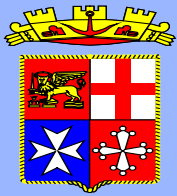


LE REGOLE IDROGRAFICHE SUL CAMPO: ANALISI DI UN CASO STUDIO

Capitano di Corvetta Nicola PIZZEGHELLO

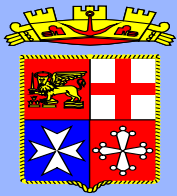
Roma, 17 febbraio 2016



Sommario

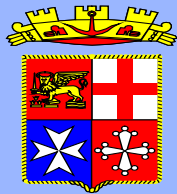
- Le misure idrografiche
- Il rilievo idrografico
- Gli output del rilievo

CASE STUDY

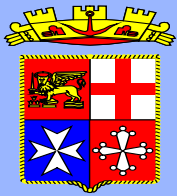


L'idrografia oggi

“Hydrography is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defence, scientific research, and environmental protection. .” IHO-S32



MISURARE NEL CAMPO IDROGRAFICO

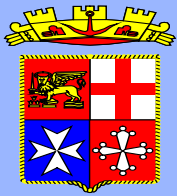


Misurare

MEASURE: process of experimentally obtaining one or more quantity values that can reasonably be attributed to a quantity

(BIPM JCGM 200:2012 - International vocabulary of metrology)

- Attività sperimentale (PRATICA)
- Valori (NUMERI)
- Attività ragionata (STRATEGIA DI MISURA)



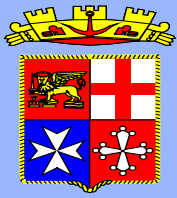
Misurare

QUANTITY VALUE: number and **reference**
together expressing magnitude of a quantity

(BIPM JCGM 200:2012 - International vocabulary of metrology)

- Numero
- Reference

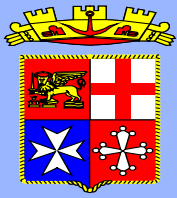
(Frame di riferimento e Sistema di misura)



System vs frame

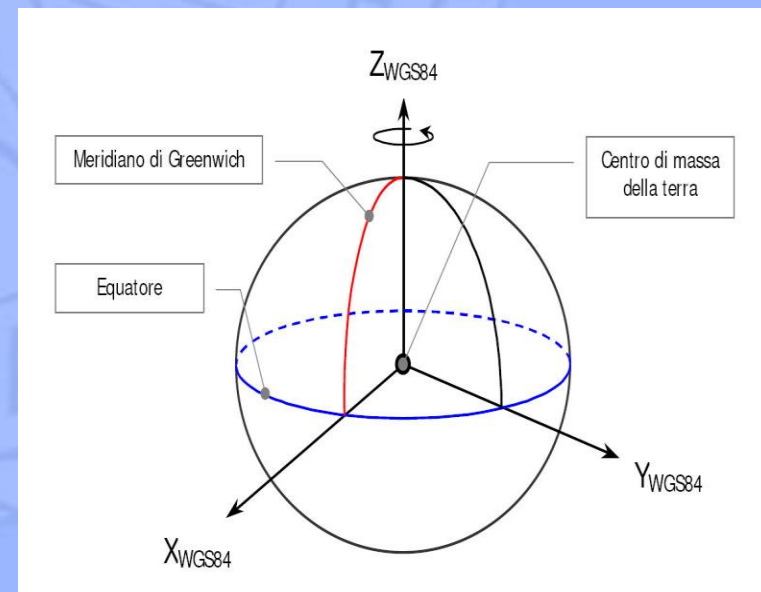
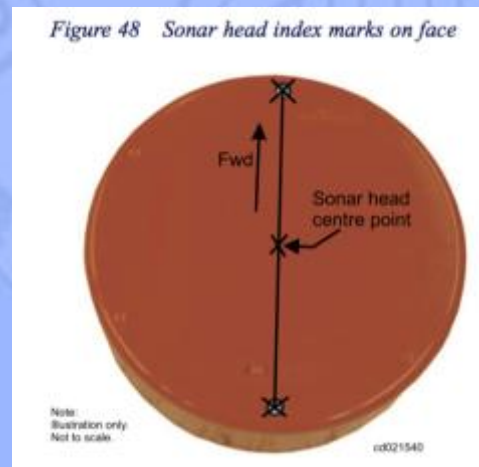
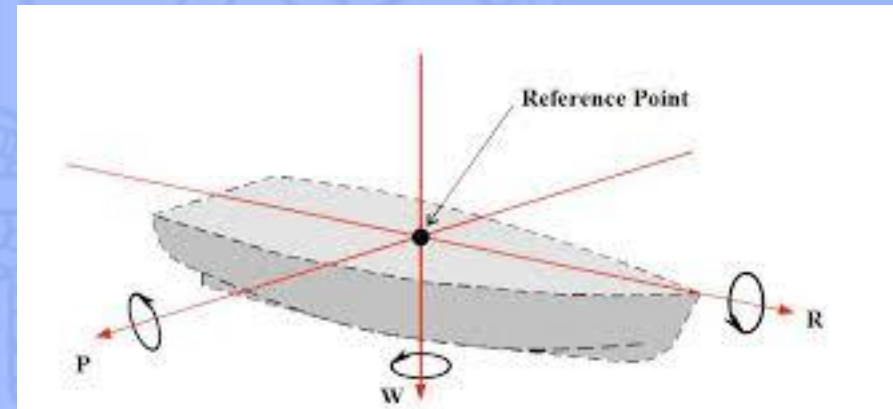


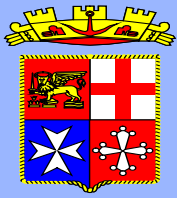
- 4D environment (X-Y-Z-t)
- REFERENCE SYSTEM (set di regole)
- REFERENCE FRAME (realizzazione MATERIALE del set di regole imposto)



Reference system

- Geometria
- Posizionamento teorico
ETRSYY; ITRSYY;
vessel reference system;
reference system
strumentale

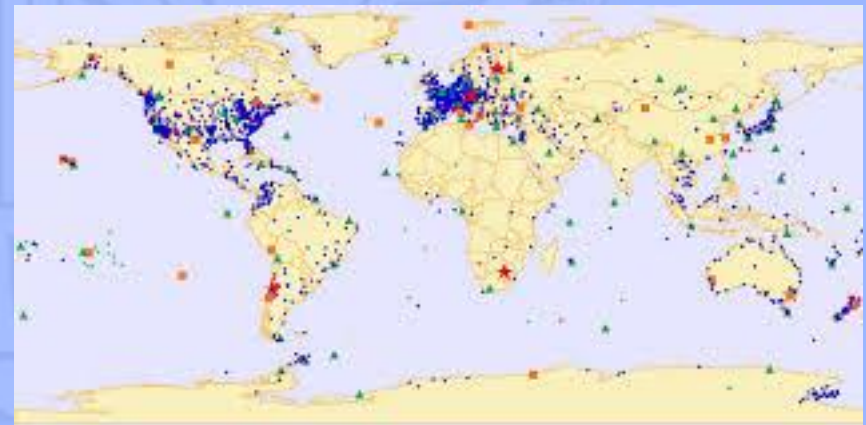


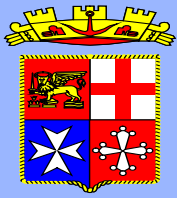


Spatial reference frame

Rete di punti materializzati

- ETRFYY
- ITRF (WGS84) YY



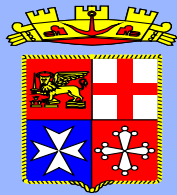


Spatial reference frame

Rete di punti materializzati

- Vessel reference frame
- Reference frame strumentale

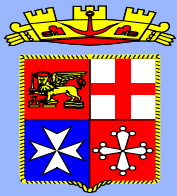




Time reference frame

- Rete di orologi
- UTC

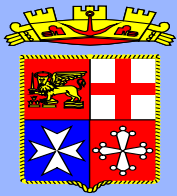




Misure idrografiche

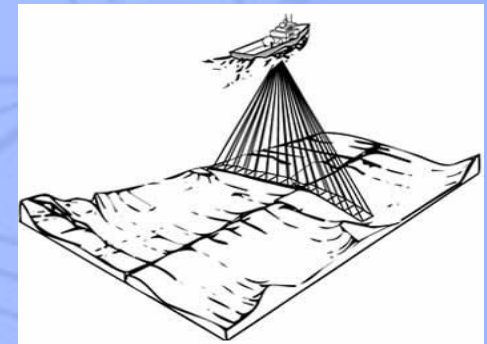
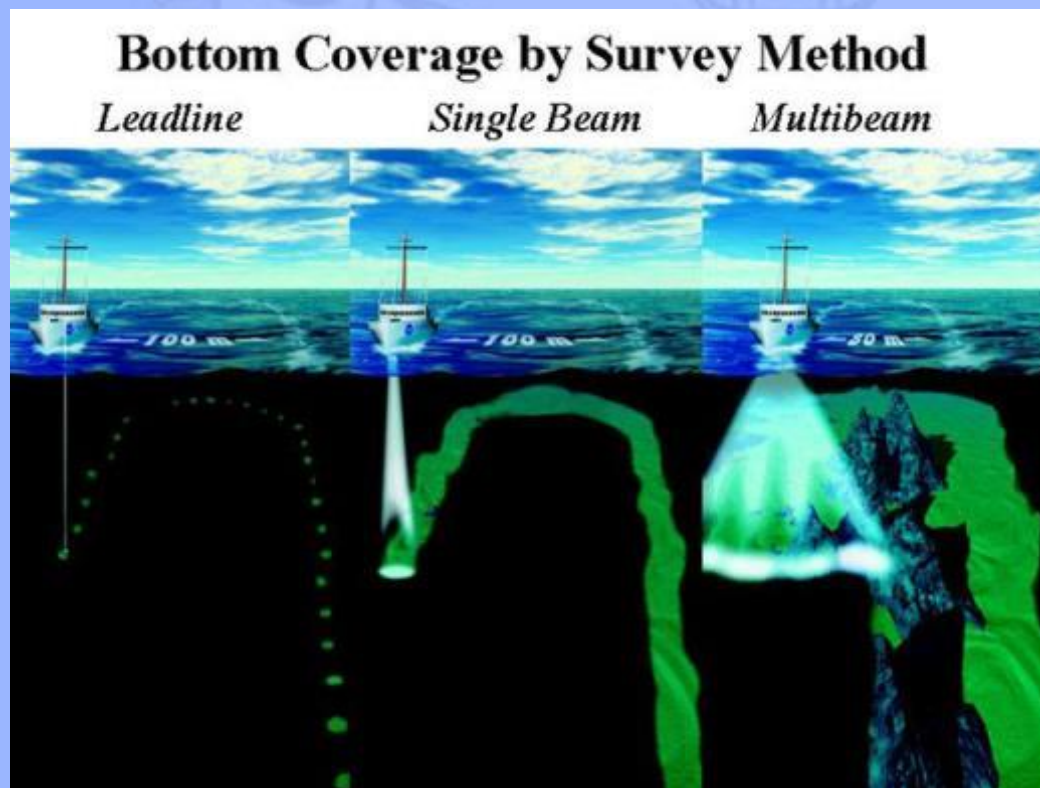
- Profondità (Z-t)
- Posizione (XYZ-t)
- Assetto (HHRP-t):
heading(gyro)-heave-roll-pitch
- Levelling (Z-t)

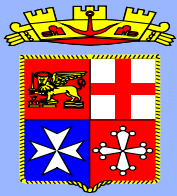
SPATIAL E TIME FRAME DI MISURA SONO
OVUNQUE



Profondità

MULTIBEAM (pointing angle-travel time)

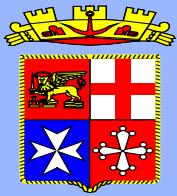




Profondità

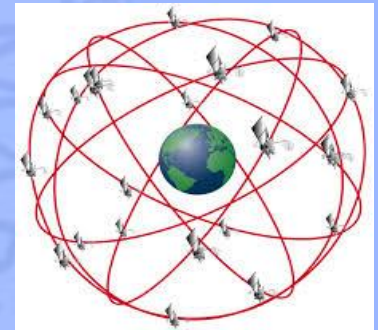
- MULTIBEAM (pointing angle-travel time)
- AUXILIARY DATA: SVP
- Output: Along-across-depth (transducer reference frame)

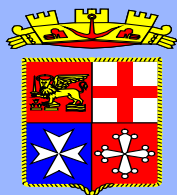




Posizione

- GNSS (Global Navigation Satellite System)
GPS + GLONASS + GALILEO (XYZ, t)
- DGNSS - RTK- PPP- PPK





Posizione

Marinestar 9200-G2 - 2016-... x

192.168.1.2

Cerca

fugro

Fugro World Wide

9200-G2
SN: 5051K72693

Receiver Status - Position

Receiver Status

- Home
- Identity
- Receiver Options
- Activity
- Position
- Position (Graph)
- Vector
- Google Earth

Satellites

Receiver Configuration

I/O Configuration

Bluetooth

MarineSTAR

Network Configuration

Security

Firmware

Help

Position:

Lat : 44° 25' 10.79463" N
Lon : 8° 55' 16.01983" E
Hgt : 166.536 [m]
Type : MarineSTAR HP+G2
Datum : ITRF08

Satellites Used:16

GPS(9): 1, 2, 3, 6, 7, 9, 17, 19, 23
GLONASS(7): 1, 2, 8, 10, 11, 18, 24

Satellites Tracked:18

GPS (9): 1, 2, 3, 6, 7, 9, 17, 19, 23
GLONASS (7): 1, 2, 8, 10, 11, 18, 24
SBAS (1): 120
MarineSTAR (1): Custom

Receiver Clock:

GPS Week: 1879
GPS Seconds: 213309
Offset: 0.36835 [msec]
Drift: -0.24172 [ppm]

Multi-System Clock Offsets:

Master Clock System: GPS
GLONASS Offset: 64.9 [ns]
GLONASS Drift: -0.023 [ns/s]

Velocity:

East : 0.00 [m/s]
North : 0.00 [m/s]
Up : -0.01 [m/s]

1-Sigma Estimates:

East : 0.216 [m]
North : 0.099 [m]
Up : 0.145 [m]
Semi Major Axis : 0.217 [m]
Semi Minor Axis : 0.095 [m]
Orientation : 82.721°

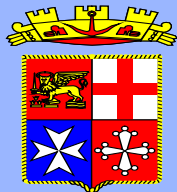
Dilutions of Precision:

PDOP : 1.2
HDOP : 0.7
VDOP : 1.0

Position Solution Detail:

Position Dimension : 3D
Position Type : MarineSTAR HP+G2
Motion Info : Roving
Augmentation : GPS+GLN
RTK Solution : N/A
RTK Init : N/A
RTK Mode : N/A
RTK Network Mode : N/A
Age of Corrections : 16.0 [Sec.]
Height Mode : Normal

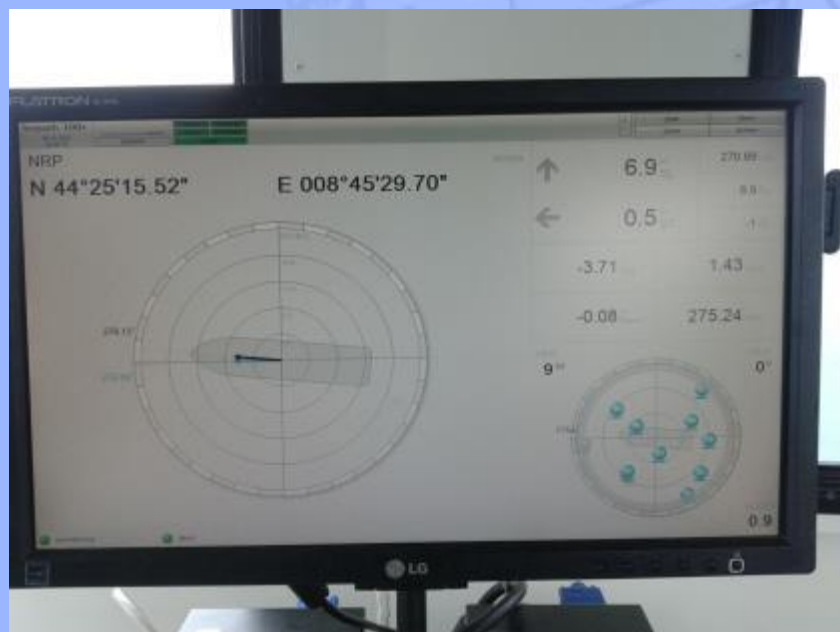
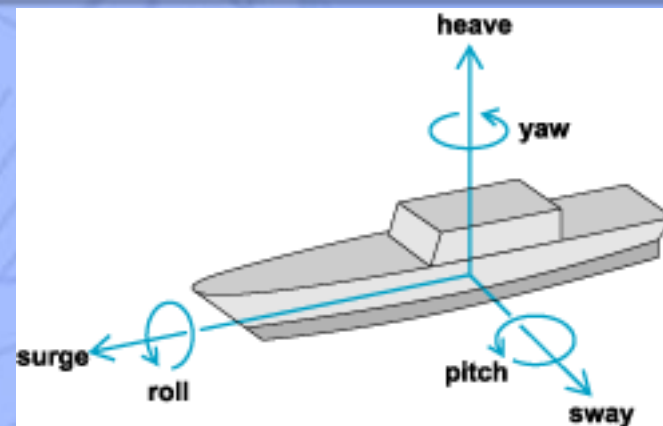
2016-01-12T11:14:52Z (UTC)

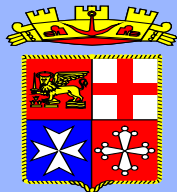


Assetto

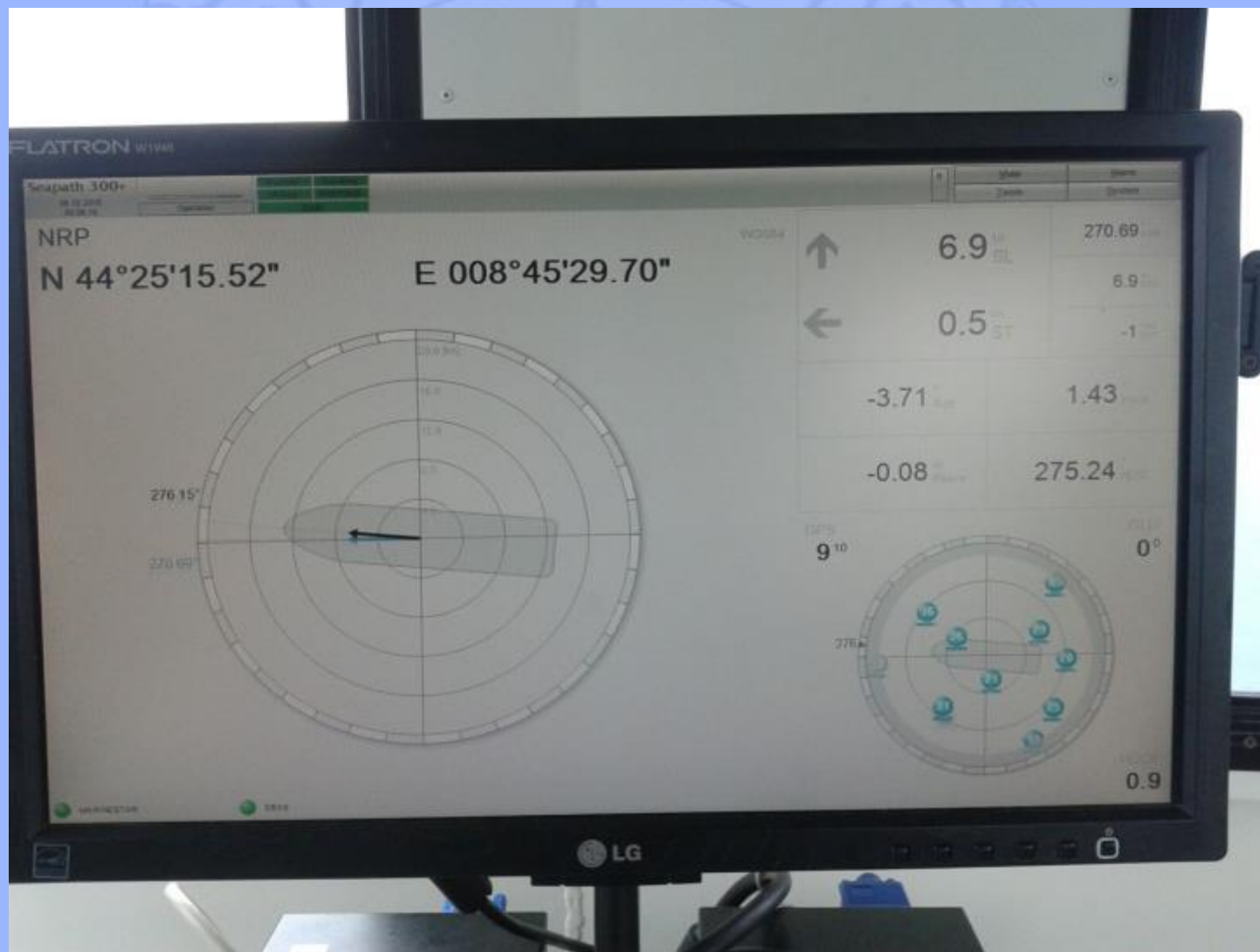
Heading, heave, roll, pitch

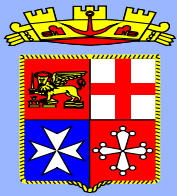
Piattaforma inerziale + GNSS





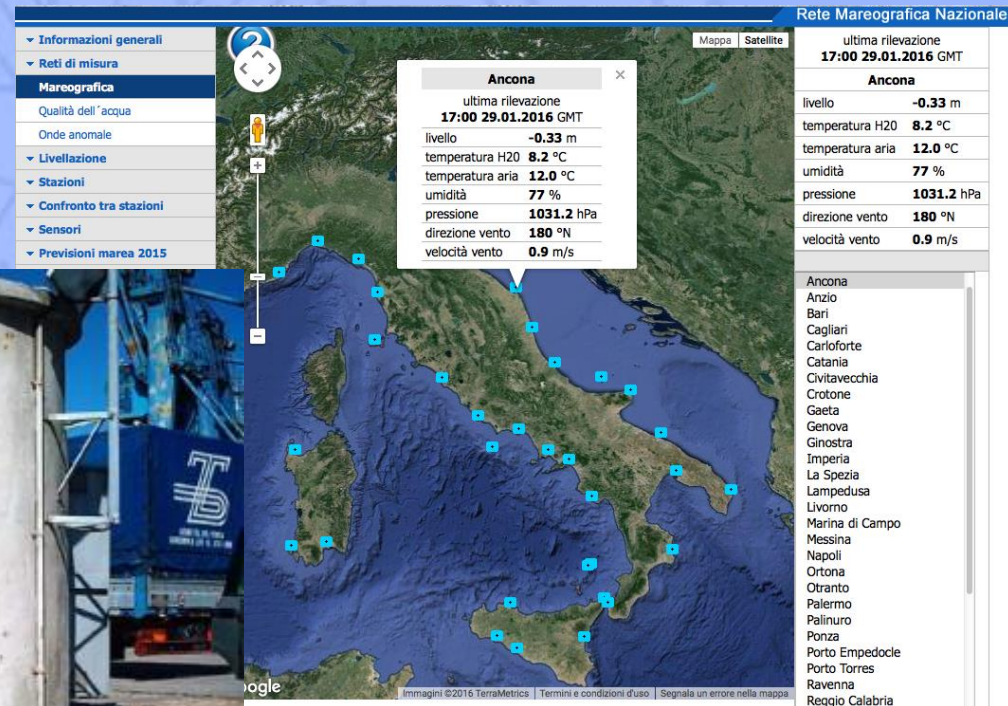
Assetto

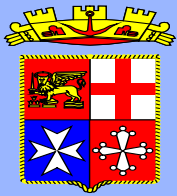




Levelling

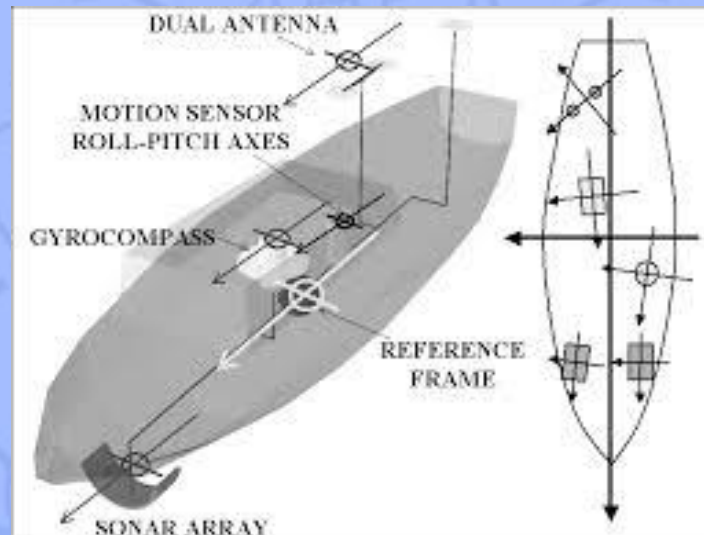
- Mareografo ISPRA (www.mareografico.it)
- Mareografo IIM

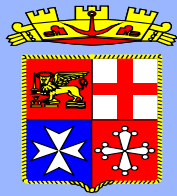




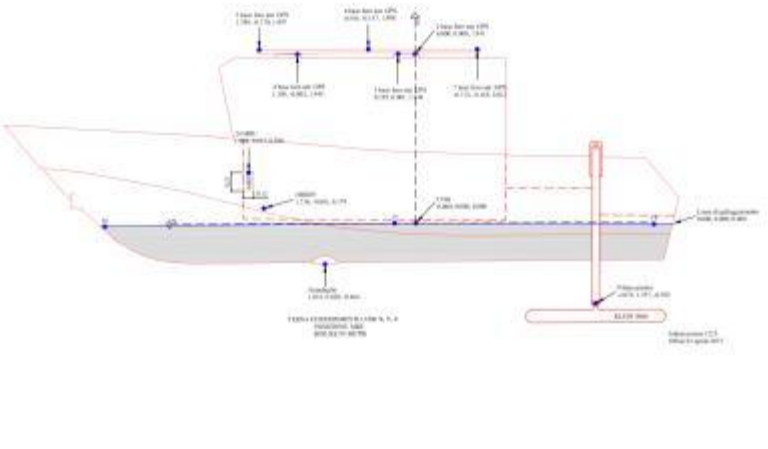
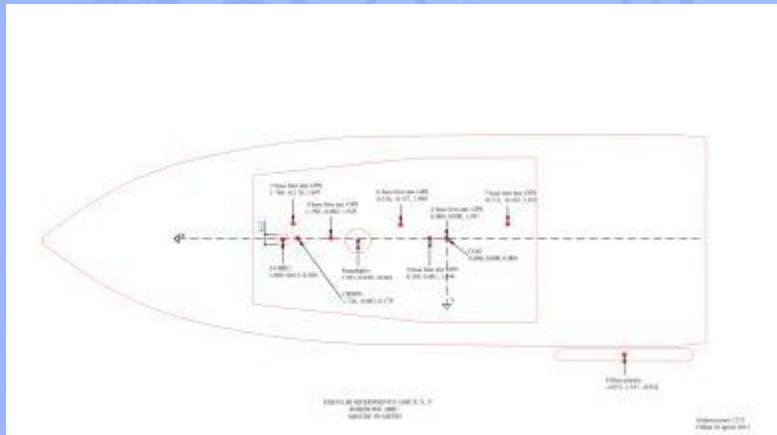
Frame di misura

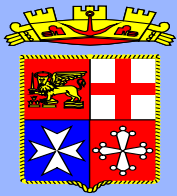
Allineamento dei reference frame strumentali al vessel reference frame (6 gradi di libertà)





Allineamento frame



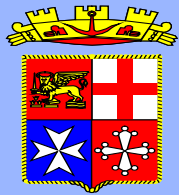


Le misure idrografiche

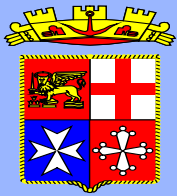


Aspetti comuni:

- Reference frame
- Strategia di misura
("reasonably attributed", BIPM)
 - Calibrazioni (bias)
 - Principi, metodi e procedure (personale, organizzazione)



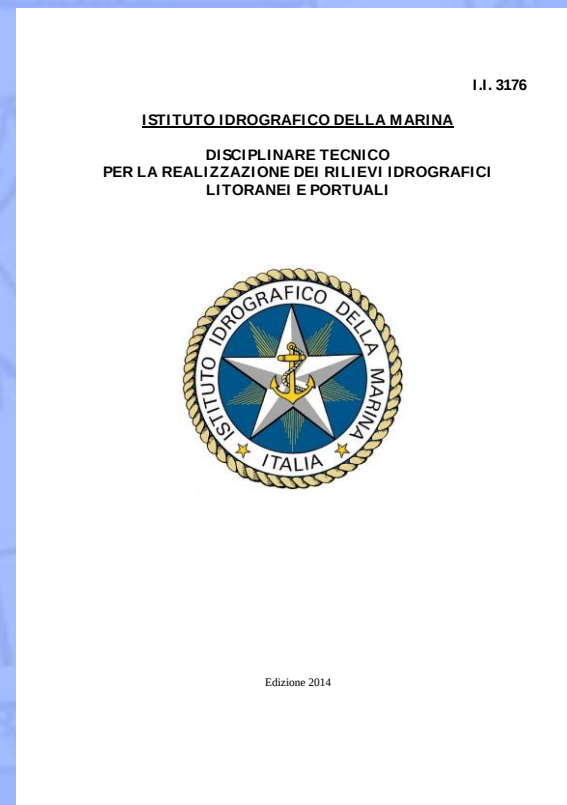
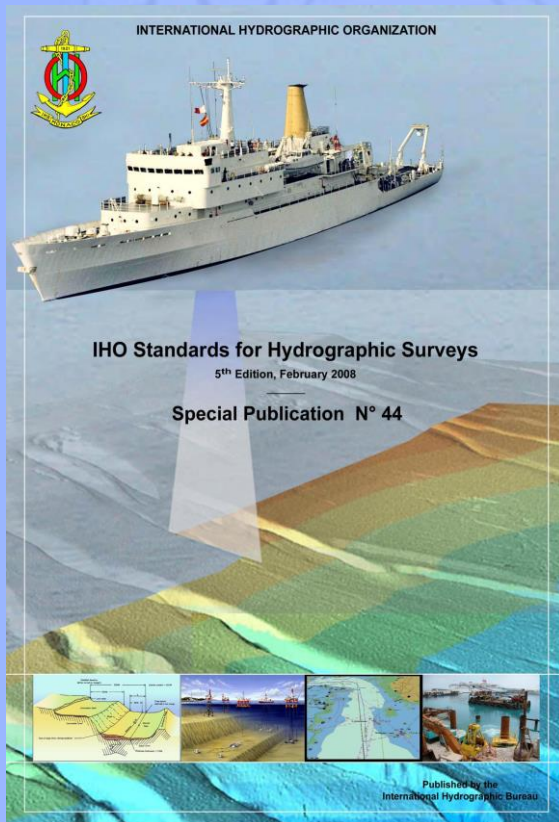
IL RILIEVO IDROGRAFICO

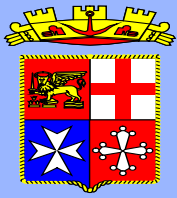


Standard idrografici



- IHO S44 ED. 2008
- Disciplinare tecnico IIM ED. 2014





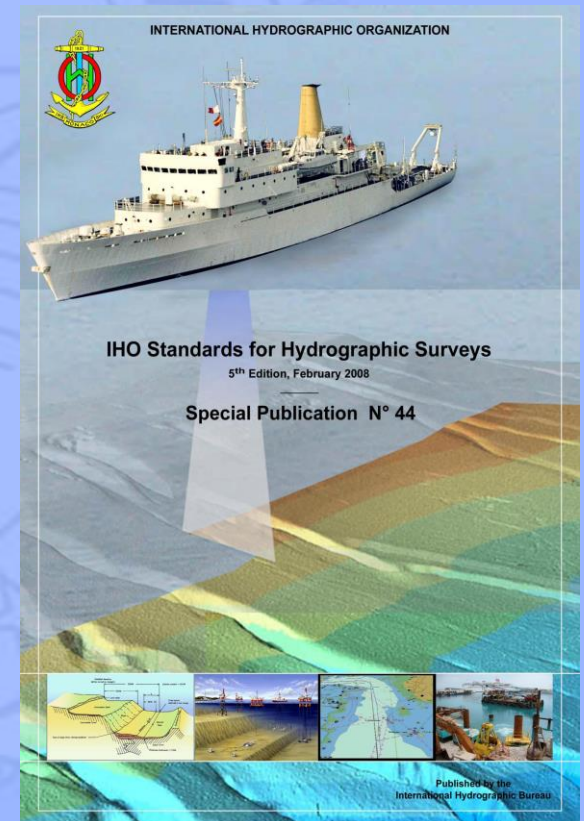
Standard idrografici internazionali

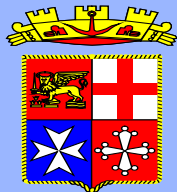


IHO S 44 – IHO Standard for Hydrographic Surveys

Aspetti chiave:

- uncertainty
- feature detection
- survey order
- minimum standards





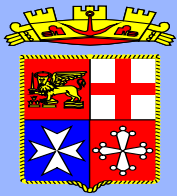
Standard idrografici internazionali



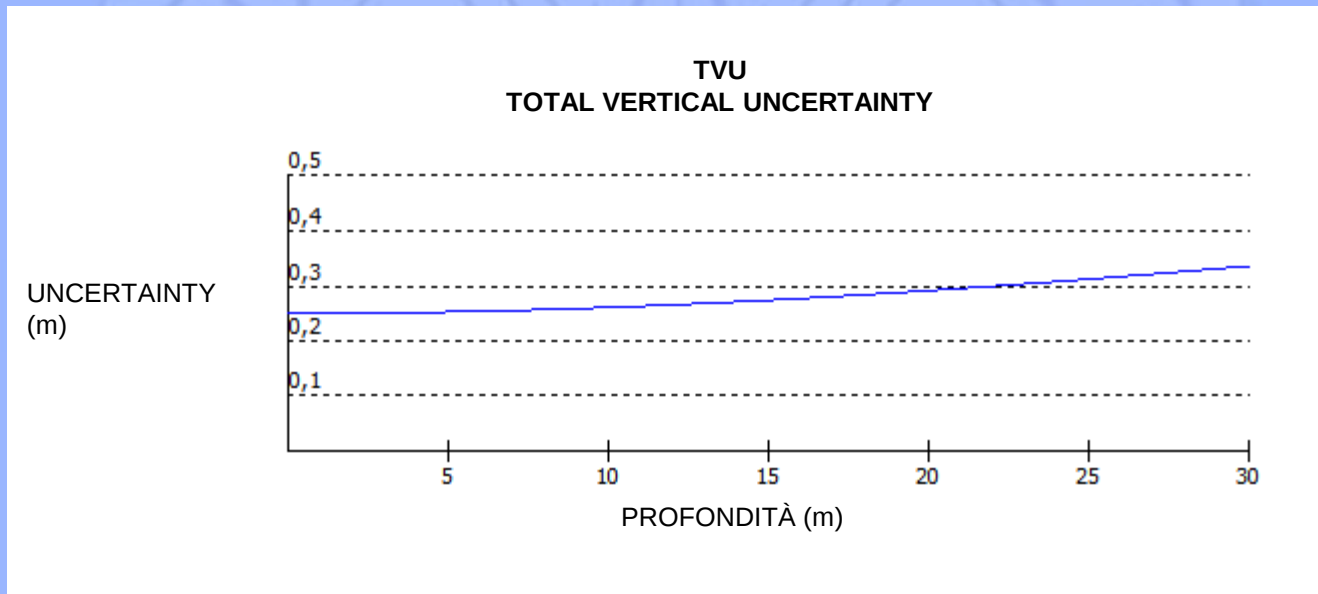
IHO STANDARDS FOR HYDROGRAPHIC SURVEYS (S-44)
5th Edition February 2008

TABLE 1
Minimum Standards for Hydrographic Surveys
(To be read in conjunction with the full text set out in this document.)

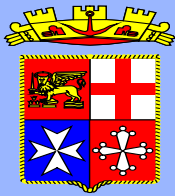
Reference	Order	Special	1a	1b	2
Chapter 1	Description of areas.	Areas where under-keel clearance is critical	Areas shallower than 100 metres where under-keel clearance is less critical but features of concern to surface shipping may exist.	Areas shallower than 100 metres where under-keel clearance is not considered to be an issue for the type of surface shipping expected to transit the area.	Areas generally deeper than 100 metres where a general description of the sea floor is considered adequate.
Chapter 2	Maximum allowable THU 95% Confidence level	2 metres	5 metres + 5% of depth	5 metres + 5% of depth	20 metres + 10% of depth
Para 3.2 and note 1	Maximum allowable TVU 95% Confidence level	a = 0.25 metre b = 0.0075	a = 0.5 metre b = 0.013	a = 0.5 metre b = 0.013	a = 1.0 metre b = 0.023
Glossary and note 2	Full Sea floor Search	Required	Required	Not required	Not required
Para 2.1 Para 3.4 Para 3.5 and note 3	Feature Detection	Cubic features > 1 metre	Cubic features > 2 metres, in depths up to 40 metres; 10% of depth beyond 40 metres	Not Applicable	Not Applicable
Para 3.6 and note 4	Recommended maximum Line Spacing	Not defined as full sea floor search is required	Not defined as full sea floor search is required	3 x average depth or 25 metres, whichever is greater For bathymetric lidar a spot spacing of 5 x 5 metres	4 x average depth
Chapter 2 and note 5	Positioning of fixed aids to navigation and topography significant to navigation. (95% Confidence level)	2 metres	2 metres	2 metres	5 metres
Chapter 2 and note 5	Positioning of the Coastline and topography less significant to navigation (95% Confidence level)	10 metres	20 metres	20 metres	20 metres
Chapter 2 and note 5	Mean position of floating aids to navigation (95% Confidence level)	10 metres	10 metres	10 metres	20 metres



Uncertainty – Special Order



THU (Total Horizontal Uncertainty) = 2 m



Disciplinare tecnico per i rilievi idrografici



ASPETTI CHIAVE

- Tracciabilità delle metodologie di rilievo
- Rappresentatività dei risultati
- Assegnazione al dato di uno standard di qualità
- Interscambiabilità dei dati raccolti e loro utilizzo nei diversi ambiti
- Integrabilità con linee guida/capitolati di rango più tecnico

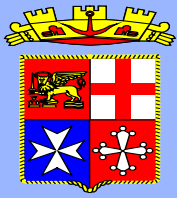
ANNESSO 1 - Elenco delle operazioni da effettuarsi in occasione di rilievi idrografici.doc

**DISCIPLINARE TECNICO
PER LA REALIZZAZIONE DEI RILIEVI IDROGRAFICI**



ANNESSO 1

Elenco delle operazioni da effettuarsi in occasione di rilievi idrografici

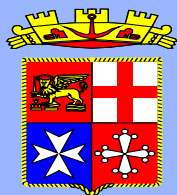


Conduzione Rilievo



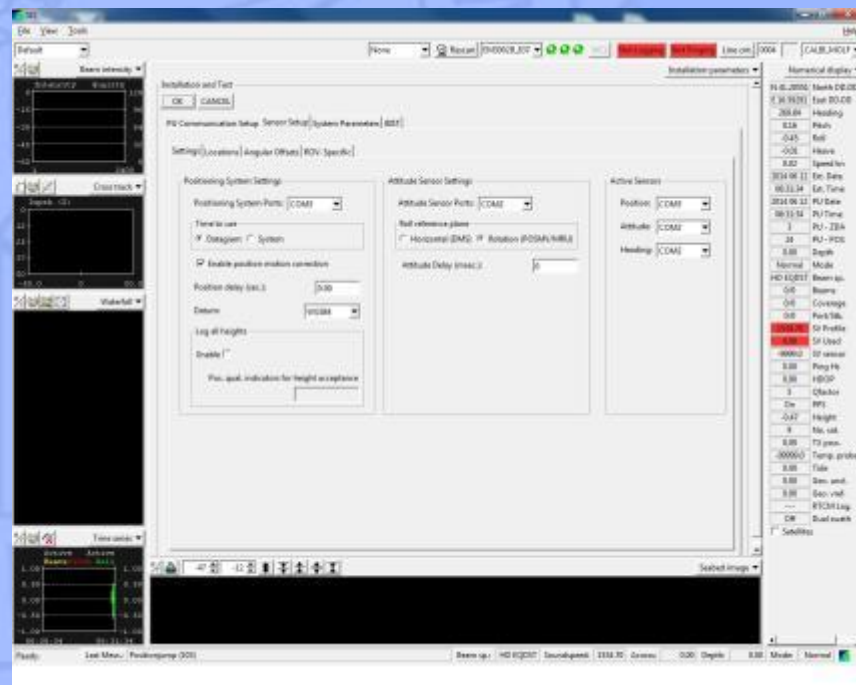
- Special order
- Scandagliamento (conduzione, sovrapposizione, velocità ecc.)

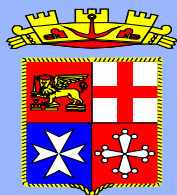




Rilievo (special order)

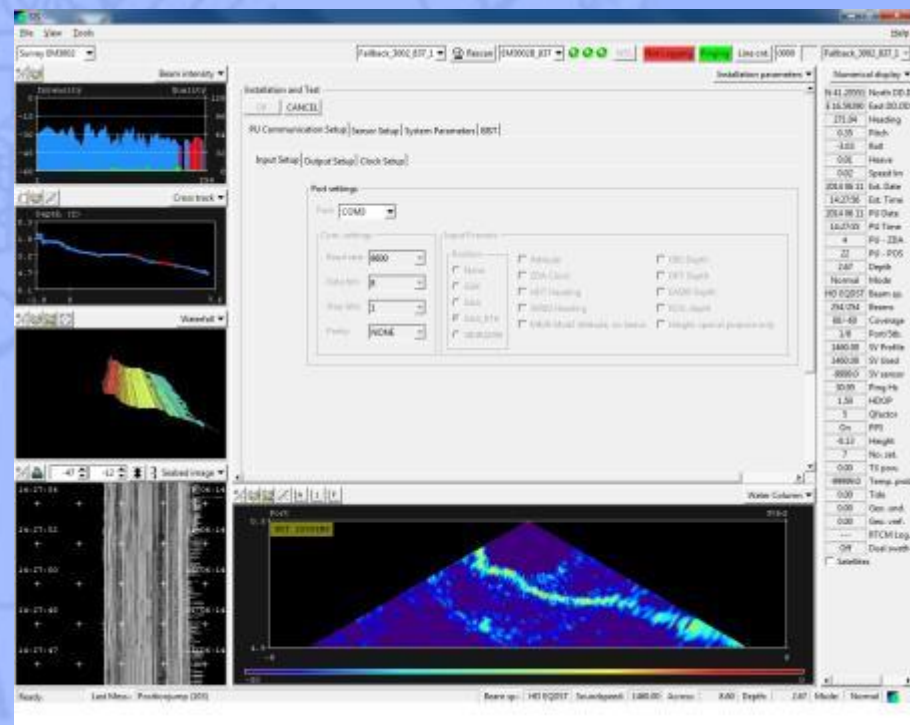
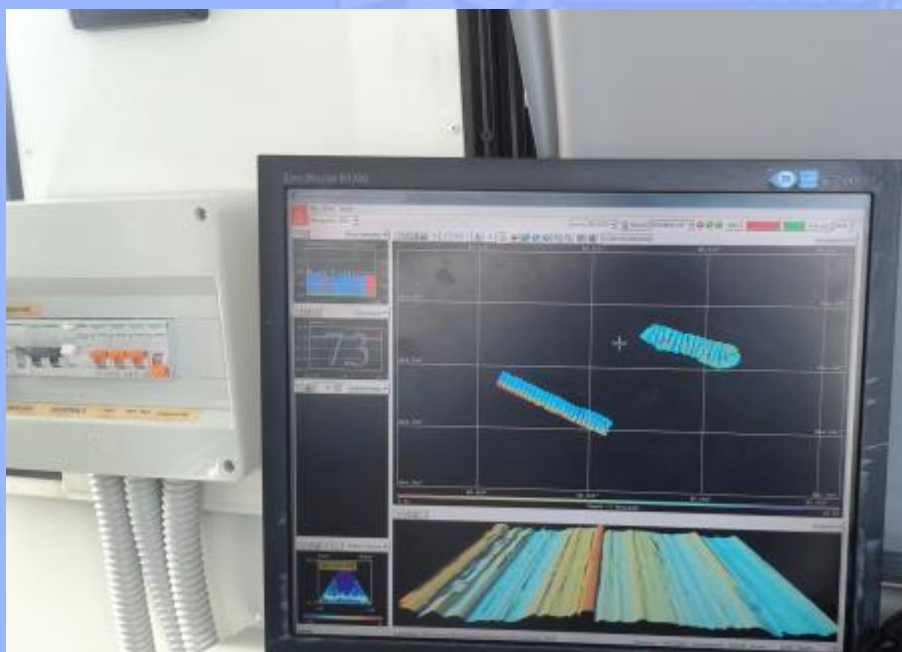
Real time monitoring

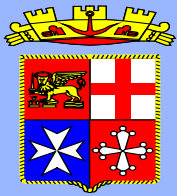




Rilievo (special order)

Real time monitoring



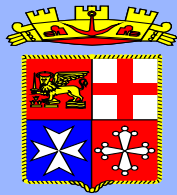


Processing

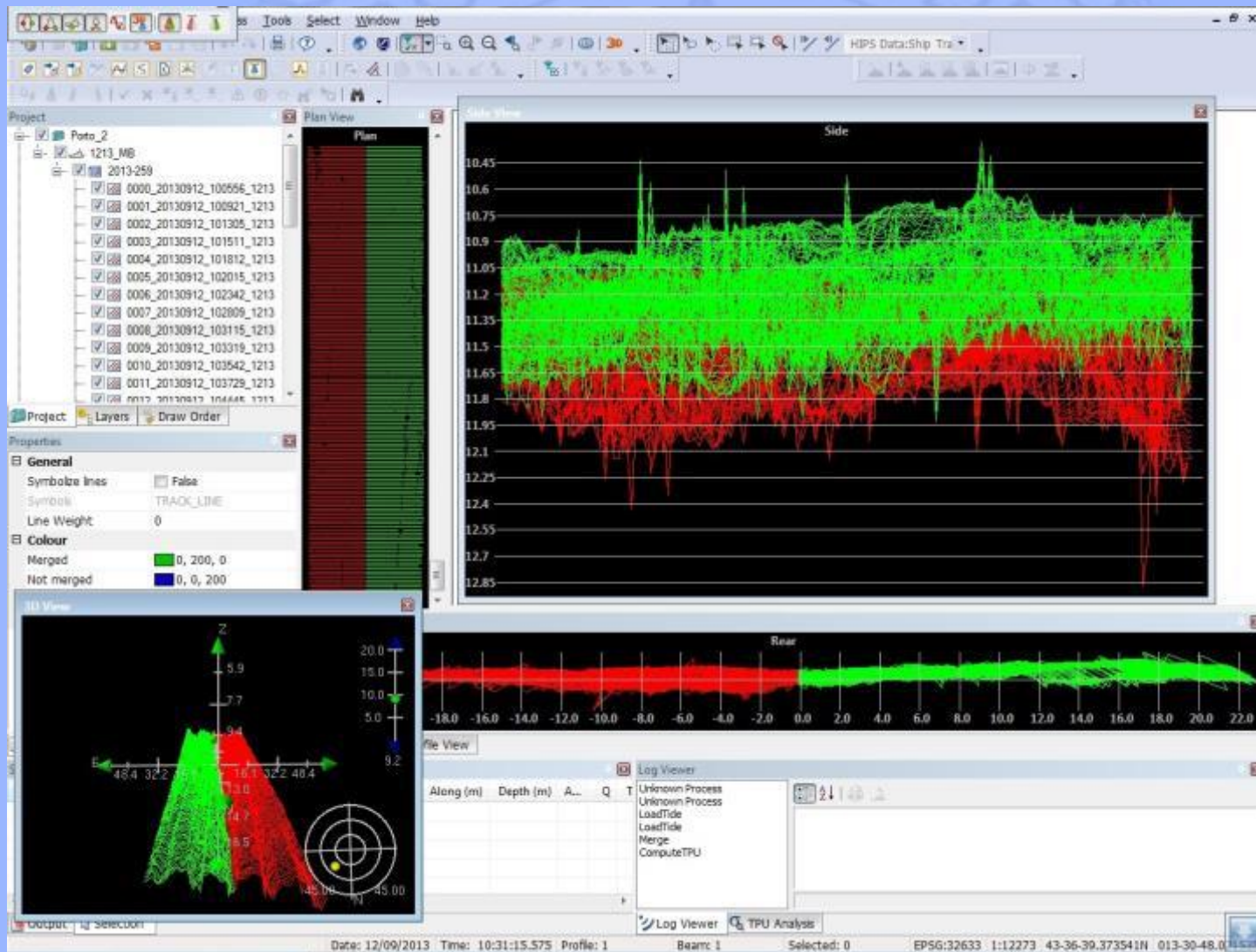
Raw data
+
Auxiliary data (svp, tide)

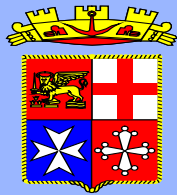


4D+uncertainty soundings point cloud

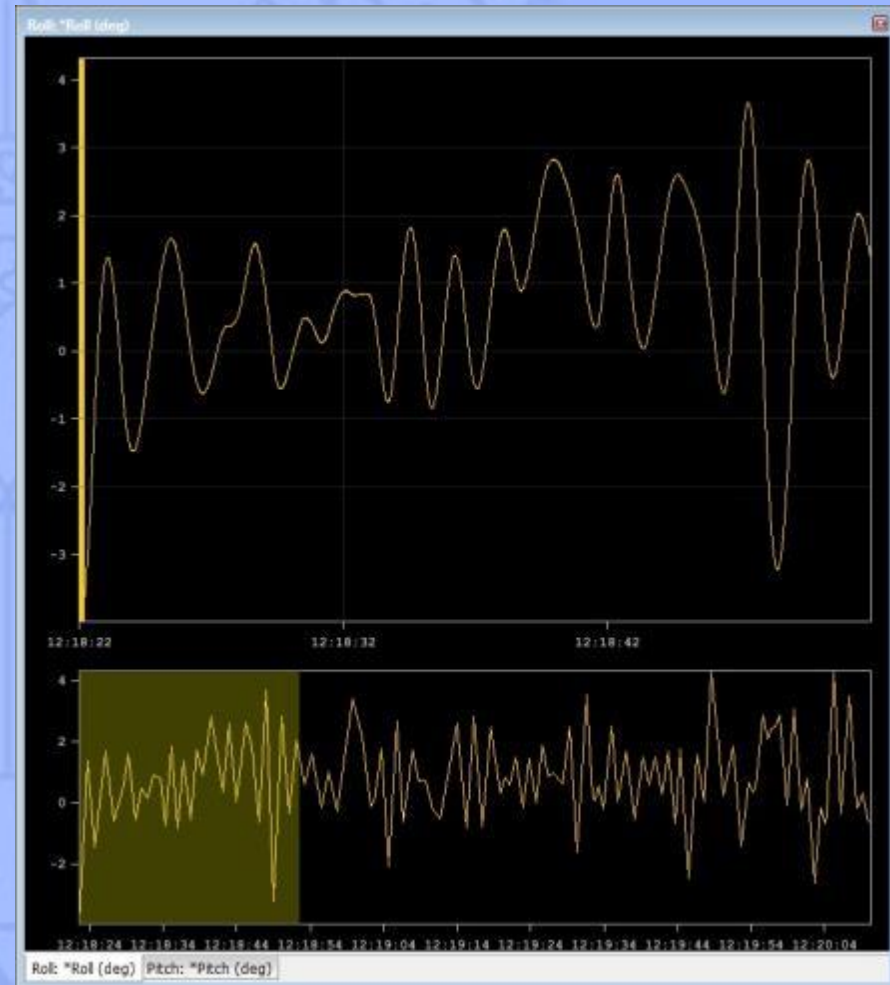
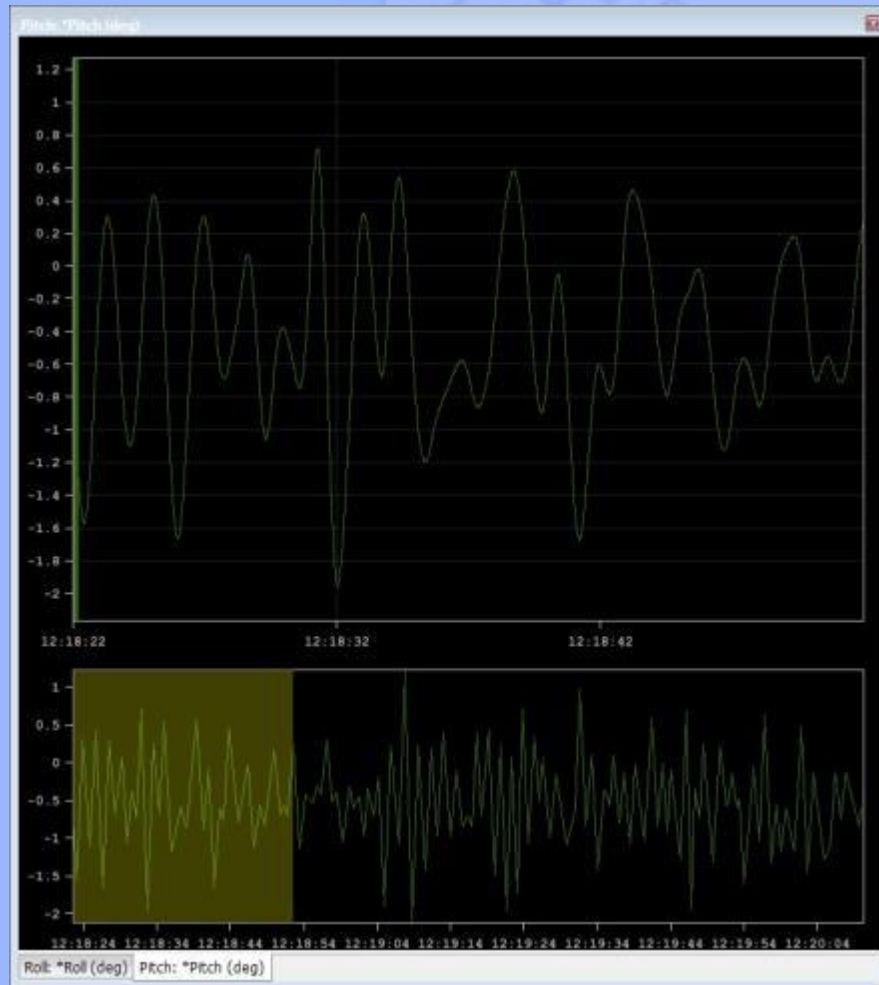


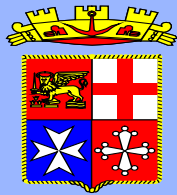
Processing



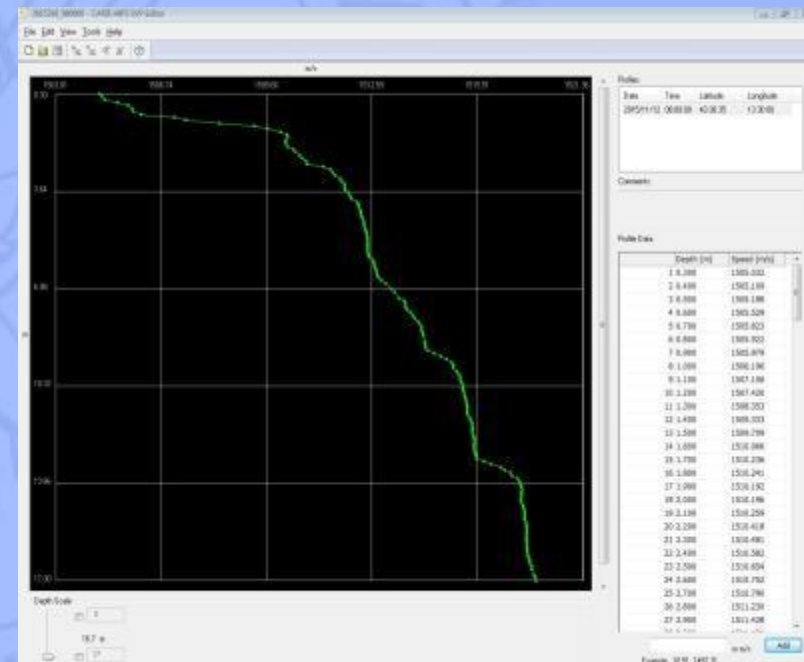
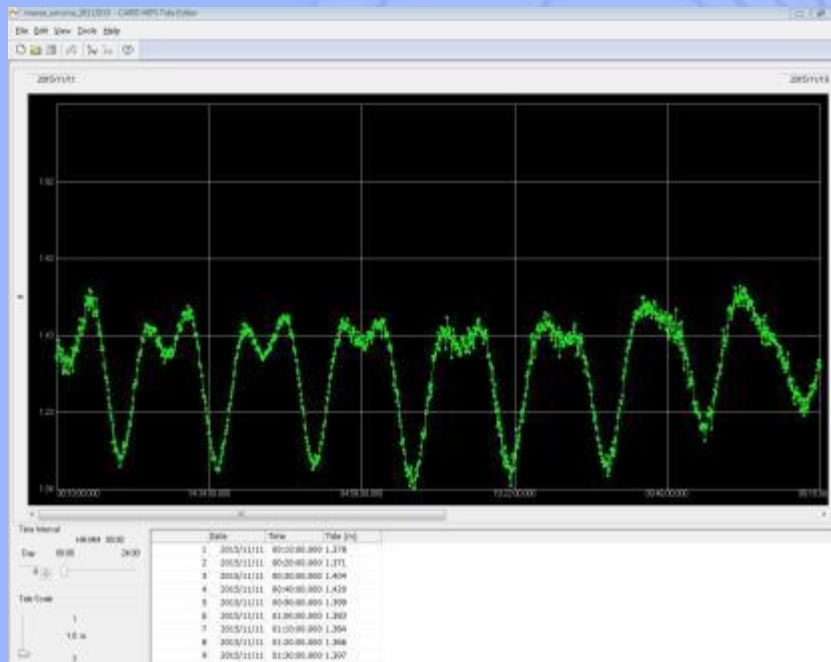


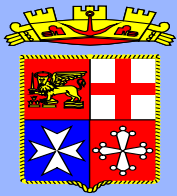
Processing





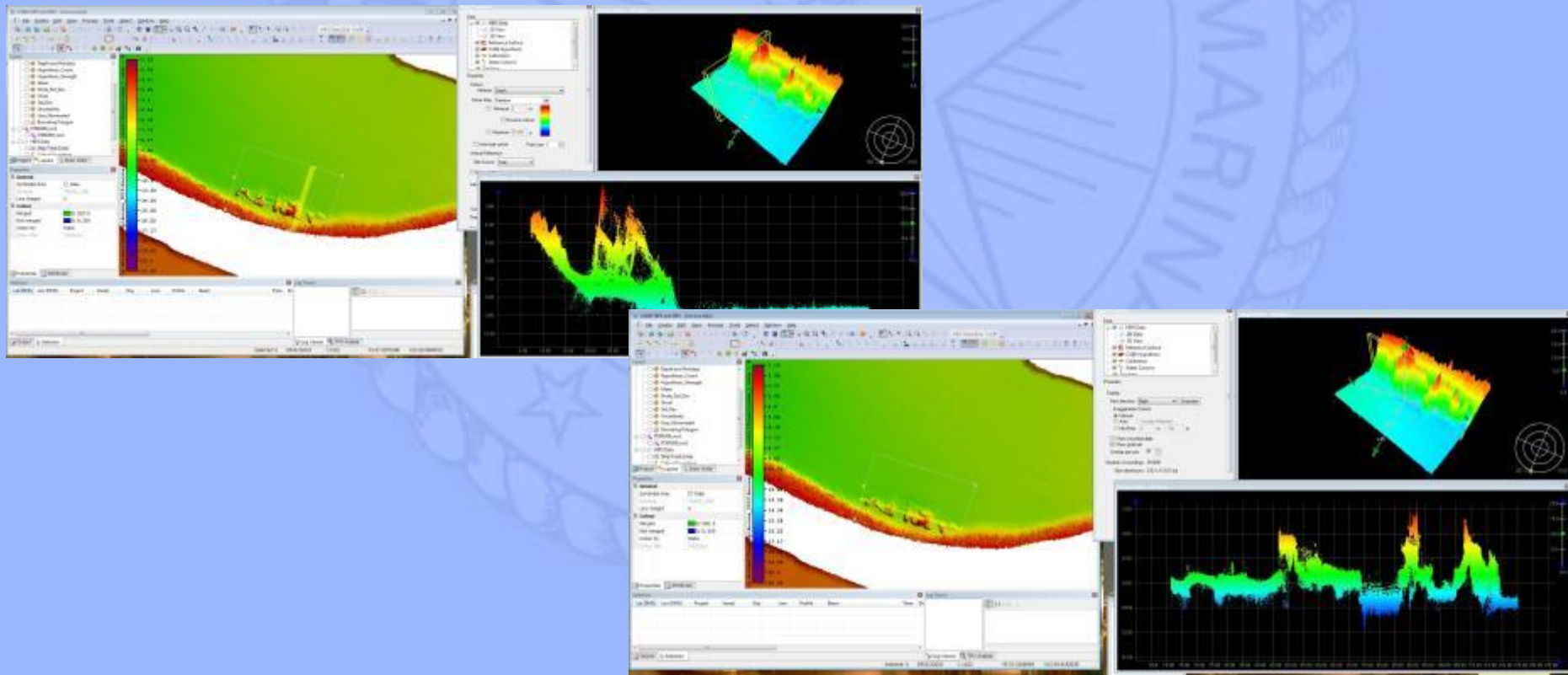
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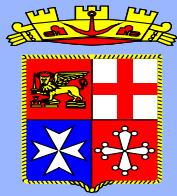




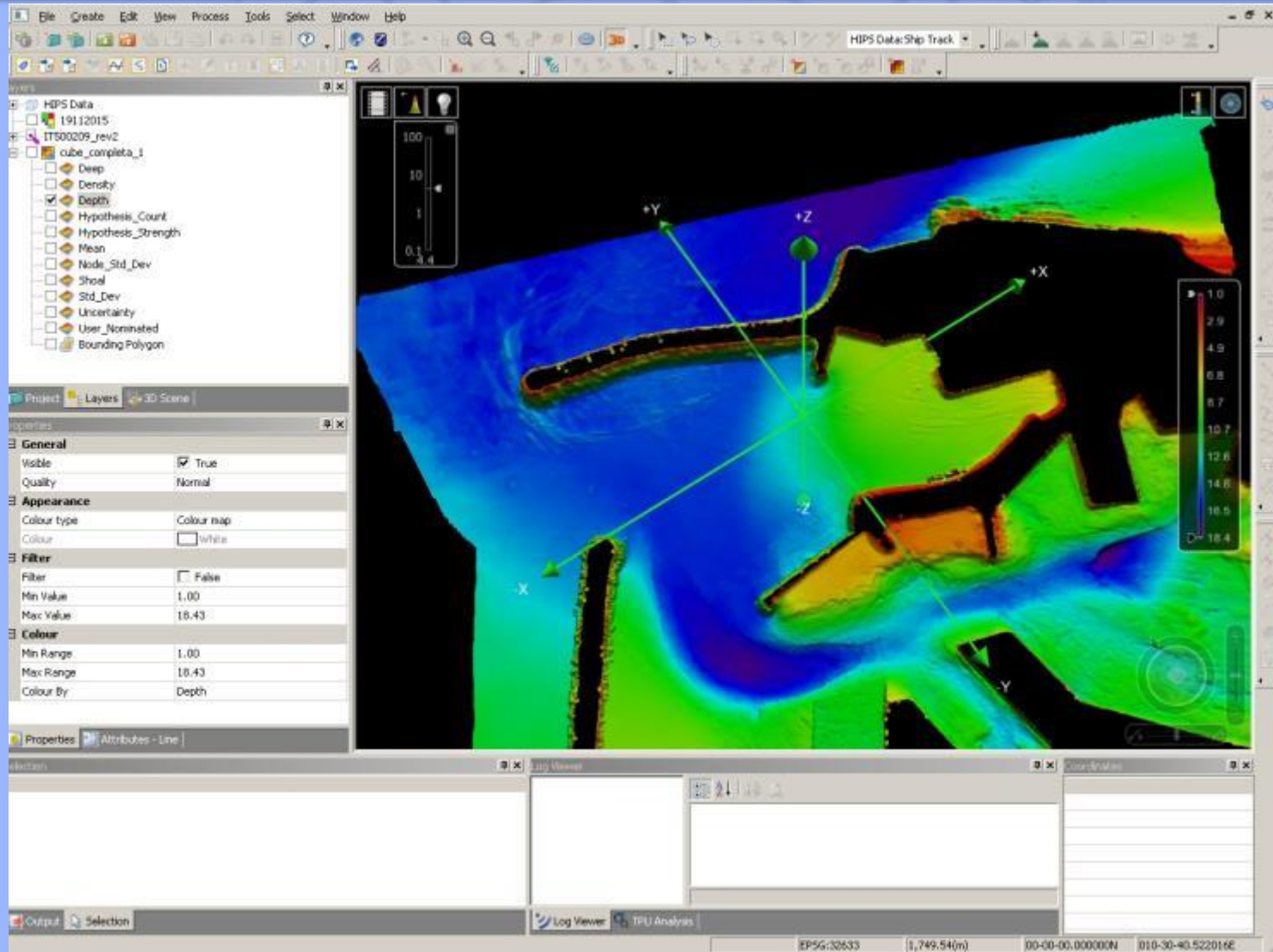
Processing

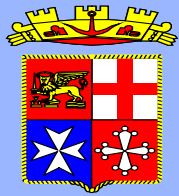
- From soundings to digital elevation model
- Gridding NODE VS SOUNDING
- CUBE (combined uncertainty and bathymetry estimator)



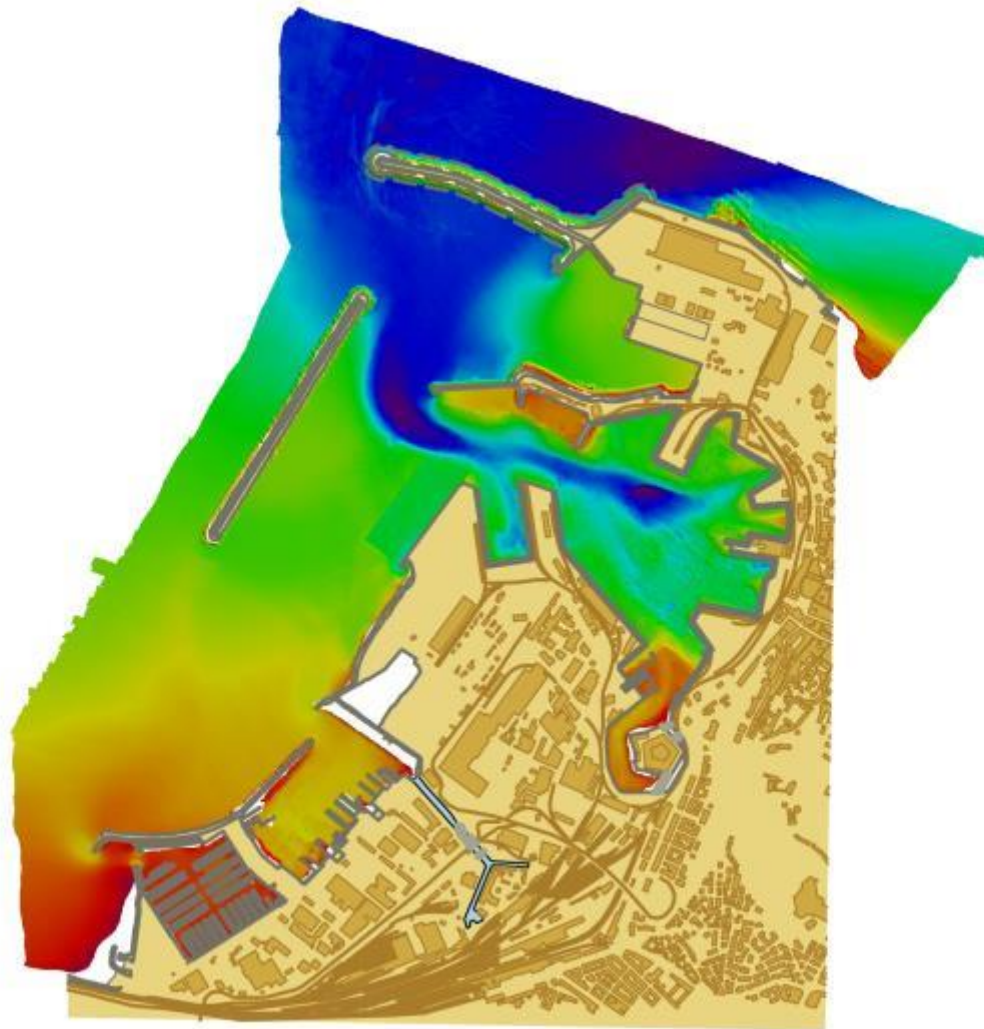


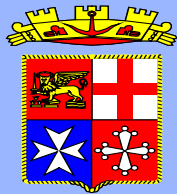
Processing



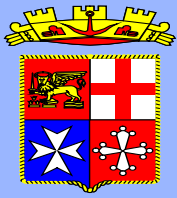


Processing





GLI OUTPUT DEL RILIEVO IDROGRAFICO



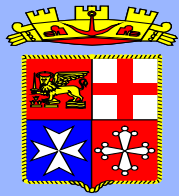
Output



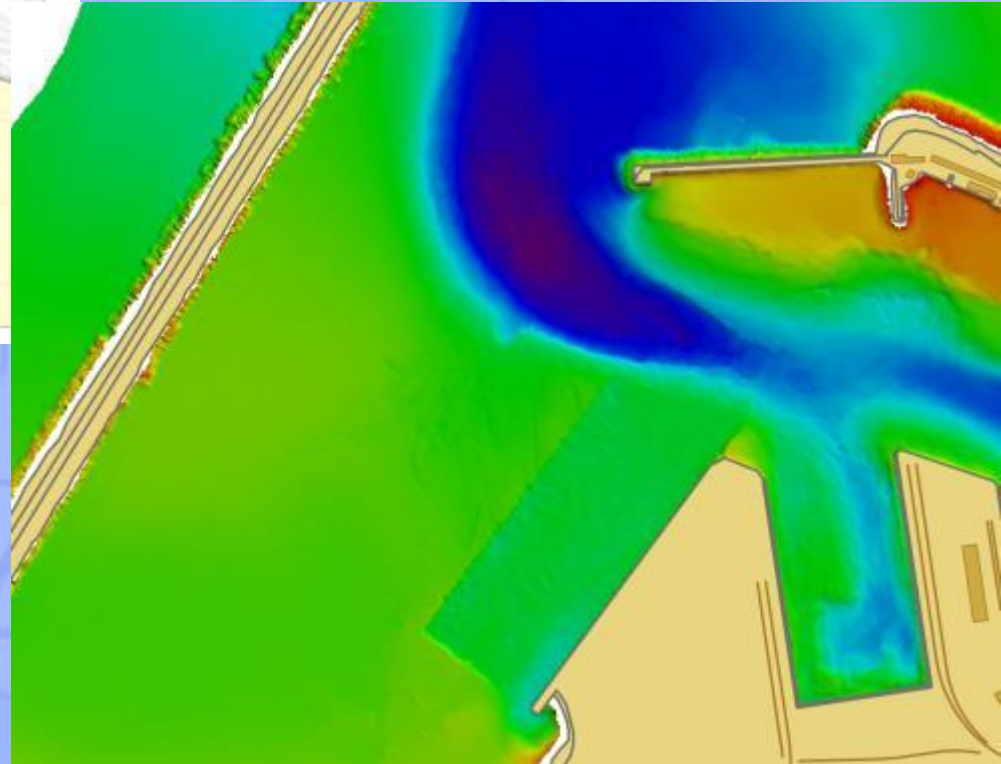
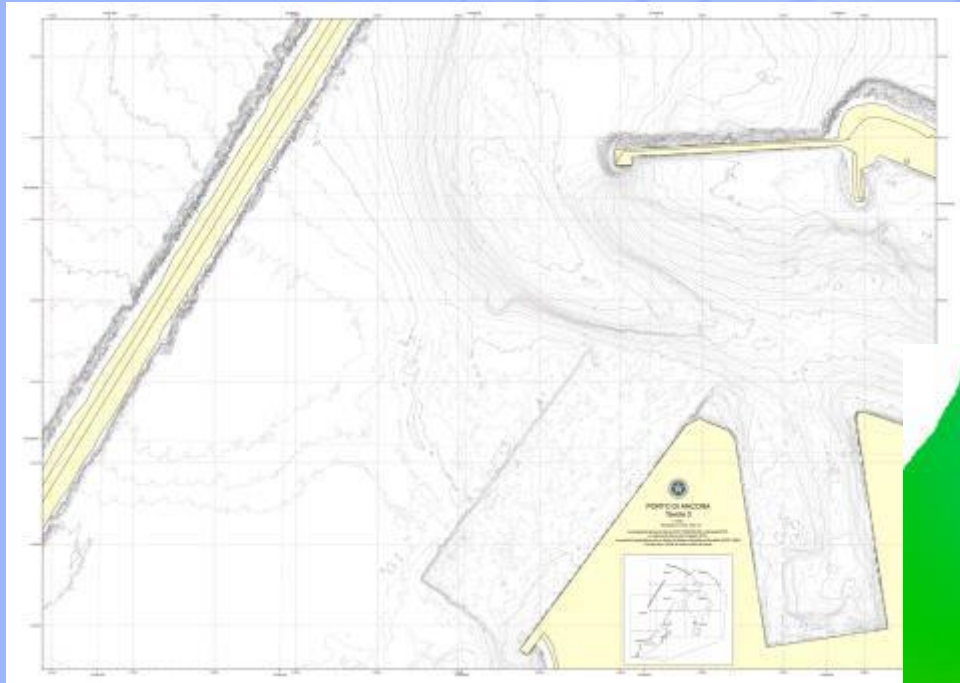
- Soundings
- Contours
- Charting
- Volume computation
- Ecc.

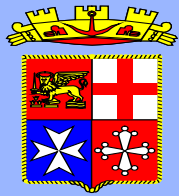
CRITERI:

- Tracciabilità (ping to chart)
- QC-QA



Output



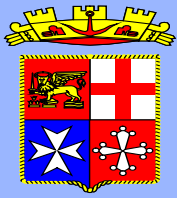


Output



Carta nautica di Ancona



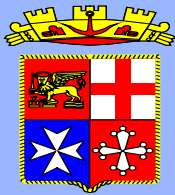


Conclusioni

- Procedure rigorose e consolidate per i rilievi idrografici ai fini della sicurezza della navigazione
- Disciplinare tecnico per la omogeneità dei dati idrografici



L'applicazione degli standard fornisce
ai dati del rilievo idrografico
rappresentatività e confrontabilità



GRAZIE PER L'ATTENZIONE!

I.I. 3176

ISTITUTO IDROGRAFICO DELLA MARINA

DISCIPLINARE TECNICO
PER LA REALIZZAZIONE DEI RILIEVI IDROGRAFICI
LITORANEI E PORTUALI



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