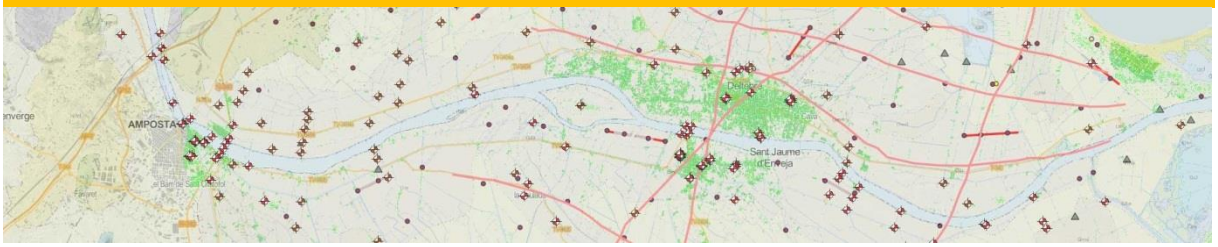
Geoindex viewer legend – Life Ebro ADMICLIM project



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Basic information

The Ebro delta is an active sedimentary body which is the result of the interaction of the Ebro River sedimentary processes and the Mediterranean Sea marine dynamics. For this reason its shoreline is not fixed and changes with time, depending the most dominant process. Most of the maps and information developed during the Life EBRO-ADMICLIM project considered the shoreline of the ICGC 1:50.000 topographic map (2011). This consideration aims to keep spatial consistency to the map. Nevertheless the used coastline present some changes compared with the last available shoreline of the Ebro Delta plain. Hence both shorelines are considered important and hence, presented as basic information.

Shoreline base profiles of the Ebro Delta plain

Shoreline Topographic base 1:50.000

Shoreline 2017

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Soil map

Soil map of Catalonia at scale 1:250.000. The classification used for the definition of the pedological map is based on the information of trenches and physicochemical data of soil samples acquired from the database of soils of Catalonia. This database includes the organic matter content as well as its environmental conditions, and other physicochemical variables such as pH, Calcium carbonate content, sediment-size, cationic exchange capacity, gravimetric humidity and dry density, which allow the pedological classification. Based on the obtained variables, the 1:250.000 scale soils map and the classifications of the USDA (USDA, 1999) and the FAO (FAO-UN, 2014), each type of soil observed in Ebro Delta Plain was identified and described as:

Delta Soil	USDA	FAO
S1	Hydric Haplohemist	Hemic Histosol
S2	Thapto-Histic Fluvaquents	Gleyic Histic Fluvisol
S3	Oxyaquic Xerofluvents	Haplic Fluvisol
S4	Typic Psamments	Haplic Arenosol
S5	Aeric Fluvaquents	Gleyic Fluvisol

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Marshes

From the second half of the 19th century, level of detail and precision of cartographic documentation increases, allowing a more exhaustive analysis of the morphological evolution of the Ebro Delta plain through its georeferencing. Based on the projection of the 19th century maps, some of the most relevant changes on Ebro delta can be described. In particular, the nautical charts of the Hydrographic Commission of 1878-1880 (Galván et al., 1887) and 1886-1887 (Riudavets et al., 1890) allow the location of the shoreline and marsh domains of the Ebro Delta area about 130 year before present. Marsh domains location is important since these materials are prone to contain high quantities of organic matter which is highly compressible, boosting subsidence rates (especially if it's recent).

Approximated distribution of marshes around 1880

- Marshes in 1880
- Islands in the Ebro river in 1880

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Delta evolution

The Ebro Delta is an active sedimentary system that throughout recent history has undergone very significant changes. Maps of the Ebro Delta produced before 1880 cannot be correctly projected on a present day coordinates system, as they lack of the necessary precision. This factor implies that this type of map is not valid to quantify the surface changes over the Ebro Delta plain. Nevertheless, this is valuable qualitative information which allows having a general idea of the delta formation processes, the sediment possible distribution and the intervals when the different delta domains have been emerged.

On the contrary, from the second half of the 19th century, more detailed and precise cartographic documentation is available, allowing its geographical referencing. As a consequence is possible to perform a more exhaustive analysis of the morphological evolution of the Ebro Delta plain shoreline and the sediment accumulated on the Ebro Delta front through the comparison of consecutive shorelines and bathymetries respectively.

Approximated shorelines prior to 1880

- About 3000 years ago
- VI and X centuries
- X and XIII centuries
- Year 1580
- Year 1750
- Year 1880

Shorelines evolution (since 1923)

- Year 1923
- Year 1945
- Year 1956
- Year 1974
- Year 1983
- Year 1993
- Year 2005
- Year 2014

Sedimentary dynamics of the Ebro delta front between 1890 and 1976

- -2 m
- 0 m
- 24 m
- No data

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Earth observation (DInSAR)

Measures of the Ebro delta's movements were registered by using Satellite-based Differential Interferometry radar (DInSAR) technique. This is a remote sensing technique that uses a stack of satellite images to monitor the surface motion with millimeter precision. The satellite images correspond to the Synthetic Aperture Radar (SAR), which is a specific sensor operating with microwave signal. This remote sensing technique allows obtaining terrain movements data of large areas with a large amount of measurement points. One of the main limitations of DInSAR technique is that changing surfaces (such as vegetated soils or crops) produce changes of radar signal reflection and cannot be measured.

For Life EBRO-ADMICLIM project, data from ERS, ENVISAT and SENTINEL missions where used. The gathered data covers the intervals 1992-2010 (ERS-ENVISAT) and mid-2014-2017 (SENTINEL). As most of the delta is covered by rice fields, a set of artificial corner reflectors aimed to supply reliable reflection points on the Ebro Delta plain where installed within the project. Corner reflector layer include elements identifier files in PDF format as an attached element that can be visualized and downloaded (WMS in QGIS, only downloadable).

Sentinel movement rate (mm/year)

- More than 15
- 12 – 15
- 9 -12
- 6 – 9
- 3 – 6
- Stability
- 3 – 6
- 6 – 9
- 9 – 12
- 12 – 15
- More than 15
- Corner reflector

ERS-ENVISAT movement rate (mm/year)

- More than 15
- 12 – 15
- 9 -12
- 6 – 9
- 3 – 6
- Stability
- 3 – 6
- 6 – 9
- 9 – 12
- 12 – 15
- More than 15

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Geophysical surveys

Geophysical surveys within the Ebro Delta sedimentary body where performed, reinterpreted and integrated on the construction of a geological model used to identify the most vulnerable areas to subsidence. In addition geophysical results allowed the determination of the saline intrusion within the delta's sediments.

Geophysical surveys and profiles locations

- Seismic refraction
- AMT
- Electrical resistivity tomography
- Geophysical log
- Horizontal to vertical spectral ratio
- Seismic noise array
- Seismic reflection

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Boreholes and samples

Boreholes, geological description and soil and borehole samples are compiled from the Cartographic and Geological Institute of Catalonia (ICGC) and other databases as well as from scientific articles and PhDs. The soil and borehole samples compiled were primarily collected for diverse purposes and therefore the available parameters present some variations such as different grain size ranges and density considerations.
This layer includes links to the borehole logs and sample profiles as attached information when available.

Borehole and sample location


Borehole
Sample (soils and boreholes)

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1:50,000 geologic map

The ICGC's geological map at 1:50,000 its presented to supply the geological frame context of the Ebro delta plain. The details of the different units and its specific information can be found on the geological map summary.

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3D Model

The geological structure of the modern Ebro Delta is closely related to the evolution of the continental shelf over the last 20000 years (the last glacial maxima). Worldwide research on modern marine delta formation ages indicate that, regardless of latitudinal and climatic regime most of these depocenters are formed within a restricted period between 8000 and 6500 radiocarbon years before present (Stanley et al., 1994), when the sea rise rate began to decelerate (Siddall et al., 2003; Doyle et al., 2015). As a consequence, Ebro delta sedimentary body is composed by Holocene and Pleistocene transgressive units, grouped as the whole sedimentary body (QH20) and the Holocene sedimentary body (without Pleistocene units; QH). The main units can be synthetized in QHlmpd, QHfd, QHprd, QPtf and QPtc.

Unit	Description
QPtc	Upper Pleistocene transgressive coarse grained and sandy deposits
QPtf	Upper Pleistocene transgressive fine grained any muddy deposits
QHprd	Holocene prodelta deposits
QHfd	Holocene delta front deposits
QHl	Holocene lagoon (bay), mash, river overbank and alluvial plain deposits

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Sedimentary units thicknesses

Thickness of the QH deposits

0 m

58 m

No data

Thickness of the QH20 deposits

0 m

62 m

No data

Thickness of the QHImpd deposits

0 m

25 m

No data

Thickness of the QHfd deposits

0 m

17 m

No data

Thickness of the QHprd deposits

0 m

50 m

No data

Thickness of the QPtf deposits

0 m

22 m

No data

Thickness of the QPtc deposits

0 m

18 m

No data

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Sedimentary unit's base contour map and 3D model workframe

QH

QH20

QHfd

QHlmpd

QHprd

QPtc

QPtf

Workframe of the 3D model

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Limit of the sedimentary deposits

- QHfd
- QHlmpd
- QHprd
- QPtc
- QPtf

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Units distribution depth sections

Distribution of the Holocene and Upper Pleistocene units at -5m elevation

- S5 QHlmpd
- S5 QHfd
- Substratum

Distribution of the Holocene and Upper Pleistocene units at -15m elevation

- QHfd
- QPtf
- Substratum

Distribution of the Holocene and Upper Pleistocene units at -25m elevation

- S25 QHprd
- S25 QPtf
- S25 QPtc
- Substratum

Distribution of the Holocene and Upper Pleistocene units at -35m elevation

- QHprd
- QPtf
- QPtc
- Substratum

Distribution of the Holocene and Upper Pleistocene units at -45m elevation

- QHprd
- QPtf
- QPtc
- Substratum

Delta environments

The sedimentary units of the delta define and/or contain different sedimentary environments the environment limits are not clear, generally being a transitional boundaries. However, the deposits associated with each of these environments generally have specific lithological, physical and/or chemical characteristics that make them likely to be differentiated if enough quality information is available. The different sedimentary environments determined on the Ebro Delta area are defined as:

Environment	Description
Basement	Mesozoic basement
QPN	Neogene-Quaternary deposits
QPt	Upper Pleistocene transgressive deposits.
QHprd	Holocene prodelta deposits
QHfd	Holocene delta front deposits
QHl	Holocene lagoon (bay) deposits
QHm	Holocene marsh deposits
QHpd	Holocene overbank and alluvial channel deposits
QHf	Holocene over bank deposits of the Ebro river valley

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Map of the modern sedimentary environments of the Ebro Delta

- Basement
- QHf
- QHfd
- QHl
- QHm
- QHpd
- QHprd
- QPN
- YQPt

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Adreces d'interès

Cartographic and Geological Institute of Catalonia. Life Ebro ADMICLIM project (ICGC)

LIFE EBRO-ADMICLIM website project (LIFE+EU)

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