EUROPEAN SEA LEVEL SERVICE - RESEARCH INFRASTRUCTURE

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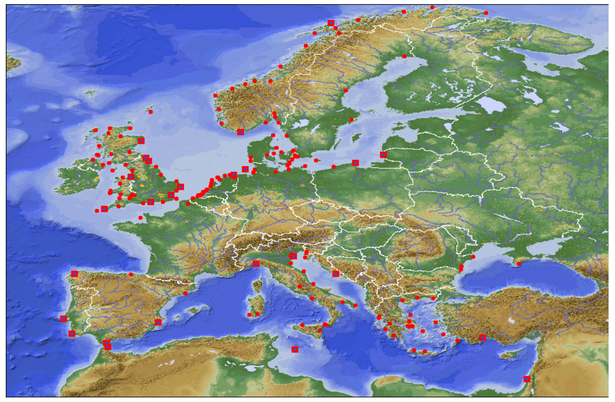
Introduction

The European Sea-Level Service (ESEAS) as an international collaboration of governmental and non-governmental organizations in 21 countries has developed into a major research infrastructure for all aspects related to sea-level. The ESEAS-RI (Research Infrastructure) project was established by the ESEAS to support the research infrastructure of the ESEAS and facilitate full exploitation of existing and future European sea level observations. The project aims at providing a database for research and other uses, on a European scale, of sea level trends and variability as input for coastal management and research in coastal dynamic processes. The complete set of results from ESEAS-RI can be found through http://www.eseas.org.

Upgrading of the European in-situ Sea Level Observing Network

The regional observing site network comprising GLOSS stations and other national stations, has been improved through upgrading of existing stations. The upgrading consist of improvements of the instruments as well as adding CGPS to a selected number of tide gauges. GPS campaigns was carried out at a number of selected tide gauge sites and the result was used in the improved determination of the crustal movement on the sites. All sites have been classified by ESEAS.

ESEAS Observing Sites



ESEAS Observing Sites - Classification

Application A: absolute sea level variations.
Application B: various applications (including tides, ocean circulation and sea level extremes) using hourly, quality controlled data.
Application C: satellite altimetry calibration.
Application C1: calibration of satellite altimeter biases.
Application C2: calibration of satellite altimeter biases and monitoring of drifts in the biases.
Application D: operational oceanography, including storm surges.

ESEAS

EVR1-CT-2002-40025

Sea Level Standards – Multipurpose Data

Data Exchange

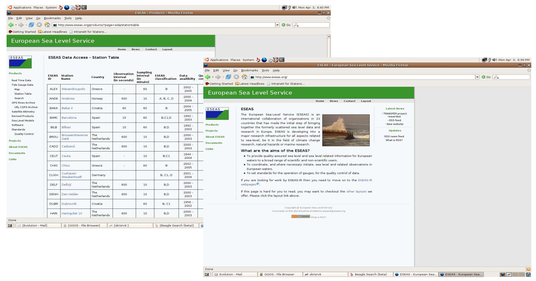
Within the framework of the ESEAS-RI project an exchange format has been agreed, together with a set of quality flags. The format is a simple 'spreadsheet' style format similar to that in use in many of the participating organisations. This format has been defined taking into account international guidelines developed by working groups within the IOC's International Data and Information Exchange Committee. The format also includes relevant ancillary information. Historical data has been digitalized and made available on the ESEAS Data Portal.

Quality Control routines

The ESEAS quality control is based on a common set of procedures for the quality control of observed sea level data, which to a great extent can be referred to those specified by the Intergovernmental Oceanographic Commission for the Global Sea Level Observing System (GLOSS). The procedures include checking for unexpected anomalies in the time series, or in the derived tidal parameters, and in the filtering of the raw data to provide monthly means. Quality control also extends to other information such as documentation of datum information, metadata, exchange format, application classification, and levels of quality control as well.

Two levels of quality control depending on the delivery time line are defined:
L1: quality control for near real time products, and
L2: full quality control and analysis for delayed mode products.

ESEAS Data Portal



Example of Metadata Included in Each Data File:

Format: TGINEX version 1.0
PSMSL code: 200006
ESEAS ID: BILB
Station Name: Bilbao
Country: Spain
Contributor: Puertos del Estado
Latitude: 43.3372
Longitude: 3.0358
Coordinate system: WGS84
Record interval: 40 seconds
Sampling interval: 5 minutes
Datum information: Data refer to the Bilbao harbour datum
Instrument type: Acoustic
Instrument precision: Centimetre
Quality control level: L2
Quality control flag: 1-Correct value, 2-Interpolated value,
3- Wrong value, 9-Missing value
Parameter 1: Date (yyyy/mm/dd)
Parameter 2: Time (hh:mm:ss)
Parameter 3: Observed sea level (m)
Parameter 4: Quality control flag of Observed sea level
Parameter 5: Residual (observed-expected sea level) (m)
Parameter 6: Quality control flag of Residual

2004/01/01 00:00:00 1.770 1 0.029 1
2004/01/01 00:05:00 1.780 1 0.030 1

Vertical Crustal Movements at ESEAS Observing Sites (EOS)

On the basis of the processing and analysis strategies developed in the project, a 5.33-year data set for 30 ESEAS Observing Sites with CGPS stations was processed and CGPS coordinate time series from different analysis solutions were analysed, using Maximum Likelihood Estimation (MLE) and Empirical Orthogonal Function (EOF) analysis.

Beside computation of vertical velocity estimates with realistic uncertainties accounting for coloured noise in the time series, which was the main focus of the analysis, research was carried out to establish whether and how different GPS processing strategies affect the stochastic properties of the time series.

Using the vertical land movement estimates from CGPS and absolute gravity, a comparison with independent evidence for vertical land movements was carried out based on evidence from sea level records from tide gauges, geological evidence from the past 10,000 years and results from glacial isostatic adjustment models, and and offset of the CGPS estimates from the AG estimates was computed for each analysis solution

A good correlation between the vertical land movements based on 'absolute gravity-aligned CGPS estimates of vertical station velocities' and the changes in sea level measured by the tide gauges was demonstrated for the North Sea and Atlantic Coast of Europe.

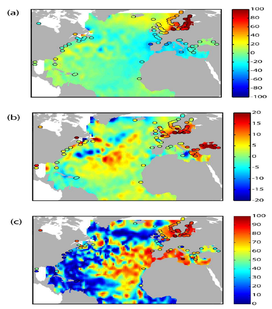
The average change in sea level, decoupled from vertical land movements, were computed.

Empirical Models for Decadal to Inter-decadal Sea Level Variations

A preliminary empirical model of inter-decadal sea level variations for the global and North Atlantic Ocean is derived from a combination of hydrodynamic models and altimetry. A model for sea level variability in the Mediterranean Sea was constructed for the period 1955-2003. The global interannual sea level variability during 1950-2002 is reconstructed using the spatial patterns corresponding to the altimetry data between 1993-2001 and the temporal patterns corresponding to the tide gauge between 1950-2002.

The reconstructed model reproduces the global averaged interannual variability observed by altimetry between 1993-2003 with a root mean square error of about 2 centimeters and corresponds to about 50 % of the variability of the global ocean between 1993-2001.

The altimetric analysis identified and quantified the inter-annual to inter-decadal sea level signal known from tide gauges, but not in-between. It also showed that the spatial pattern of the sea level changes are identical between 8 and 12 years, which supports the validity of the empirical model of inter-decadal sea level variations derived on the basis of tide gauges and multi-mission satelllite altimetry.



The correlation is computed for the time interval 01/1993 to 10/2001. The sea level is determined from Topex/Poseidon observations with a spatial and temporal resulotion of 1 degree and 1 month respectively. Nils Kjær, DK

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