Overview of Sea Level Data Quality Control

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Principles Of Quality Control

“To ensure the data consistency within a single data set and within a collection of data sets and to ensure that the quality and errors of the data are apparent to the user who has sufficient information to assess its suitability for a task.” (Unesco, 1993)
GLOBAL SEA LEVEL OBSERVING SYSTEM (GLOSS)

MANUAL ON QUALITY CONTROL OF SEA LEVEL OBSERVATIONS

Version 1.0
Principles Of Quality Control

Quality control starts with:  
- Good maintenance  
- Good record keeping

So, keep maintenance records to hand, when quality controlling a time series.

This helps to identify whether errors are random:
- Malfunctions
- Bad readings

Or systematic:
- Change in practice
- Change in instrumentation
- Change in environment
Principles Of Quality Control

It will be immediately clear (especially with some experience) by looking at the residuals if there is:

- A spike or jump in the data due to instrumental faults
  These can be evaluated by ‘buddy checking’ and flagged, if appropriate
- Missing data
- Reference level changes
- A timing error
- And many other errors → see the IOC Manuals

These errors can then be fixed in the data set. The final data set is called the Quality Controlled Delayed-Mode data set.
Examples: Gaps
Examples: Outliers/Spikes
Examples: Datum Shift and ‘buddy checking’
Examples: Multiple problems!
What’s the problem?
What’s the problem?
What’s the problem?
What’s the problem?

**SEA LEVEL STATION MONITORING FACILITY**

- **Intro**
- **Map**
- **Station lists**
- **Station details**
- **Services**
- **GLOSS**
- **Catalog**

**Station metadata**
- **Code**: Bang
- **Country**: UK
- **Location**: Bangor
- **Status**: Operational
- **Local Contact**: National Oceanography Centre (UK)
- **QC data**: PSMSL 1856 (1994-2018)
- **Latitude**: 54.66
- **Longitude**: -5.57
- **Connection**: FTP box
- **Type of sensor**: bub (bubbler)
- **Sampling rate (min)**: 15

**Sealevel at Bangor station (offset: 0.956 m)**

- **Period**: From 2017-12-03 00:00:00 to 2017-12-10 00:00:00
- **Signals**:
  - Remove outliers
  - Remove spikes
- **Data**:
  - Relative level: signal - average over selected period
  - Absolute level: as received
  - Offset signals: relative signals + offset

Site developed and maintained by VLIZ for UNESCO/IOC

[disclaimer] [contact]
Gas supply and pressure flow control 10 ml/min.

Pressure recorder
Constriction here may damp wave effects

HAT

Sea surface

level for possible datum control extra pressure point (B gauge)

LAT

Pressure point outlet

Gauge zero

System suitable for tube lengths less than 200 m
Pressure tube internal diameter 4 mm
What's the problem?

### SEA LEVEL STATION MONITORING FACILITY

**Station metadata**

- **Code**: rothe
- **Country**: Antarctica
- **Location**: Rothera
- **Status**: Operational
- **Local Contact**: British Antarctic Survey (UK)
- **Other Contact**: National Oceanography Centre (UK)
- **GLOSS ID**: 342 [gate handbook]
- **QC data**: UHSIC 832 (2002-2011)
- **RMHSL**: 1931 (2009-2013)
- **Latitude**: -67.5667
- **Longitude**: -68.1333
- **Connection**: GTS message
- **GTS message type**: SEHS40
- **Type of sensor**: Sensor 1
- **Sampling rate (min)**: 1

### Sealevel at Rothera station (offset: 2.40775 m)

- **Graph**
  - **Dates**: Sep 13 2017 - Oct 9
  - **Period**
    - **2017-10-13**: 12h, 7 days, 30 days
  - **Signals**
    - Remove outliers
    - Remove spikes
  - **Data**
    - Relative levels: signal - average over selected period
    - Absolute levels: as received
    - Offset signals: relative signals + offset

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Rothera Radar Gauge, Antarctic Peninsula

- Data missing Oct 2017
Removal of Tides for Quality Control

Tides often dominate a sea level record, so separation of tidal and non-tidal components is important and facilitates data quality control.

Sea levels vary on different time scales and for different reasons e.g.

- Tsunamis
- Seiches
- Storm surges
- Seasonal cycle
- Mean sea level changes

But, they are sometimes masked by the tidal variations in a record.
Sometimes variations are obvious...
Others are less clear….  

An example from Port Stanley Nov-Dec 2004

Observed

Prediction
Non-tidal record shows:
1. No big storm surges (Southern Hemisphere summer)
2. A lot of high-frequency noise of a few cm due to harbour seiches
3. On 27 December arrival of the Sumatra tsunami (15 cm or so)

⇒ None of this is evident from looking at the total observed record.
Removal of Tides from a record is good because....

1. The *separation* of the sea level record into tidal and non-tidal components *is needed* to produce tide tables or tidal predictions

2. The *non-tidal signals* (seiches, tsunamis) become clearly *identified*

3. Tidal analysis *facilitates quality control*, allowing *errors* in the sea level time series to be *identified*
Timing Errors
Data Spikes
Summary

Quality control is needed……..

“To ensure the data consistency within a single data set and within a collection of data sets and to ensure that the quality and errors of the data are apparent to the user who has sufficient information to assess its suitability for a task.” (Unesco, 1993)

• Good quality control requires good record keeping
• Tidal analysis allows errors and non-tidal variations to be clearly identified
Thank you

For more information on the Commonwealth Marine Economies Programme, please contact us via:

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