Marine Databases produced by the UK Met Office

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The Met Office Hadley Centre produces numerous observational datasets. The EN4 and HadIOD (Hadley Centre Integrated Ocean Database) datasets are two of those focusing on ocean data. Both are freely available for research and private use from https://www.metoffice.gov.uk/hadobs. Present uses of these datasets include, but are not limited to, the creation of ocean reanalyses, model and forecast verification and ocean heat content monitoring.

The EN4 dataset provides subsurface temperature and salinity profiles from 1900 to the present day alongside globally complete, infilled analyses which are accompanied by uncertainty estimates down to 1000m. The current version of EN is EN.4.2.1 (Good et al., 2013), with EN.4.3.0 due for release in 2021.

The EN4 dataset takes input data from four sources, the World Ocean Database, Argo, the Arctic Synoptic Basin wide Oceanography database and the Global Temperature and Salinity Profile Programme (GTSPP). When monthly updates are performed, with approximately half a month lag, data are taken from Argo and GTSPP only. Monthly netCDF files are available, with data contained at a higher resolution within these files for profiles.

The profiles in EN4 are fully quality controlled using an automatic QC procedure, with flags indicating which checks have been failed, allowing users to interrogate the data in greater detail. If a profile has failed any QC checks it will not be passed into the analyses. For eXpendable BathyThermographs (XBTs) and Mechanical Bathythermographs (MBTs) bias corrections are also provided.

The EN4 analyses are on a one by one degree horizontal grid with 42 depth levels, of increasing size, down to 5500m. These analyses are produced by combining background fields with the quality controlled observations and will relax back to climatology in the persistent absence of observations. The 'observations weights' variables provide information on the weighting of observations to background. These observation weights fields can be seen for three months of the temperature analyses in Figure 1, illustrating, alongside the profile coverage plots on the left, the increase in spatial coverage over time. The profile plots also indicate the increase in depth coverage.

EN.4.3.0 will include a number of changes relative to EN.4.2.1, focusing on improving uncertainty representation. A recent machine learning project providing a probabilistic estimate of XBT types in the case of missing metadata will be used to expand the bathythermograph correction ensemble. The method of calculating uncertainties in the analyses will be revisited, making use of the additional decade of data since EN4 was first produced. Measurement uncertainty estimates from HadIOD will be incorporated into the EN4 profiles and then feed into the analyses and the representivity errors encountered when going from point based observations to infilled analyses will be investigated.

HadIOD combines surface temperature data (from 1850 onwards) with subsurface temperature and salinity data (from 1900), providing an integrated database ideal for use where both surface and subsurface data are required, for example, in coupled reanalyses. HadIOD.1.2.0.0 (the current version) takes subsurface data from EN4 and surface data from ICOADS release 2.5.1 (Woodruff et al., 2011), the Copernicus Marine Environmental Monitoring Service (CMEMS) and a few additional smaller sources. For each observation HadIOD provides quality flags and measurement uncertainty estimates, as well as bias corrections where these are available (for MBTs, XBTs and ships). HadIOD data are released as daily files, updated on a monthly basis with a lag of a few months.
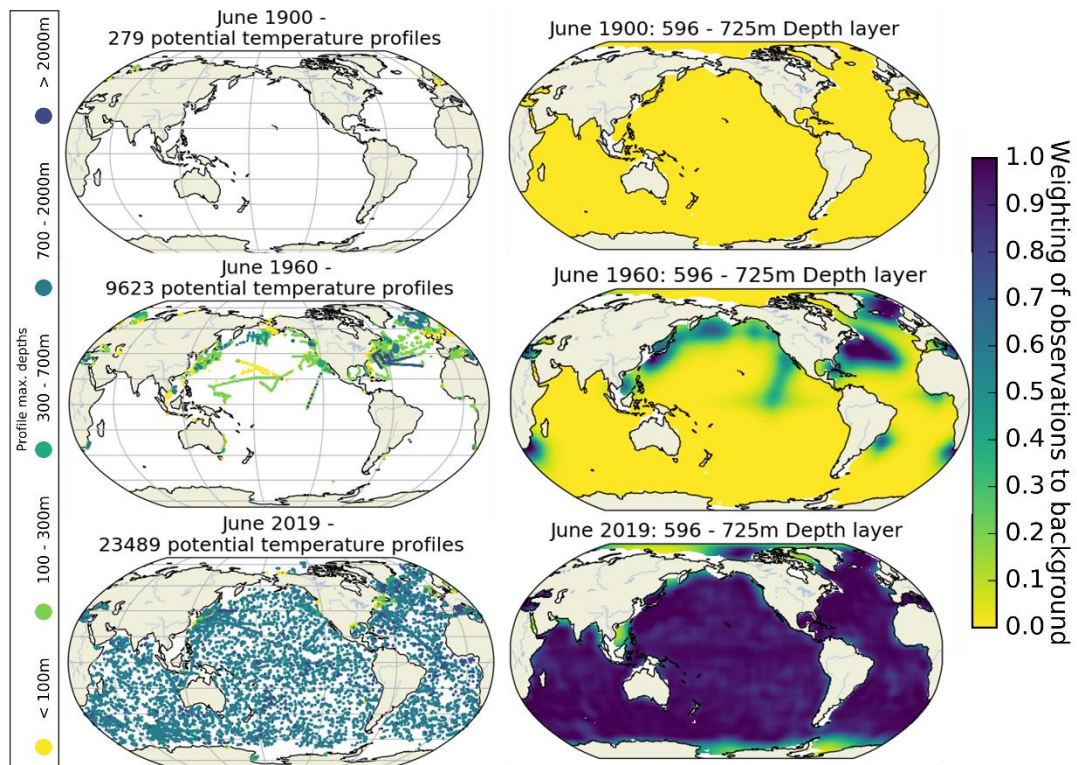
Figure 1: EN4 over time. Plots on the left indicate profile coverage, colour coded by profile maximum depth, whilst plots on the right indicate the relative weighting of observations to background fields in the analyses at an intermediate depth layer.

References:

Argo: http://wo.jcommops.org/cgi-bin/WebObjects/Argo

ASBO: See Good et al., 2013 for which input sources of this dataset are taken

Atkinson et al., 2014: C. P. Atkinson, N. A. Rayner, J. J. Kennedy and S. A. Good (2014): An Integrated Database of Ocean Temperature and Salinity Observations, Journal of Geophysical Research: Oceans, 119, 10, pp 7139 – 7163, doi: 10.1002/2014JC010053

CMEMS: http://marine.copernicus.eu/. Product INSITU_GLO_NRT_OBSERVATIONS_013_030 (Global Ocean In Situ Near Real Time Observations). Drifting Buoys.

Good et al., 2013: S. A. Good, M. J. Martin and N. A. Rayner (2013): EN4: Quality Controlled Ocean Temperature and Salinity Profiles and Monthly Objective Analyses with Uncertainty Estimates, Journal of Geophysical Research: Oceans, 118, 12, pp 6704-6716

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