016-07-07_SST_16.nc.gz

2016-07-07_SST_17.nc.gz

2016-07-07_SST_18.nc.gz

2016-07-07_SST_19.nc.gz

2016-07-07_SST_20.nc.gz

2016-07-07_SST_21.nc.gz

2016-07-07_SST_22.nc.gz

2016-07-07_SST_23.nc.gz

Hint

1. After each file selection, press the RAW button to download.

2. You can get all data files here

► Data files, in Netcdf format, are available, either at specific date-time (one time-step) or all time-steps as one file.

Binary (NetCDF) data

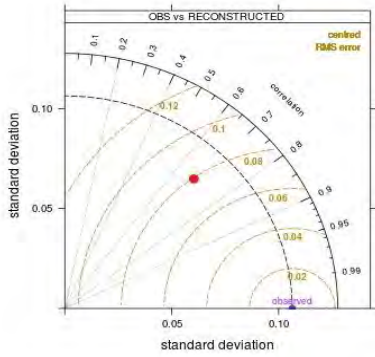
- ▶ Data files are in standard (known as 'classic') Netcdf format, guaranteed to be accessible under any Netcdf library version.
- ▶ Variable naming conventions follow a 'loose' standard, easily adopted.
- ▶ Every file is about 120 KB and contains the reconstructed SST (in Celsius degrees) region area at certain time (hourly) and date.

```
016-09-07_SST_00 {
s:
  on = 460 ;
  at = 351 ;
  ime = UNLIMITED ; // (1 currently)
:
double lon(lon) ;
  lon:long_name = "longitude" ;
  lon:units = "degrees_east" ;
  lon:standard_name = "longitude" ;
  lon:_FillValue = -32767.f ;
double lat(lat) ;
  lat:long_name = "latitude" ;
  lat:units = "degrees_north" ;
  lat:standard_name = "latitude" ;
  lat:_FillValue = -32767.f ;
double time(time) ;
  time:units = "hours since 2015-05-01 01:00:00" ;
  time:calendar = "standard" ;
  time:_FillValue = -32767.f ;
short sst(time, lat, lon) ;
  sst:long_name = "sea_surface_temperature" ;
  sst:units = "degC" ;
  sst:_FillValue = -32767.f ;
  sst:add_offset = 25.4193340891331 ;
  sst:scale_factor = -0.000166910726243466

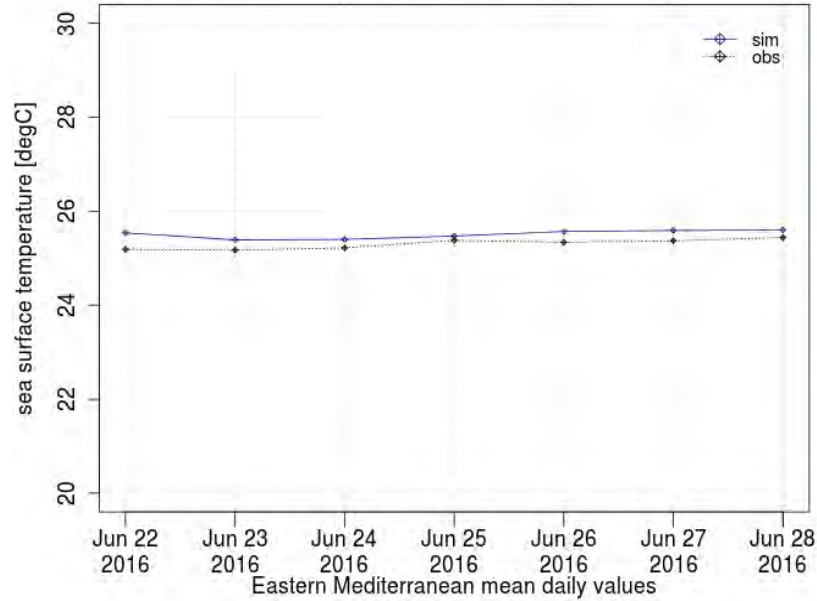
attributes:
  :Conventions = "COARDS/CF-1.0" ;
  :description = "DINEOF reconstructed SST"
```

Case study 1:

Comparing a Global SST Analysis, L4 OSTIA, 0.05 deg daily (MET OFFICE-GLO-SST-L4-NRT-OBS-SST-V2) with SST Reconstructed data using the DINEOF.

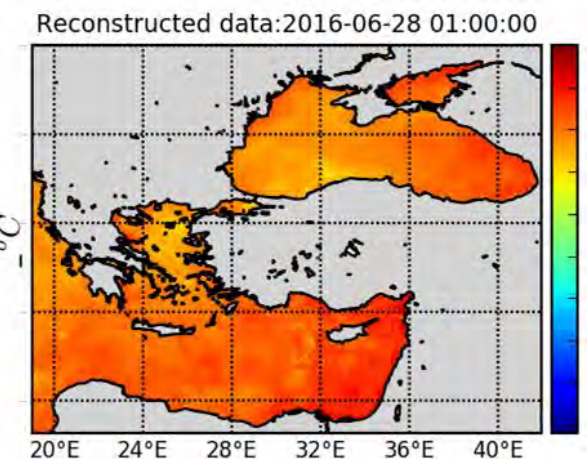
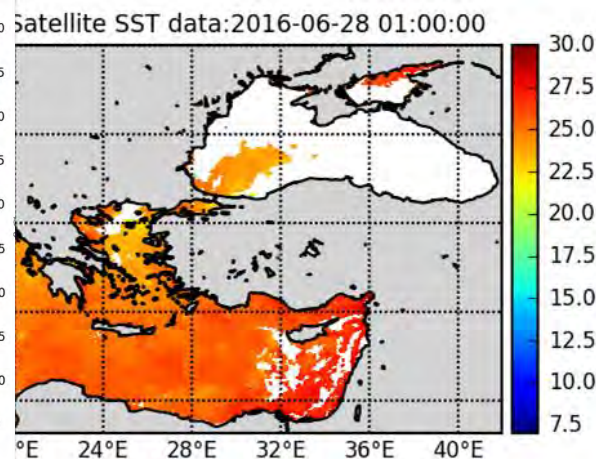
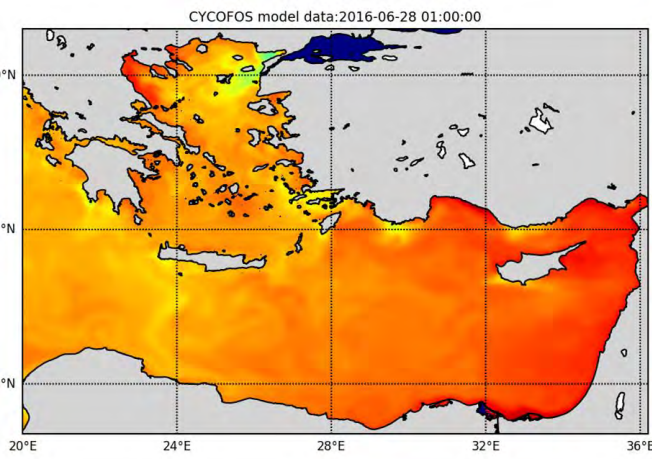


Reconstructed data (=sim) vs GLO-SST-L4-NRT satellite (=obs) data



- GoFs:
- ME = 0.21
 - MAE = 0.21
 - MSE = 0.05
 - RMSE = 0.22
 - NRMSE = 206.7
 - PBIAS = 0.8
 - RSR = 2.07
 - rSD = 0.83
 - NSE = -3.98
 - mNSE = -1.24
 - rNSE = -4
 - d = 0.5
 - md = 0.31
 - rd = 0.5
 - cp = -5.01
 - r = 0.68
 - R2 = 0.46
 - bR2 = 0.46
 - KGE = 0.64

acronym	Statistical test
ME	Mean Error
MAE	Mean Absolute Error
MSE	Mean Square Error
RMSE	Root Mean Square Error
NRMSE	Normalized Root Mean Square Error
PBIAS	Percent Bias
RSR	Ratio of RMSE to the Standard Deviation of the Observations
rSD	Ratio of Standard Deviations
NSE	Nash-Sutcliffe Efficiency
mNSE	Modified Nash-Sutcliffe Efficiency
rNSE	Relative Nash-Sutcliffe Efficiency
d	Index of Agreement
md	Modified Index of Agreement
rd	Relative Index of Agreement
cp	Persistence Index
r	Pearson product-moment correlation coefficient
R2	Coefficient of Determination
bR2	coefficient of the regression line between simulations and observations
KGE	Kling-Gupta efficiency



Case study 2: Comparing with CYCOFOS model

► CYCOFOS is a high resolution 2x2 Km 4D, hydrodynamic operational model providing hourly data over the Eastern Mediterranean :

<http://www.oceanography.ucy.ac.cy/cycofos>

► Diversions of the SST in the North Aegean Sea, are due to differences between the surface layers of the model and the satellite data (about 2m) and also the model's forcing.

Thank you for your attention!

Visit

<https://emed-bsea-sst.github.io/Data/>

Project partners:

