

GHR SST requirements for Argo near-surface temperature profiles

*As discussed at the GHR SST Joint Workshop on Tropical
Warm Pool and High Latitude SST Issues, Melbourne, 2012.*

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with input from the GHR SST Science Team
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GHR SST XII Edinburgh 2011:

*“The **near-surface measurements from Argo** profiling floats provide a new data set that is **highly valuable for independent validation of SST retrievals, models and analyses**. Thus the GHR SST Science Team recommends that these data are **reserved for independent validation**.“*

Melbourne Workshop 2012:

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GHR SST validation using Argo data

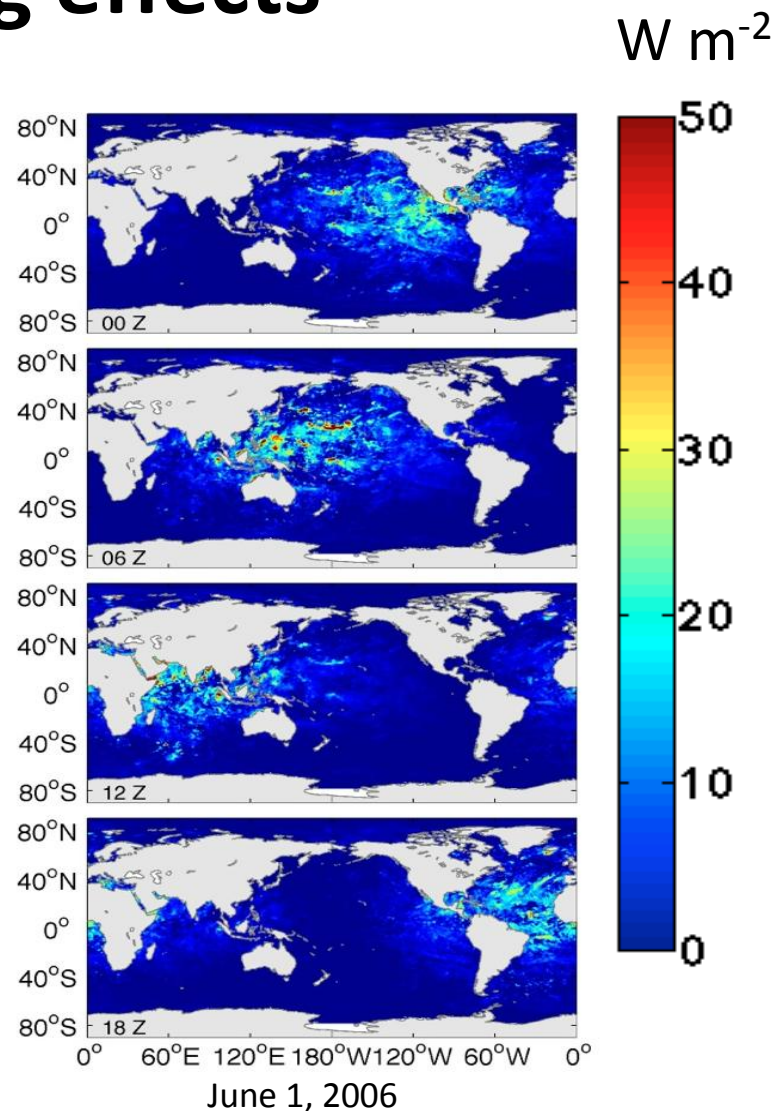
- The GHR SST Multi-Product Ensemble (GMPE) system is run daily at the Met Office, taking various L4 analyses as inputs, transfers them onto a common grid, and produces an ensemble median and standard deviation
- Validation against Argo data (at 3 to 5 m depth) has shown that the GMPE median is more accurate than any of the contributing analyses with a standard deviation error of 0.40K globally with respect to the near-surface Argo data
- Results to be published in a Deep Sea Research II Special Issue on Satellite Oceanography and Climate Change

Diurnal warming effects

Diurnal warming (DW) impacts convection as well as heat and moisture fluxes on a seasonal to intra-seasonal (MJO, ENSO) and climate scale.

Model parameterisation for DW is required as the physics are not resolved.

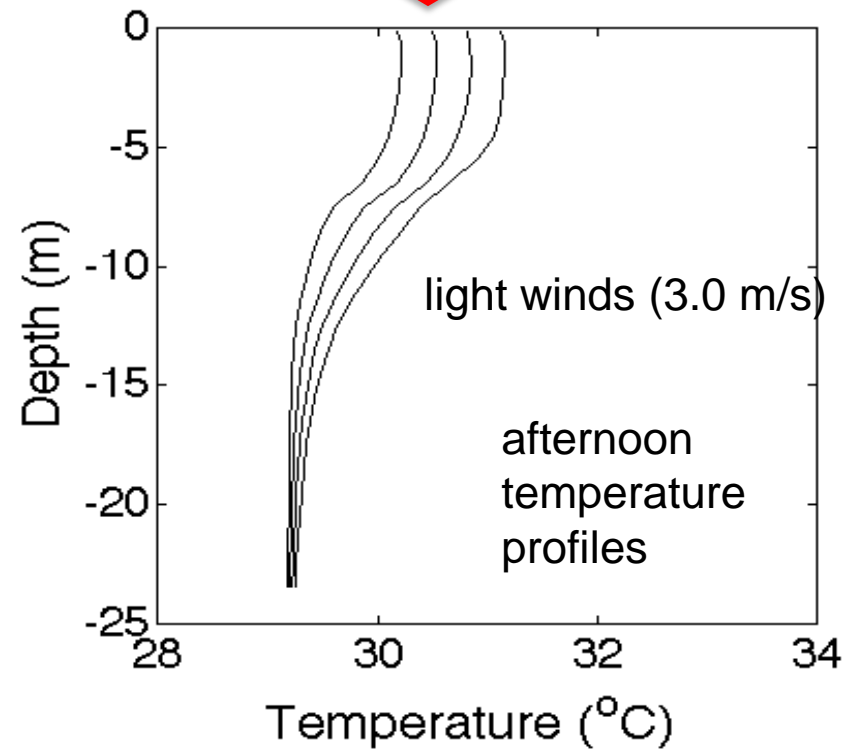
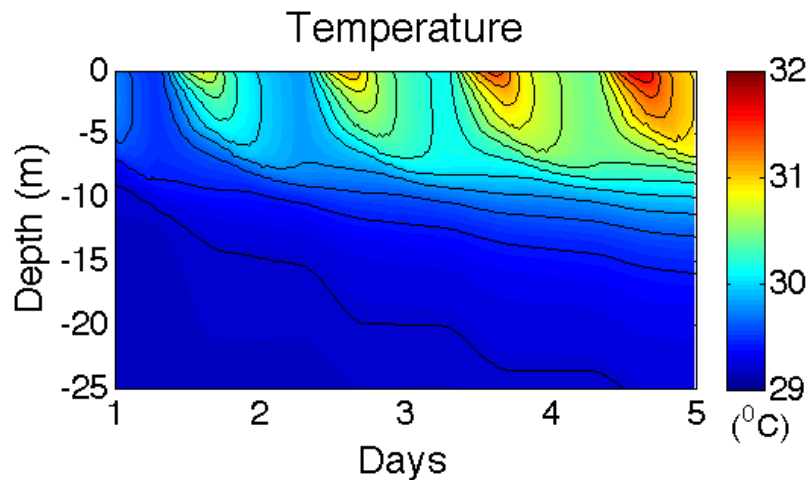
The likelihood of Argo observing DW is much higher than that of dedicated short-term measurement campaigns.



Modelled (deeper) diurnal warm layers to be verified with Argo:

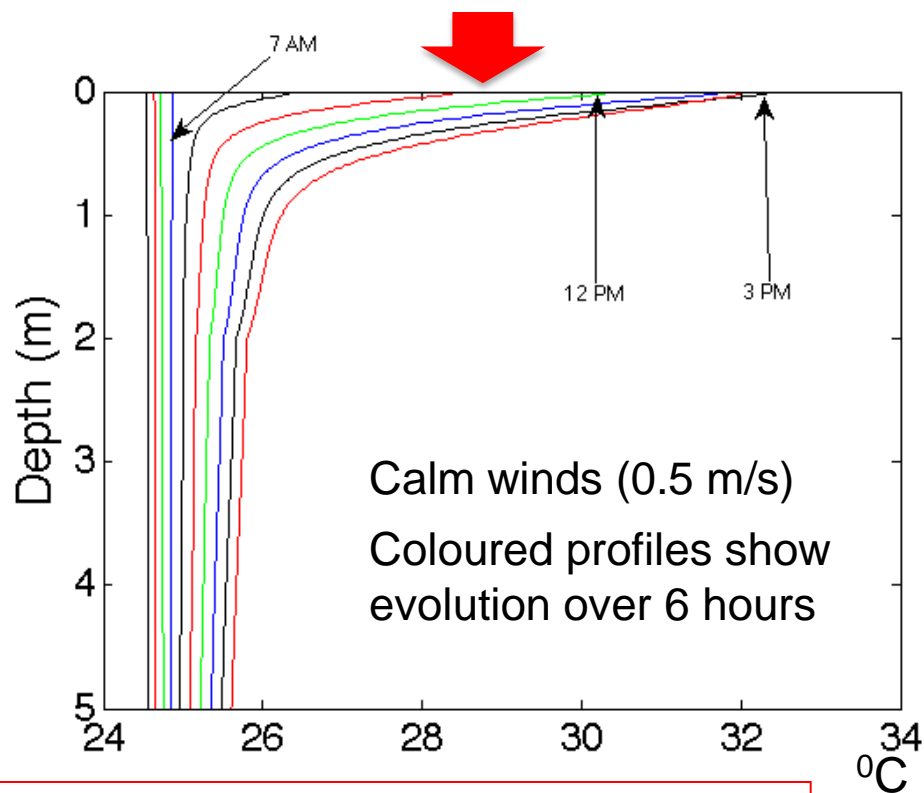
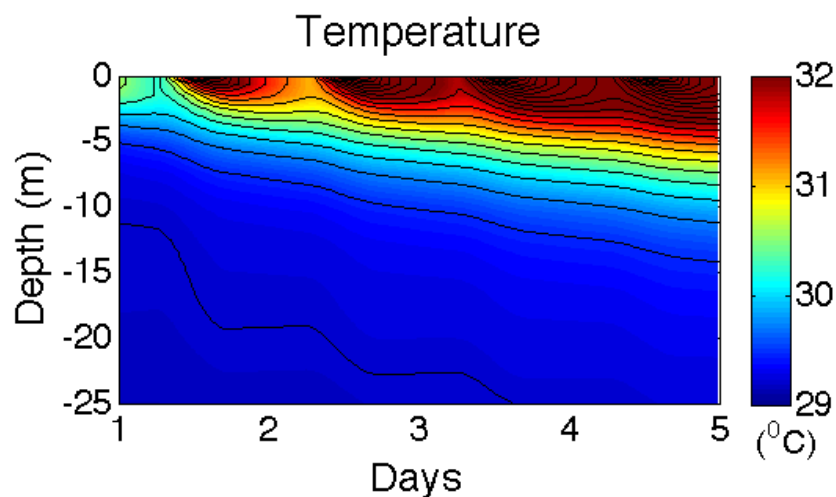


Modelled Diurnal Warming:

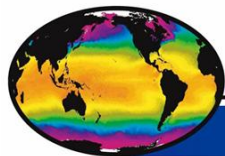


Modelled (shallow) diurnal warm layers to be verified by Argo:

Modelled Diurnal Warming:



There are almost no in situ measurements covering very large warming cases, i.e., in excess of 3K.



GHRSSST

Group for High Resolution
Sea Surface Temperature

GHRSSST requirements for Argo near-surface temperature profiles
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Work with GHR SST since AST#12

- BODC have collected data from NST capable Apex Argos floats deployed by UK, US, Japan and India and Scripps Iridium floats that do high res (1m) sampling near the surface (<ftp://ftp.pol.sc.uk/pub/bodc/argo/NST/>)
- An analysis of the un-pumped data was made by Sarah Quinn as a summer MSc project at Reading University, in collaboration with Andrea Kaiser-Weiss (GHR SST Project Office) and Prof. Keith Haines
- For this study we had 3,007 profiles (recorded between October 2008 and May 2011) from 54 NST capable floats.

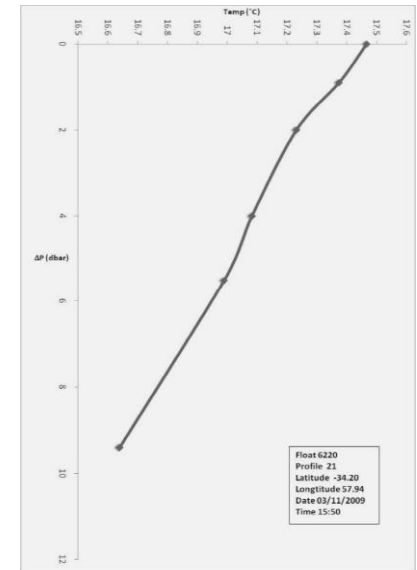
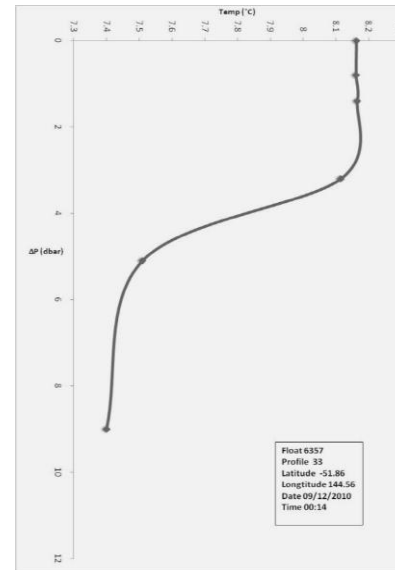
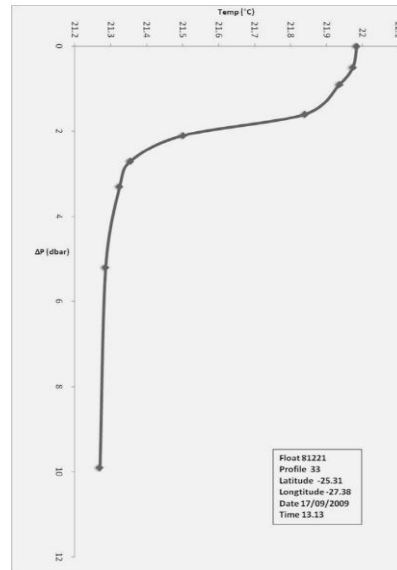
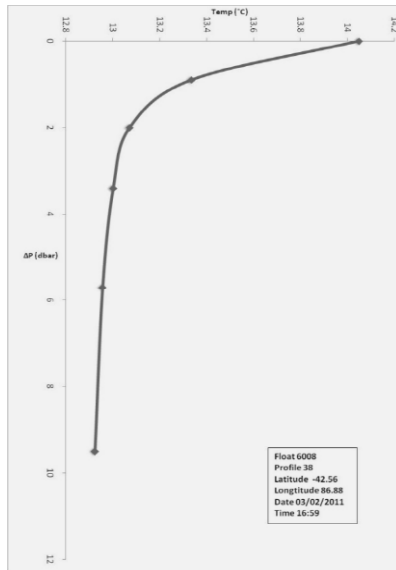
Determination of the surface

- One of the challenges was to more accurately determine the depth of the measurements as the pressure sensors exhibit a slow drift and an offset needs to be applied
- Near the surface the NST floats sample the temperature every 6 seconds (~0.6 dbar intervals)
- Surfacing identified when the pressure change between two points was < 0.5 dbar - implies the float had stopped ascending
- (Surface) value then taken as the pressure offset to adjust the deeper values (it should be possible to further refine this method)

Results

- Between 10 m depth and the ocean surface 62 profiles (from 26 different floats) showed evidence of diurnal warming (stratification), with a ΔT greater than 0.5 °C between 10 m and the surface
- The maximum temperature difference seen was 2.4 °C and the diurnal mixing layer was identified as spanning from 0.1 m to 8 m below the surface
- Various vertical structures were observed, where in some cases the stratification probably reflected remnants of diurnal structures from the previous day(s)

Examples of stratification observed in the top 10 metres



Although we don't know by how much less accurate the un-pumped measurements are compared to the standard pumped measurements, the data do demonstrate the ability of such floats to record significant near-surface stratification that would otherwise be missed and so provide information of value to the GHR SST community

Requirements for GHR SST applications

1. **Accuracy requirements** for learning more about diurnal warming are **not stringent**.
2. The **vertical resolution** would be required **as high as possible**.
3. Information on **type and time of the measurement** is required for application.
4. Pressure sensor uncertainties will be dealt with by normalizing with the surface pressure reading.
5. Previous studies (Steve Riser, Jon Turton) suggest that the accuracy of the un-pumped data is sufficient for the GHR SST requirements.

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“Current studies suggest there is value in the Argo near-surface temperature profiles. **More data could significantly increase this value.**”

- GHRST just want near surface data - don't care that much whether it is pumped or non-pumped as long as the accuracy/errors are stated
- Deeper cross-calibration measurements suggest agreement of pumped & non-pumped measurements is sufficiently good
- How close to the surface can we safely go with the pump on to ensure delivering the most accurate data? - then continue with pump off
- Sensor lag would suggest un-pumped measurements would underestimate near-surface stratification