Unifying vertical reference surfaces in the North Sea
An overview of developments

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Introduction
Vertical references:
Marine: Terrestrial
MSL: Geoid
LAT (IHO TR!): Ellipsoid
Chart Datum: National system

Complications of these differences:
Coastal management tasks require merging;
GNSS heights cannot be used;
Reference level of hydrodynamic models problematic.
The views expressed in this presentation represent the opinion of the author. They do not necessarily coincide with any position of the Netherlands government.

Theory

- **MSL**
- **Geoid**
- **LAT**
- **CD (Chart Datum)**

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**Geoid**

- Equipotential surface = reference surface of hydrodynamic model
- Defined terrestrially

**MSL**

- Is not defined on land
- Can be observed at tide gauges
- Can be observed outside the littoral zone by radar altimetry
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NSHC-TWG work

Differences MSL-ellipsoid smaller than 0.5 m.
NSHC-TWG work
Differences LAT-ellipsoid smaller than 0.5 m.

NSHC-TWG work
Differences CD-ellipsoid smaller than 0.8 m.
NSHC-TWG work
Differences CD-ellipsoid smaller than 0.8 m.

Bringing Land And Sea Together

BLAST WP3:
developing the marine and coastal reference base
TUDelft/Deltares, University College London, Danish TU
TUDelft/Deltares contribution
Connect the geoid with the other reference surfaces
Using:
(Retracked) radar altimetry
Gravimetric data from various sources
Hydrodynamic model DCSM
Iterative model calibration

Radar altimetry
+ High-spatial resolution
+ Homogenous coverage
- Gaps along the coast
- Observes instantaneous sea surface
→ Requires hydrodynamic model to reduce heights to equipotential surface.
**DCSM**

Used operationally to forecast water levels and storm surges in the North Sea. Calculates the sea level and the depth-averaged current (2D version) on the Northwest European Continental Shelf.

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**Gravimetry**

Satellite gravimetry: low spatial resolution

Airborne/marine/terrestrial gravimetry: inhomogeneous coverage
Conclusion

NSHC-TWG surfaces neither consistent nor fully covering North Sea. BLAST provides opportunities to create common reference surfaces. This has the potential to create consistent depth model of North Sea, and it enables marine and terrestrial data merging.