Module 6

Spatial Data Quality in Environmental Marine Characterization

As a map maker need to make decisions in the map making processes

Fitness for purpose, you cannot have a data set with an overall lower quality, you should still make a decision, need to decide if it is worth it to just view some of the surface or if you need details

In marine habitat mapping it is critical to assess the data quality

Error- the difference or disagreement between a measure and the true or accepted values (this can never be known)

Uncertainty- estimate of the limits to which we can expect an error to go, at ta species level of confidence, interval around a measure valued such that any repetition of the measurement will produce a new result that lies within this interval, called a confidence interval

Confidence intervals, in stats we can predict under specific condition how often our measurement uncertainties are likely to exceed a certain value

These values define a confidence region and the likelihood that our measurements lie inside this confidence regions referred to as the confidence level

Errors:

Systematic error- associated with a particular measure instrument of experimental techniques consistent error, can be identified though calibration

Random error- caused by lack of observer or instrument precision, non-consistent, can be account for by taking repeated measurements and taking the mean of those measurements

Calibration error- part of the instruments, indicates how well the instrument has been made, is provided by the manufacturers

Artefacts- common in bathymetric data but rarely acknowledged, usually within error specifications

Motion recording, might not be true and might not record a moving object correctly

Time synchronization, might not record an object at the right time, lag in time, a delay in time

Features that run across survey lines can be misaligned

Atlantis?? The single beam echo sounders, and they did a survey pattern with lines to validate, google earth will interpolate data and then the data quality check that goes into it, it might not be true

When you apply morphology with the different attributes you can start to see some objects in the image, some attributes will show a better picture of the sea floor

Error propagation and artefacts

With a lot of artefacts the computer will classify the attributes incorrectly

Systematic errors:

Mistake comes into play with when they quantify incorrect classification

When there is no error, there is a higher quality map, but not always true, sometimes more error meant higher accuracy, because it an ecological component, some few small errors can have a big impact on maps

i.e scallops, artefacts increase rugosity error, ground truthing showed that the high error rugosity showed that scallops were actually there

Random errors:

Most likely people will be able to find random errors, can remove outliers

Mistakes, blunders, data spikes

Can be caused by human error, faulty equipment, natural source

Assumed to be rare, compared to artefacts, where artefacts are harder to determine if they are errors

Uncertainty-

Uncertainty can be quantified

-Total propagated uncertainty (TPU)

-Total horizontal uncertainty (THU)

-Total vertical uncertainty (TVU)

These tools compute 3D uncertainties for every depths data point, using theoretical or empirical models for sensor errors

This is a huge improvement over the former approach, which was to assign **one** uncertainty value for an entire survey

Accuracy and precision

In the middle and all hitting the middle of the bullseyes

Is we all hit the same place, poor accuracy good precision

If we hit all over the place, poor accuracy and poor precision

Getting measurements we are looking for but not consistent, good accuracy and poor precision

Terminology

The international organization for standardization discourages the use of accuracy, precision, and certainty because they have diff meanings are too ambiguous

Uncertainty to them are:

-Depth measurements uncertainty

-Bathymetric model uncertainty

-Target detection uncertainty

-Spatial reference uncertainty for depths

-Spatial reference uncertainty for navigational airs

In Marine Habitat mapping-

No measurement is exact, and while every measurements contains uncertainty, there is no way to know the exact amount of it present in a measurement because we can never know the true value of the measurement

Challenging- all measured values should be reported with a assessment of the uncertainty

To be fit-for-use data must have a smaller uncertainty than it’s spatial scale

Positioning about the water, with satellite data, easy to get an accurate position, can georeferenced it, with an airplane easy to determine the GPS, underwater we can’t communicate to GPS satellites we can only get the GPS information is to connect to a supporting vessel, and then it’s somewhat accurate, and then the vessel communicates with the ROV

The spatial resolution of data should be larger than the positional accuracy

There is a trade off between accuracy and resolution

These measures should be provided as metadata with the data (look for them if you

have not collected the data yourself)

The processing workflows also introduce uncertainty (see concepts of maps of ignorance, ensemble modelling)