## Conservatoire national des arts et métiers

# HBB340 - Water Levels and Flow

## Présentation

### Objectifs pédagogiques

#### Module Outline:

Description of the forces generating tides (static and dynamic theory).

Description of the major harmonic constituents. Identification and recognition of the different types of tides.

Explanation of the concept of amphidromic points and cotidal charts.

Definition of the different tidal levels.

Explanation of the working principles of different types of water level gauges and poles. Describe the characteristics of river, coastal and offshore water level gauges. Description of the installation and operation of water level gauges and poles

Description of the relation between flow and tides. Definition of rectilinear and rotary tidal streams and related elements. Field measurements for tidal flow and currents, including log ship, pole and current meters.

Prediction of water levels for main and secondary ports, using tide tables. Calculate water level at a particular time, and/or calculate the time at which a specific height will occur.

Application of cotidal chart information.

Compute tidal predictions using numerical models.

Description of the temporal and spatial effects on water level caused by: atmospheric pressure, wind, seiches, and precipitation. Identification of water level variations occurring in rivers and lakes and due to dam operations.

Publications & Case studies

### Compétences

#### Learning Outcomes:

Fundamental knowledge of tides, tide prediction and use of in the information obtained.

Knowledge about tidal fundamentals and their origin, the use of data and information.

## Programme

### Contenu

#### Lecture 1 – General introduction and principal water level variation

General introduction wave theory

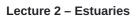
Water level variations (waves, storm surges, fresh water discharge, seiches, tsunamis, tides)

Case safety against flooding (s-plan, d-plan)

Tide generating forces

Temporal variations of tides

Classification of tides





🌞 Mis à jour le 02-04-2021

#### Code : HBB340

Unité d'enseignement de type mixte

3 crédits

Volume horaire de référence (+/-10%) : **30 heures** 

#### Responsabilité nationale :

EPN08 - Institut national des sciences et techniques de la mer (INTECHMER) / Claire MARION Connection between rivers and oceans/seas Introduction in sediment transport Introduction in river morphology Processes determining tidal propagation in estuaries Currents, salt intrusion and sediments in estuaries Case Schelde estuary Lecture 3 – Hydrometric measurements Different techniques to measure water levels Datum control, benchmarks and levelling Data transmission and validation Different techniques to measure flow velocities Measurement techniques for salinity, sediment transport Examples for the Schelde estuary Lecture 4 - ATT Introduction of Admiralty Tide Tables Practical 1 - ATT Exercises on application of ATT Lecture 5 - Harmonic analysis Introduction on harmonic analysis of tides Prediction of water levels using harmonic analysis Practical 2 - Harmonic analysis Exercise deriving harmonic components using versatile tidana Exercise predicting water levels using derived harmonic components in versatile tidana Practical 3 - Field visit Field visit of tide gauge Field visit hydrometric instruments at Flanders hydraulics Lecture 6 - Cotidal lines and models Cotidal lines Introduction on numerical models Case Water level predictions in the Schelde estuary Modalités de validation

- Contrôle continu
- Examen final