Building a climatology at Port Hacking for QC purpose in the IMOS-Toolbox

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Material

For this study, historical water samples data collected from 1953 to 2007 in the area of Port Hacking have been considered. This data set (NRSPH_1953_2007.xls) can be found in Excel format through the IMOS portal (http://imos.aodn.org.au/webportal/) looking at "ANMN National Reference Station – Delayed", "NRSPH", and then "Historical data" (https://df.arcs.org.au/ARCS/projects/IMOS/public/ANMN/NRS/NRSPHB/HISTORICAL).

This Excel sheet has been manually processed to only copy/paste the relevant columns for this study in a tab delimited text file. The considered columns are : STATION_NO, START_TIME, END_TIME, END_LAT, END_LON, START_LAT, START_LON, PRESSURE, OXYGEN, SALINITY, TEMPERATURE.

Dates are in format "dd/mm/yyyy HH:MM", geographical coordinates are in decimal degrees. My guess is that the datum is WGS84, pressure is in dbar, dissolved oxygen in umol/kg, salinity in PSU and temperature in Celsius degrees. This is consistent with what I saw in the article from McNeil, B. I. (2010), Diagnosing coastal ocean CO_2 interannual variability from 40 year hydrographic time series station off the east coast of Australia, *Global Biogeochem. Cycles, 24*, GB4034, doi:10.1029/2010GB003870.

Tools

Matlab R2010b has been used to read, plot, and process the data into a NetCDF climatology file via two scripts : readSampling.m and plotSampling.m.

Study (/QC?)

Geographical study

Historical water samples have been collected over a large geographical area.

At first sight, it is not obvious that some samples should be rejected because of their location in a very distinct area (river mouth area against offshore area, areas separated by bathymetry or coastline, etc...) than the nominal location of the National Reference Station Port Hacking 100m. The only thing which can be worrying is the important distance between the nominal NRSPHB site location and some of the water samples.

So a simple impossible location test have been performed in order to take into account only the stations which were collected within a certain radius from the nominal position of the NRSPHB site (Lat = -34.116; Lon = 151.219).

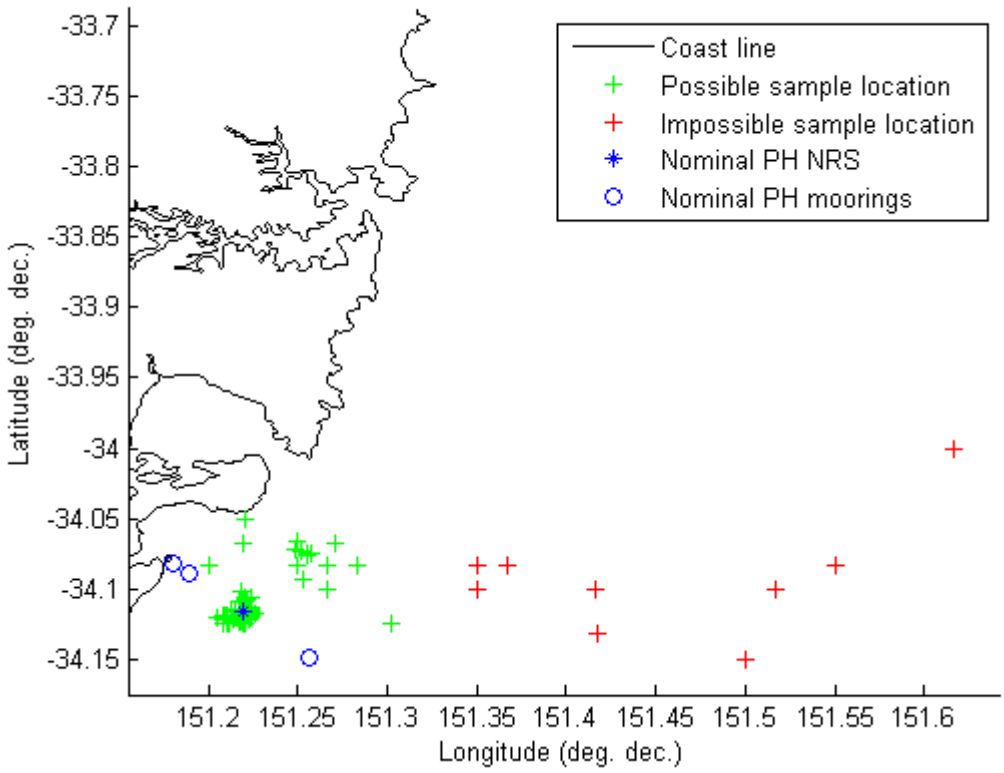

Figure 1 : Samples location

A 10km radius gives good results as it keeps only the profiles that occurred in a water column of ~=100m depth, consistent with the nominal NRSPHB site depth.

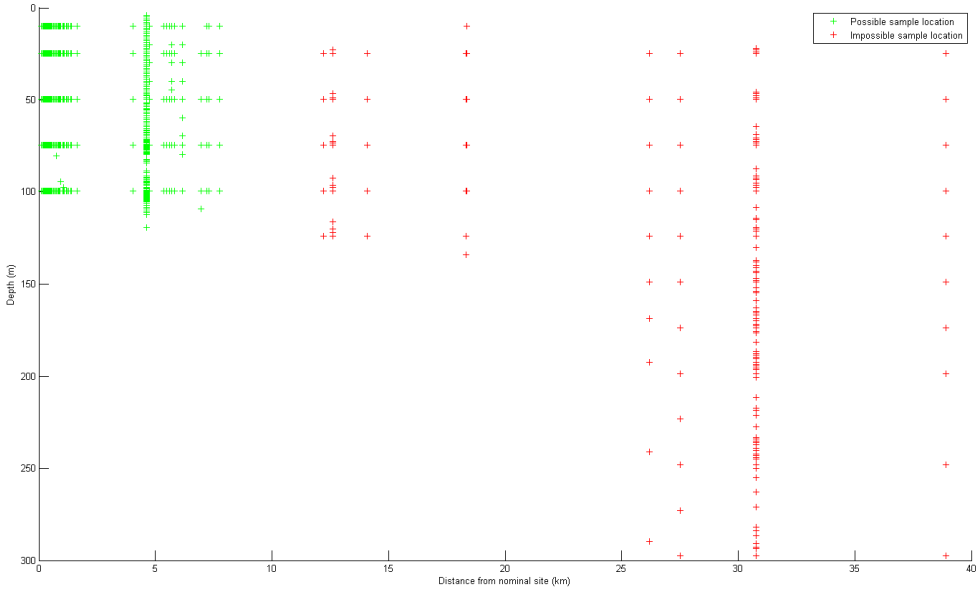

Figure 2 : Samples depth in distance from nominal NRSPHB location

Temporal study

The geographical filtering of samples previously performed still seems to be relevant from the temporal point of view.

Only 1175 on 15283 samples have been removed. Most of the samples are presents in a radius of 2 to 10km from the nominal NRSPHB site location.

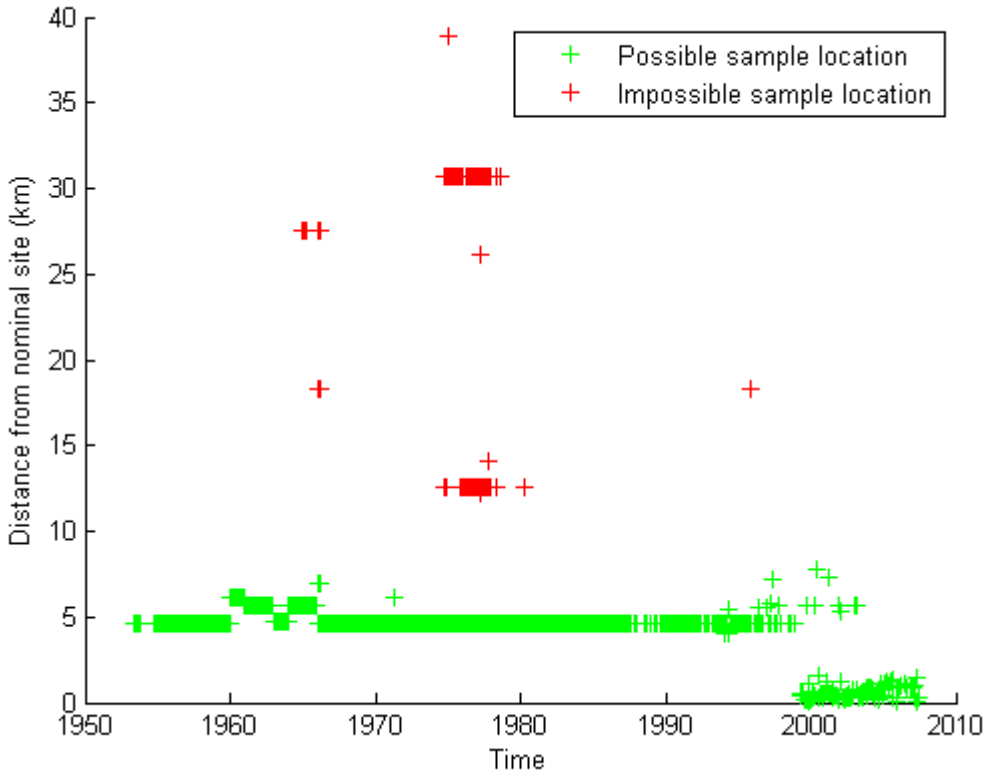

Figure 3 : Samples distance from nominal NRSPHB location in time

Again, considering samples depth in time, we can see that only samples belonging to profiles which occurred in water column depth consistent with the nominal NRSPHB site depth have been kept (probably one exception on the figure below, but then this profile is still at least 10km away from the nominal location).

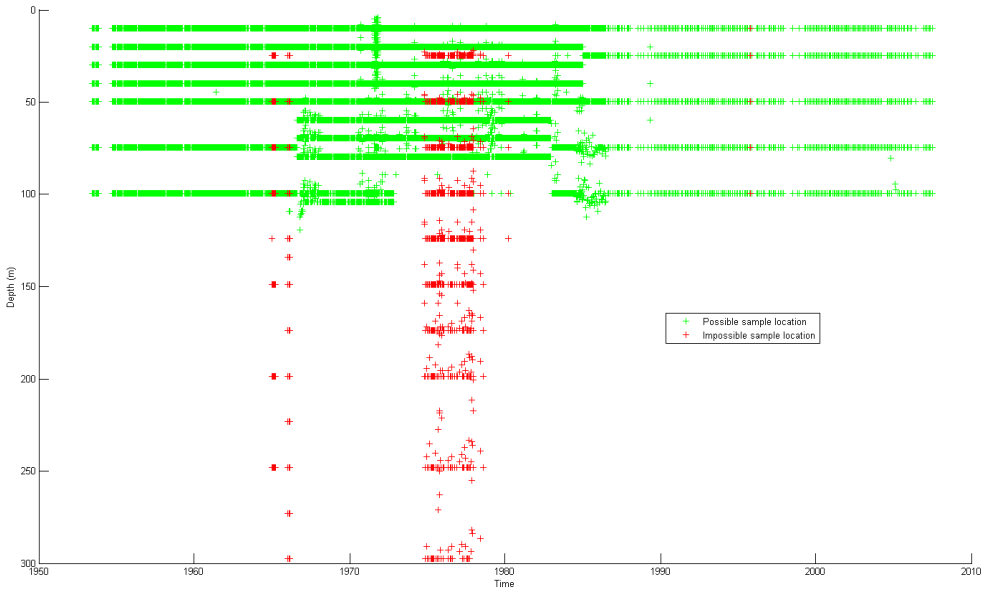

Figure 4 : Samples depth in time

Port Hacking National Reference Station has the privilege of having been Temperature and Salinity sampled over 54 years. This would make a perfect candidate to build a climatology from its entire data set, and for Quality Control purpose, if it hasn't been too much affected by climate change.

Considering samples' values at fixed depth (for each profile, the collected data has been vertically interpolated every 10m) and for each variable in time, one might be interested in the linear regression trend.

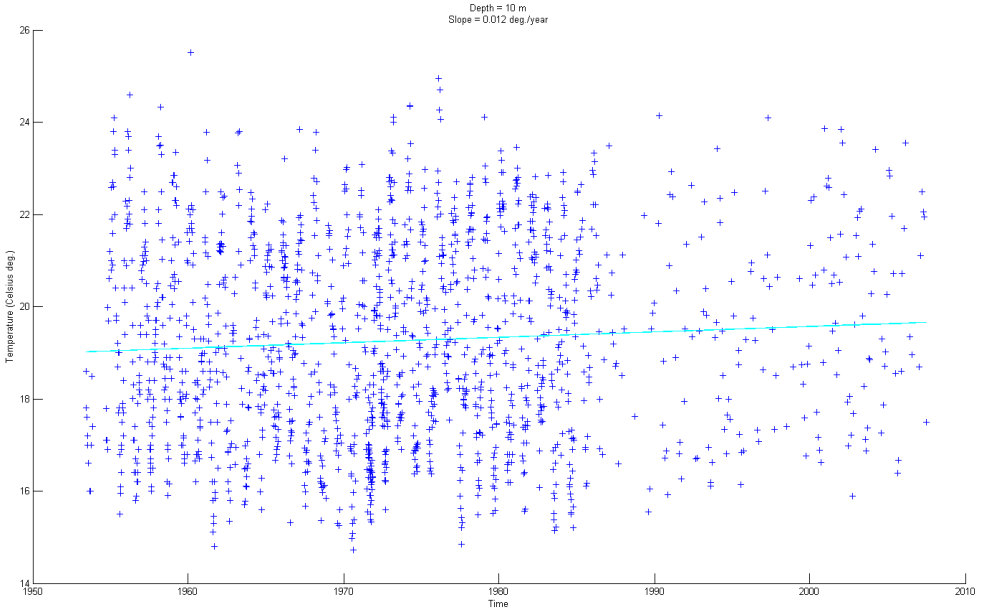

Figure 5 : Samples temperature in time at 10m (profiles' measurements are vertically interpolated)

Depth (m)	Slope (Celsius deg./year)
0	0.011
10	0.012
20	0.008
30	0.007
40	0.005
50	0.004
60	0.004
70	0.005
80	0.007
90	0.009
100	0.055

Table 1 : Temperature trend in time over data set per depth

The warming trend is more important in surface but still far lower than the maximums ocean warming trends of +/-0.05 Celsius degrees/year over the past 50 years heralded by ***The Copenhagen Diagnosis***, *2009: Updating the World on the Latest Climate Science.* I. Allison, N.L. Bindoff, R.A. Bindschadler, P.M. Cox, N. de Noblet, M.H. England, J.E. Francis, N. Gruber, A.M. Haywood, D.J. Karoly, G. Kaser, C. Le Quéré, T.M. Lenton, M.E. Mann, B.I. McNeil, A.J. Pitman, S. Rahmstorf, E. Rignot, H.J. Schellnhuber, S.H. Schneider, S.C. Sherwood, R.C.J. Somerville, K. Steffen, E.J. Steig, M. Visbeck, A.J. Weaver. The University of New South Wales Climate Change Research Centre (CCRC), Sydney, Australia, 60pp.

Increasing trends from 80 to 100m is not reliable and probably due to sometimes lack of data over the 54 years at these depths.

At this stage no conclusion has been taken as to reduce the data set time period which should be used in building the climatology in order to tamper the effect of climate change on this climatology.

Seasonal study

Considering samples values at all depths and for each variable from a seasonal point of view, one may highlight doubtful samples which need to be removed.

On the overall, the samples show an important seasonal trend while summer/stratified and winter/mixed periods are well rendered.

At the end of February for example, one profile seems to have collected particularly high temperatures at every depth.

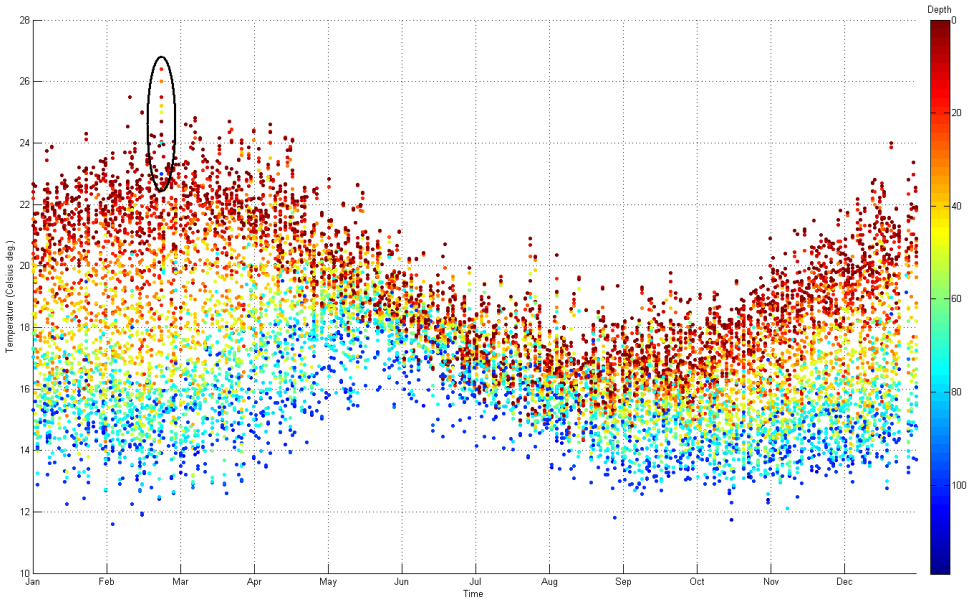

Figure 6: Samples seasonal Temperature with depth as color

Same Quality Control could be performed from seasonal plots depth by depth, or considering the sample distance from the nominal site location instead of its depth. On this latter option, we can see that the profile previously underlined is part of the furthest profiles that have been kept. On the other hand, most of the other as far profiles fit well in the seasonal range.

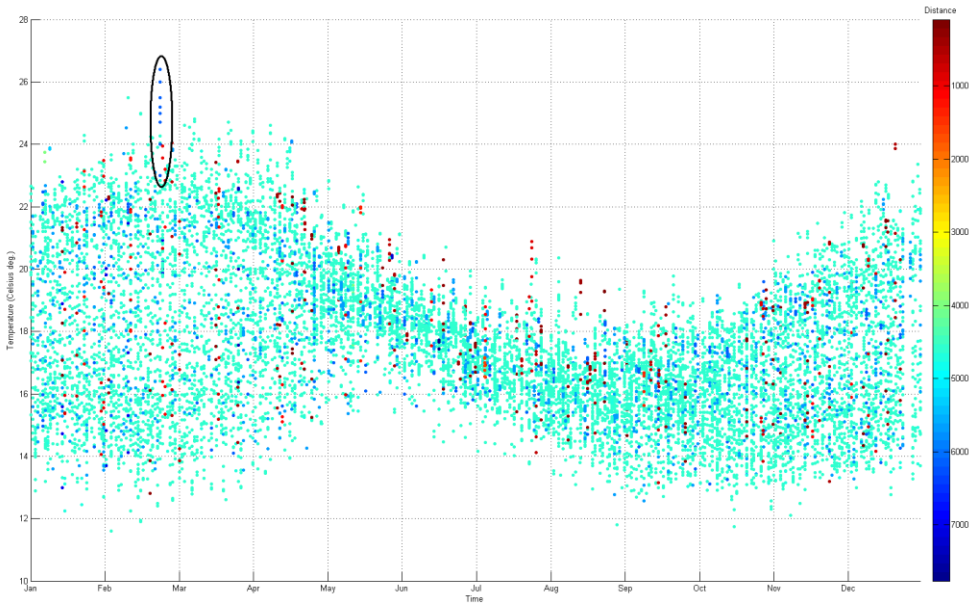

Figure 7 : Samples seasonal Temperature with distance from nominal location as color

At this stage no conclusion has been taken as to withdraw any doubtful sample from the climatology.

TS / TO plots

Temperature against Salinity and Temperature against Dissolved Oxygen plots could help in identifying very distinct water masses that could have been sampled. In the case few identified distinct samples are found then they would be likely to be excluded from the climatology.

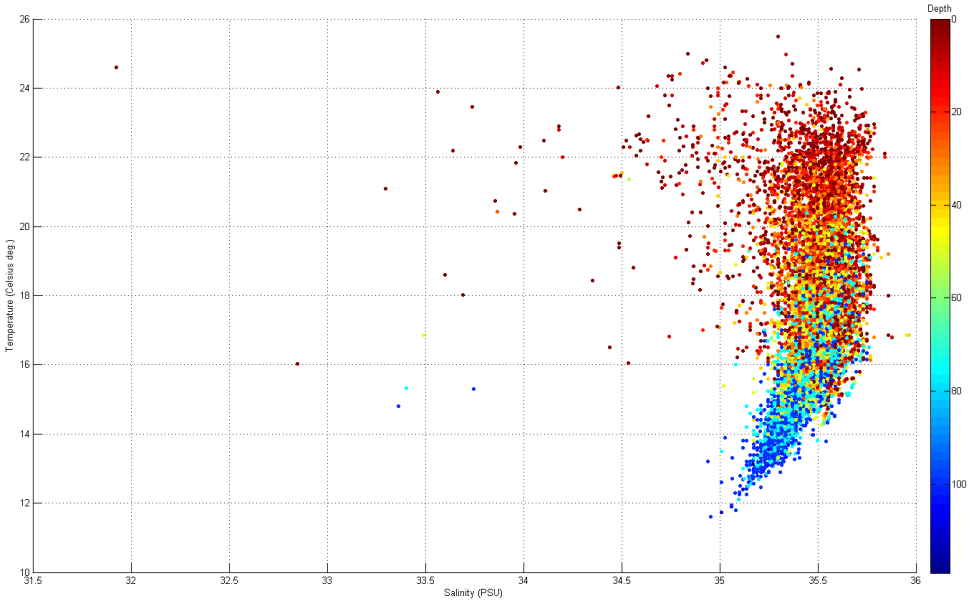

Figure 8 : Samples Temperature / Salinity plot with depth as color

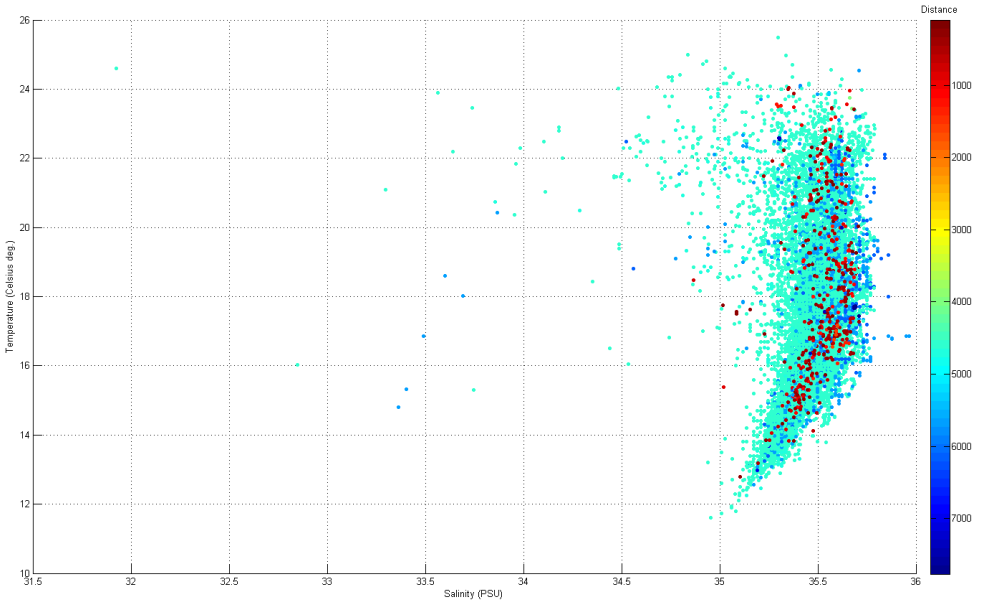

Figure 9 : Samples Temperature / Salinity plot with distance form nominal location as color

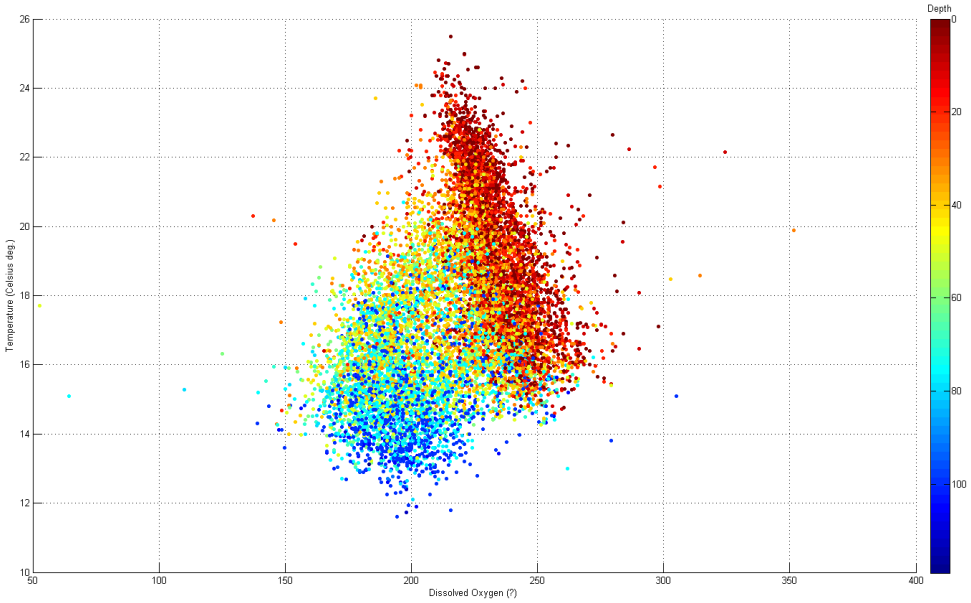

Figure 10 : Samples Temperature / Dissolved Oxygen plot with depth as color

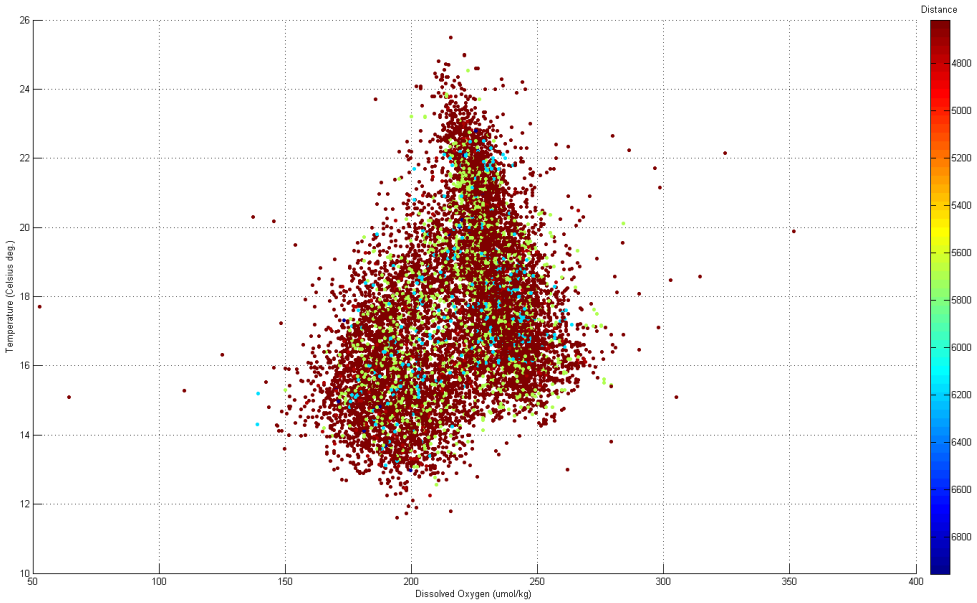

Figure 11 : Samples Temperature / Dissolved Oxygen plot with distance from nominal location as color

At this stage no conclusion has been taken as to withdraw any doubtful sample from the climatology.

Climatology building methodology

Processing the data

For each profile, all measured parameters have been vertically interpolated between 0 and 100m every 10m to have data on a regular vertical grid. Linear interpolation has been used and NaN introduced on outer boundaries when necessary.

Date time information is converted in days of year (values are integers belonging to [0; 365[ ) so that we have seasonal time information.

Then, from a seasonal point of view and for each depth, data has been binned on a bi-weekly basis (bin size = 365/26 ~= 14.04 days) and then mean, median, standard deviation, min, max and n number of samples per bin has been computed.

Given time represents the location in time of the centre of a bin. It has been decided that the first centre of a bin is 1st of January at 00:00am (equivalent seasonal time value = 0).

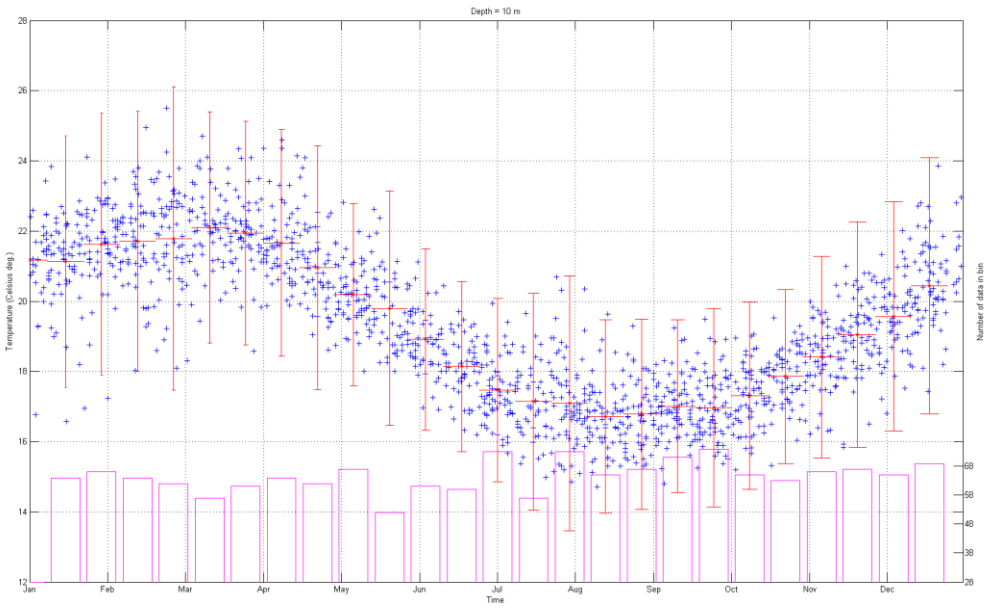

Figure 12 : Temperature binning at depth = 10m

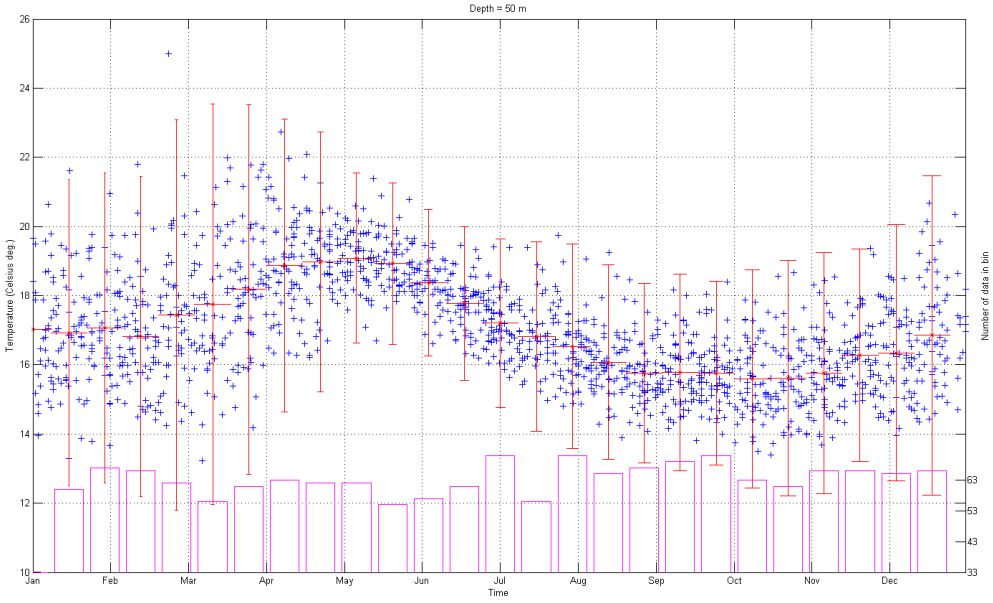

Figure 13 : Temperature binning at depth = 50m

Formatting the processed data in NetCDF file format

The NetCDF file format for this climatology file tries to follow as much as possible the IMOS NetCDF user manual. In addition, because the file contains climatological data, it intends to follow the recommendations described in 7.4. Climatological Statistics of the CF conventions version 1.6.

Global attributes

Here is below a dump of the global attributes from the file :

```
ncks -M Clim_NRSPHB_2011.nc

Opened file Clim_NRSPHB_2011.nc: dimensions = 5, variables = 24, global atts. = 31, ID =
65536, type = NC_FORMAT_CLASSIC

Global attribute 0: date_created, size = 20 NC_CHAR, value = 2012-01-16T04:36:39Z

Global attribute 1: project, size = 41 NC_CHAR, value = Integrated Marine Observing System
(IMOS)

Global attribute 2: Conventions, size = 6 NC_CHAR, value = CF-1.5

Global attribute 3: institution, size = 4 NC_CHAR, value = ANMN

Global attribute 4: abstract, size = 52 NC_CHAR, value = NSW-IMOS Port Hacking 100m water
samples climatology

Global attribute 5: source, size = 64 NC_CHAR, value = NSW Port Hacking 100m historical water
samples from 1953 to 2007

Global attribute 6: keywords, size = 48 NC_CHAR, value = Port Hacking 100m, Climatology, TEMP,
PSAL, DOX2
```

```
Global attribute 7: references, size = 22 NC_CHAR, value = http://www.imos.org.au

Global attribute 8: netcdf_version, size = 3 NC_CHAR, value = 3.6

Global attribute 9: site_code, size = 6 NC_CHAR, value = NRSPHB

Global attribute 10: geospatial_lat_min, size = 1 NC_DOUBLE, value = -34.116

Global attribute 11: geospatial_lat_max, size = 1 NC_DOUBLE, value = -34.116

Global attribute 12: geospatial_lon_min, size = 1 NC_DOUBLE, value = 151.219

Global attribute 13: geospatial_lon_max, size = 1 NC_DOUBLE, value = 151.219

Global attribute 14: geospatial_vertical_min, size = 1 NC_DOUBLE, value = 0

Global attribute 15: geospatial_vertical_max, size = 1 NC_DOUBLE, value = 100

Global attribute 16: geospatial_vertical_step, size = 1 NC_DOUBLE, value = 10

Global attribute 17: local_time_zone, size = 1 NC_DOUBLE, value = 10

Global attribute 18: climatology_day_start, size = 10 NC_CHAR, value = 1953-05-31

Global attribute 19: climatology_day_end, size = 10 NC_CHAR, value = 2007-07-02

Global attribute 20: climatology_day_step, size = 1 NC_DOUBLE, value = 14.0384615385

Global attribute 21: lineage, size = 669 NC_CHAR, value = Historical water samples have been
filtered in order to take into account only the stations which were collected within a 10km
radius from the nominal position of the National Reference Station Port Hacking 100m (Lat = -
34.116; Lon = 151.219). For each profile, parameters have been vertically interpolated to have
data on a regular vertical grid. Then, from a seasonal point of view (time information
converted in days of year) and for each depth, data has been binned on a bi-weekly basis (bin
size ~= 14.04 days) to compute mean, median, standard deviation, min, max and n number of
samples per bin. Given time represents the location in time of the centre of a bin.

Global attribute 22: data_centre, size = 41 NC_CHAR, value = eMarine Information
Infrastructure (eMII)

Global attribute 23: data_centre_email, size = 16 NC_CHAR, value = info@emii.org.au

Global attribute 24: author, size = 18 NC_CHAR, value = Guillaume Galibert

Global attribute 25: author_email, size = 30 NC_CHAR, value = guillaume.galibert@utas.edu.au

Global attribute 26: institution_references, size = 32 NC_CHAR, value =
http://www.imos.org.au/emii.html

Global attribute 27: citation, size = 126 NC_CHAR, value = The citation in a list of
references is: "IMOS [year-of-data-download], [Title], [data-access-url], accessed [date-of-
access]"

Global attribute 28: acknowledgement, size = 340 NC_CHAR, value = Any users of IMOS data are
required to clearly acknowledge the source of the material in the format: "Data was sourced
from the Integrated Marine Observing System (IMOS) - an initiative of the Australian
Government being conducted as part of the National Collaborative Research Infrastructure
Strategy and and the Super Science Initiative."

Global attribute 29: distribution_statement, size = 266 NC_CHAR, value = Data may be re-used,
provided that related metadata explaining the data has been reviewed by the user, and the data
is appropriately acknowledged. Data, products and services from IMOS are provided "as is"
without any warranty as to fitness for a particular purpose.
```

```
Global attribute 30: project_acknowledgement, size = 46 NC_CHAR, value = The production of
this data was funded by IMOS
```

Variables attributes

Here is below a dump of some of the variables attributes from the file :

```
ncks -m Clim_NRSPHB_2011.nc

DAY_OF_YEAR: type NC_DOUBLE, 1 dimension, 8 attributes, chunked? no, compressed? no, packed?
no, ID = 0

DAY_OF_YEAR RAM size is 26*sizeof(NC_DOUBLE) = 26*8 = 208 bytes

DAY_OF_YEAR dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

DAY_OF_YEAR attribute 0: name, size = 11 NC_CHAR, value = DAY_OF_YEAR

DAY_OF_YEAR attribute 1: long_name, size = 11 NC_CHAR, value = day_of_year

DAY_OF_YEAR attribute 2: climatology, size = 18 NC_CHAR, value = climatology_bounds

DAY_OF_YEAR attribute 3: units, size = 19 NC_CHAR, value = days since 1953-1-1

DAY_OF_YEAR attribute 4: axis, size = 1 NC_CHAR, value = T

DAY_OF_YEAR attribute 5: valid_min, size = 1 NC_DOUBLE, value = 0

DAY_OF_YEAR attribute 6: valid_max, size = 1 NC_DOUBLE, value = 365

DAY_OF_YEAR attribute 7: _FillValue, size = 1 NC_DOUBLE, value = 999999



DEPTH: type NC_DOUBLE, 1 dimension, 10 attributes, chunked? no, compressed? no, packed? no, ID
= 1

DEPTH RAM size is 11*sizeof(NC_DOUBLE) = 11*8 = 88 bytes

DEPTH dimension 0: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

DEPTH attribute 0: name, size = 5 NC_CHAR, value = DEPTH

DEPTH attribute 1: standard_name, size = 5 NC_CHAR, value = depth

DEPTH attribute 2: long_name, size = 5 NC_CHAR, value = depth

DEPTH attribute 3: units, size = 1 NC_CHAR, value = m

DEPTH attribute 4: axis, size = 1 NC_CHAR, value = Z

DEPTH attribute 5: positive, size = 4 NC_CHAR, value = down

DEPTH attribute 6: valid_min, size = 1 NC_DOUBLE, value = 0

DEPTH attribute 7: valid_max, size = 1 NC_DOUBLE, value = 12000

DEPTH attribute 8: _FillValue, size = 1 NC_DOUBLE, value = 999999

DEPTH attribute 9: reference_datum, size = 11 NC_CHAR, value = sea surface
```

```
LATITUDE: type NC_DOUBLE, 1 dimension, 9 attributes, chunked? no, compressed? no, packed? no,
ID = 2

LATITUDE RAM size is 1*sizeof(NC_DOUBLE) = 1*8 = 8 bytes

LATITUDE dimension 0: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

LATITUDE attribute 0: name, size = 8 NC_CHAR, value = LATITUDE

LATITUDE attribute 1: standard_name, size = 8 NC_CHAR, value = latitude

LATITUDE attribute 2: long_name, size = 8 NC_CHAR, value = latitude

LATITUDE attribute 3: units, size = 13 NC_CHAR, value = degrees_north

LATITUDE attribute 4: axis, size = 1 NC_CHAR, value = Y

LATITUDE attribute 5: valid_min, size = 1 NC_DOUBLE, value = -90

LATITUDE attribute 6: valid_max, size = 1 NC_DOUBLE, value = 90

LATITUDE attribute 7: _FillValue, size = 1 NC_DOUBLE, value = 999999

LATITUDE attribute 8: reference_datum, size = 42 NC_CHAR, value = geographical coordinates,
WGS84 projection



LONGITUDE: type NC_DOUBLE, 1 dimension, 9 attributes, chunked? no, compressed? no, packed? no,
ID = 3

LONGITUDE RAM size is 1*sizeof(NC_DOUBLE) = 1*8 = 8 bytes

LONGITUDE dimension 0: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

LONGITUDE attribute 0: name, size = 9 NC_CHAR, value = LONGITUDE

LONGITUDE attribute 1: standard_name, size = 9 NC_CHAR, value = longitude

LONGITUDE attribute 2: long_name, size = 9 NC_CHAR, value = longitude

LONGITUDE attribute 3: units, size = 12 NC_CHAR, value = degrees_east

LONGITUDE attribute 4: axis, size = 1 NC_CHAR, value = X

LONGITUDE attribute 5: valid_min, size = 1 NC_DOUBLE, value = -180

LONGITUDE attribute 6: valid_max, size = 1 NC_DOUBLE, value = 180

LONGITUDE attribute 7: _FillValue, size = 1 NC_DOUBLE, value = 999999

LONGITUDE attribute 8: reference_datum, size = 42 NC_CHAR, value = geographical coordinates,
WGS84 projection



NV: type NC_DOUBLE, 1 dimension, 1 attribute, chunked? no, compressed? no, packed? no, ID = 4

NV RAM size is 2*sizeof(NC_DOUBLE) = 2*8 = 16 bytes

NV dimension 0: NV, size = 2 NC_DOUBLE, dim. ID = 4 (CRD)
```

```
NV attribute 0: name, size = 2 NC_CHAR, value = nv

climatology_bounds: type NC_DOUBLE, 2 dimensions, 4 attributes, chunked? no, compressed? no,
packed? no, ID = 5

climatology_bounds RAM size is 26*2*sizeof(NC_DOUBLE) = 52*8 = 416 bytes

climatology_bounds dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

climatology_bounds dimension 1: NV, size = 2 NC_DOUBLE, dim. ID = 4 (CRD)

climatology_bounds attribute 0: name, size = 18 NC_CHAR, value = climatology_bounds

climatology_bounds attribute 1: long_name, size = 22 NC_CHAR, value = day_of_year_boundaries

climatology_bounds attribute 2: units, size = 19 NC_CHAR, value = days since 1953-1-1

climatology_bounds attribute 3: _FillValue, size = 1 NC_DOUBLE, value = 999999

TEMP_SD: type NC_DOUBLE, 4 dimensions, 5 attributes, chunked? no, compressed? no, packed? no,
ID = 8

TEMP_SD RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_SD dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_SD dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_SD dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_SD dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_SD attribute 0: name, size = 7 NC_CHAR, value = TEMP_SD

TEMP_SD attribute 1: long_name, size = 21 NC_CHAR, value = sea_water_temperature

TEMP_SD attribute 2: cell_methods, size = 87 NC_CHAR, value = DAY_OF_YEAR: standard_deviation
within years DAY_OF_YEAR: standard_deviation over years

TEMP_SD attribute 3: units, size = 7 NC_CHAR, value = Celsius

TEMP_SD attribute 4: _FillValue, size = 1 NC_DOUBLE, value = 999999



TEMP_max: type NC_DOUBLE, 4 dimensions, 5 attributes, chunked? no, compressed? no, packed? no,
ID = 10

TEMP_max RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_max dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_max dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_max dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_max dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_max attribute 0: name, size = 8 NC_CHAR, value = TEMP_max

TEMP_max attribute 1: long_name, size = 21 NC_CHAR, value = sea_water_temperature
```

```
TEMP_max attribute 2: cell_methods, size = 65 NC_CHAR, value = DAY_OF_YEAR: maximum within years DAY_OF_YEAR: maximum over years

TEMP_max attribute 3: units, size = 7 NC_CHAR, value = Celsius

TEMP_max attribute 4: _FillValue, size = 1 NC_DOUBLE, value = 999999



TEMP_mean: type NC_DOUBLE, 4 dimensions, 5 attributes, chunked? no, compressed? no, packed? no, ID = 6

TEMP_mean RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_mean dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_mean dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_mean dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_mean dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_mean attribute 0: name, size = 9 NC_CHAR, value = TEMP_mean

TEMP_mean attribute 1: long_name, size = 21 NC_CHAR, value = sea_water_temperature

TEMP_mean attribute 2: cell_methods, size = 59 NC_CHAR, value = DAY_OF_YEAR: mean within years DAY_OF_YEAR: mean over years

TEMP_mean attribute 3: units, size = 7 NC_CHAR, value = Celsius

TEMP_mean attribute 4: _FillValue, size = 1 NC_DOUBLE, value = 999999



TEMP_median: type NC_DOUBLE, 4 dimensions, 5 attributes, chunked? no, compressed? no, packed? no, ID = 7

TEMP_median RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_median dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_median dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_median dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_median dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_median attribute 0: name, size = 11 NC_CHAR, value = TEMP_median

TEMP_median attribute 1: long_name, size = 21 NC_CHAR, value = sea_water_temperature

TEMP_median attribute 2: cell_methods, size = 63 NC_CHAR, value = DAY_OF_YEAR: median within years DAY_OF_YEAR: median over years

TEMP_median attribute 3: units, size = 7 NC_CHAR, value = Celsius

TEMP_median attribute 4: _FillValue, size = 1 NC_DOUBLE, value = 999999
```

```
TEMP_min: type NC_DOUBLE, 4 dimensions, 5 attributes, chunked? no, compressed? no, packed? no, ID = 9

TEMP_min RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_min dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_min dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_min dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_min dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_min attribute 0: name, size = 8 NC_CHAR, value = TEMP_min

TEMP_min attribute 1: long_name, size = 21 NC_CHAR, value = sea_water_temperature

TEMP_min attribute 2: cell_methods, size = 65 NC_CHAR, value = DAY_OF_YEAR: minimum within years DAY_OF_YEAR: minimum over years

TEMP_min attribute 3: units, size = 7 NC_CHAR, value = Celsius

TEMP_min attribute 4: _FillValue, size = 1 NC_DOUBLE, value = 999999



TEMP_n: type NC_DOUBLE, 4 dimensions, 4 attributes, chunked? no, compressed? no, packed? no, ID = 11

TEMP_n RAM size is 26*11*1*1*sizeof(NC_DOUBLE) = 286*8 = 2288 bytes

TEMP_n dimension 0: DAY_OF_YEAR, size = 26 NC_DOUBLE, dim. ID = 0 (CRD)

TEMP_n dimension 1: DEPTH, size = 11 NC_DOUBLE, dim. ID = 1 (CRD)

TEMP_n dimension 2: LATITUDE, size = 1 NC_DOUBLE, dim. ID = 2 (CRD)

TEMP_n dimension 3: LONGITUDE, size = 1 NC_DOUBLE, dim. ID = 3 (CRD)

TEMP_n attribute 0: name, size = 6 NC_CHAR, value = TEMP_n

TEMP_n attribute 1: long_name, size = 38 NC_CHAR, value = number_of_sea_water_temperature_values

TEMP_n attribute 2: cell_methods, size = 57 NC_CHAR, value = DAY_OF_YEAR: sum within years DAY_OF_YEAR: sum over years

TEMP_n attribute 3: _FillValue, size = 1 NC_DOUBLE, value = 999999
```