3.11 Bathymetry grid development

Following the pre-processing and data cleaning phase for the source data, the next grid development phase was conducted using Generic Mapping Tools (GMT) software (Wessel and Smith, 1991), following the methodology used in Becker et al. (2009). GMT is a Unix-based gridding and plotting software package that can deal with large datasets. This grid development phase is a 'repair and replace' method that is widely used for aggregating source bathymetry data for regional-scale and global-scale grids, e.g. SRTM30_PLUS (http://topex.ucsd.edu/WWW_html/srtm30_plus.html), and also used in Google Earth topography.

The cleaned xyz source data files from each of the multibeam, singlebeam, ENCs, ALB, ITEM DEM, SDB and coastline datasets were first decimated using GMT blockmedian into individual xyz data files representing single node points at 0.00015° (~15 m) resolution (Figure 11). The decimated data files were then concatenated into one large xyz file. Next, GMT blockmedian was conducted on the single large file to decimate the combined data to 0.0003° (~30 m) resolution in order to produce one valid depth point for each pixel location to be used in the interpolated bathymetry grid at that same 0.0003° resolution.

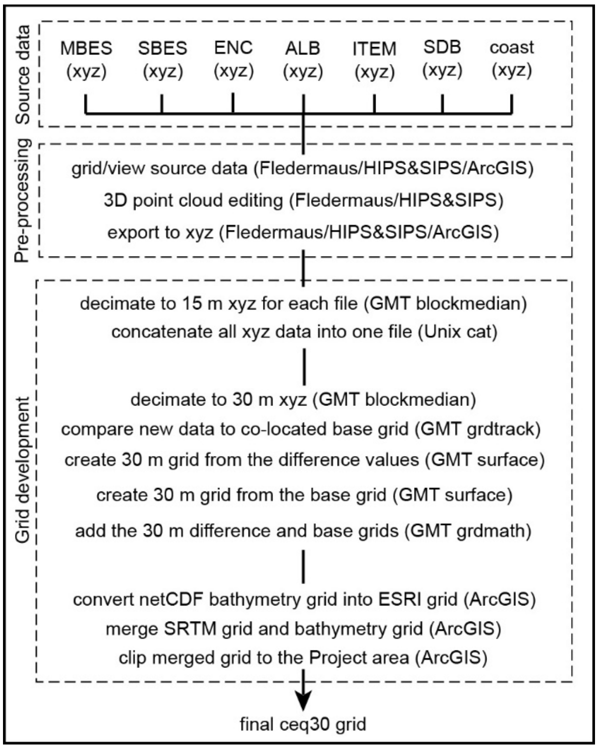

Figure 11 Processing scheme used to develop the ceq30 bathymetry grid.

The 0.0003° blockmedian values from the combined file were then compared with the co-located depths from an underlying base grid, in this case the AusBathyTopo grid (Whiteway, 2009). This base grid has a pixel size of 0.0025° (~250 m). The purpose of using the base grid was firstly as a comparison to flag any new source data that may be greatly in error and thus be rejected, and secondly to provide underlying bathymetry data for grid pixels that lack coverage by the new source bathymetry data. The 'repair and replace' method is effectively repairing the AusBathyTopo base grid and replacing pixels with newer, higher-resolution data. GMT grdtrack was used to find the comparative depth differences between the co-located new data and the underlying base data.

A grid surface was made with GMT surface using those difference values between the co-located new data and the base data. GMT surface was also used to resample the AusBathyTopo base grid at the higher-resolution of 0.0003°. The difference grid and the resampled base grid were then added together with GMT grdmath. The output of this process was a network Common Data Form (netCDF) file that was converted into an ESRI raster grid using ArcGIS, which represents the ~30 m gridded bathymetry data. Next, the 0.0003° SRTM land elevation grid was merged with the bathymetry grid using ArcGIS, and lastly clipped to the Project area to produce the final ceq30 grid.

Grid development used Generic Mapping Tools (GMT) as a 'repair and replace' method to aggregate source data and interpolate the ceq30 grid.

The Geoscience Australia-supplied AusBathyTopo grid was used as the base grid for 'repair and replace' with the new source data.

The SRTM land elevation grid was merged with the interpolated bathymetry grid, then clipped to the Project area to produce the final ceq30 grid.

3.12 Total Vertical Uncertainty grid development

The accompanying Total Vertical Uncertainty (TVU) grid is useful to show the maximum allowable uncertainty at the 95% confidence level and with a similar 0.0003° pixel size. Users can thus identify the calculated TVU in metres for co-located bathymetry values on the new ceq30 grid, which have taken into account the TVUs of the source data. The TVU grid development follows closely the steps taken for the bathymetry grid development but with an extra process (Figure 12). GMT gmtmath recalculates source xyz data files using the TVU IHO S44 categories or other calculations stated for each source data type prior to TVU grid development, i.e. z bathymetry values of the xyz files were recalculated as TVU values.

The TVU source data were decimated using GMT blockmedian into individual xyz data files representing single node points at 0.00015° resolution. The decimated data files were then concatenated into one large xyz file. GMT blockmedian was conducted on the single large file to decimate the combined data to 0.0003° resolution, producing one valid TVU point for each pixel to be used in the interpolated TVU grid. The process required a TVU base grid to compare with the new TVU source data; hence, the AusBathyTopo grid was recalculated as a TVU grid equivalent to IHO S44 Order 2. In effect, the process repairs and replaces the AusBathyTopo TVU grid with TVU values from the newer, high-resolution source data.

GMT grdtrack was used to find the comparative differences between the co-located new TVU data and the underlying TVU base grid. A grid surface was made with GMT surface using those difference values between the co-located new data and the base data. GMT surface was used to resample the TVU base grid at a higher-resolution of 0.0003°. The difference grid and the resampled TVU base grid were added together with GMT grdmath. The netCDF TVU output was then converted into an ESRI raster grid using ArcGIS. The