



Ship and buoy surface data – quality comparison

And improved data assimilation

Bruce Ingleby, Multiparametric observation and analysis of the Sea, Liege, 30 April 2010



Contents

This presentation covers the following areas

- Introduction (and an old problem)
- Ship and buoy wind speeds
- Air temperatures
- Data assimilation and operational issues
- Summary of results

- Thanks to Liz Kent, Sarah North, Pierre Blouch and many others



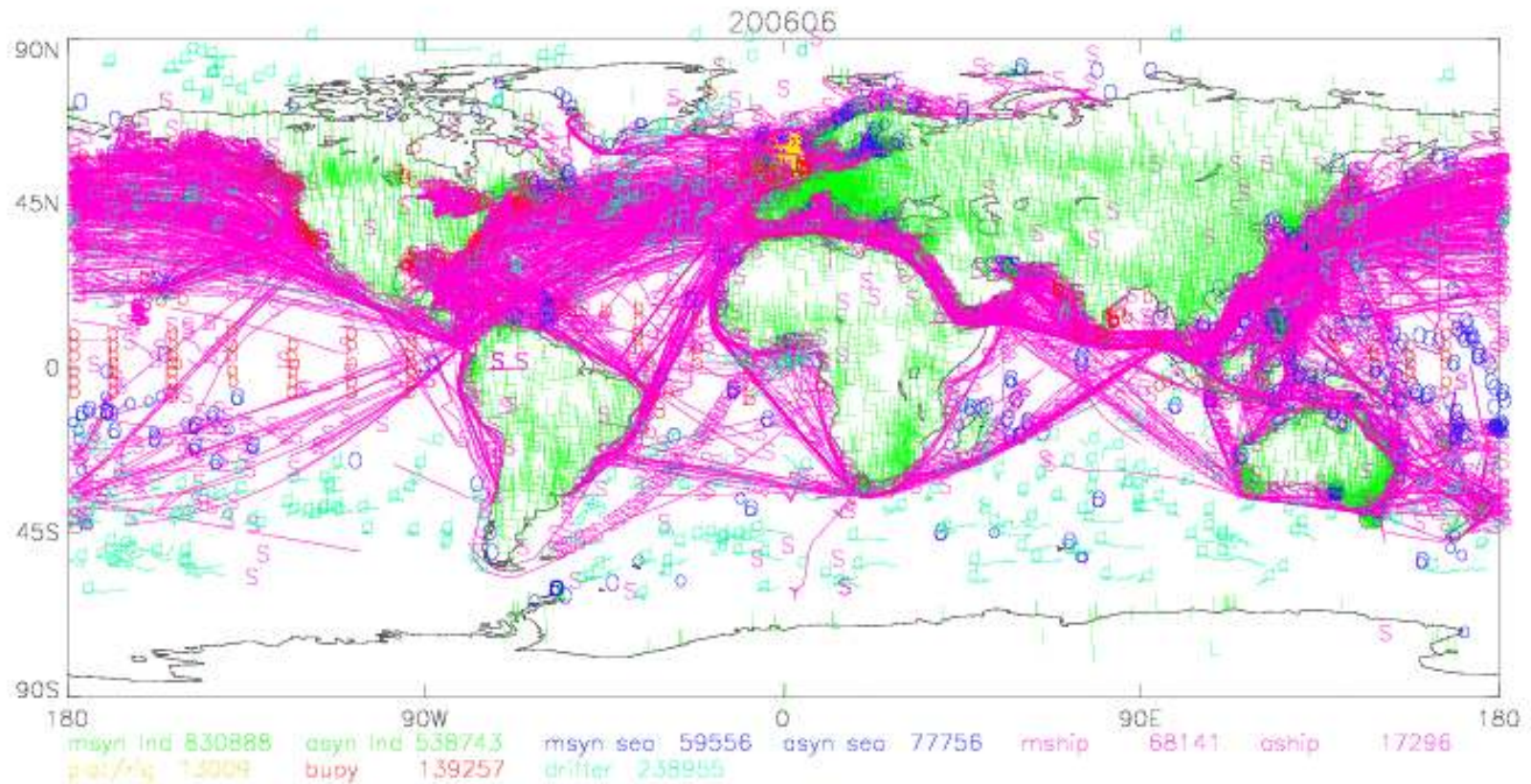
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Introduction



Surface reports June 2006





Typical numbers per 6 hours

- 13000 reports from almost 7000 Synop stations
- 750 Ship reports (2000? active ships)
 - 6% of ships automated – provide 28% of reports
 - Hourly reports vs 6-hourly manual reports
- 1200 reports from 280 moored Buoys
- 2100 reports from 400 Drifters
- Surface based upper-air (for comparison):
TEMP – 600, PILOT – 300, WINPRO – 600
- GB of satellite data! Also aircraft.



Forecast model as reference

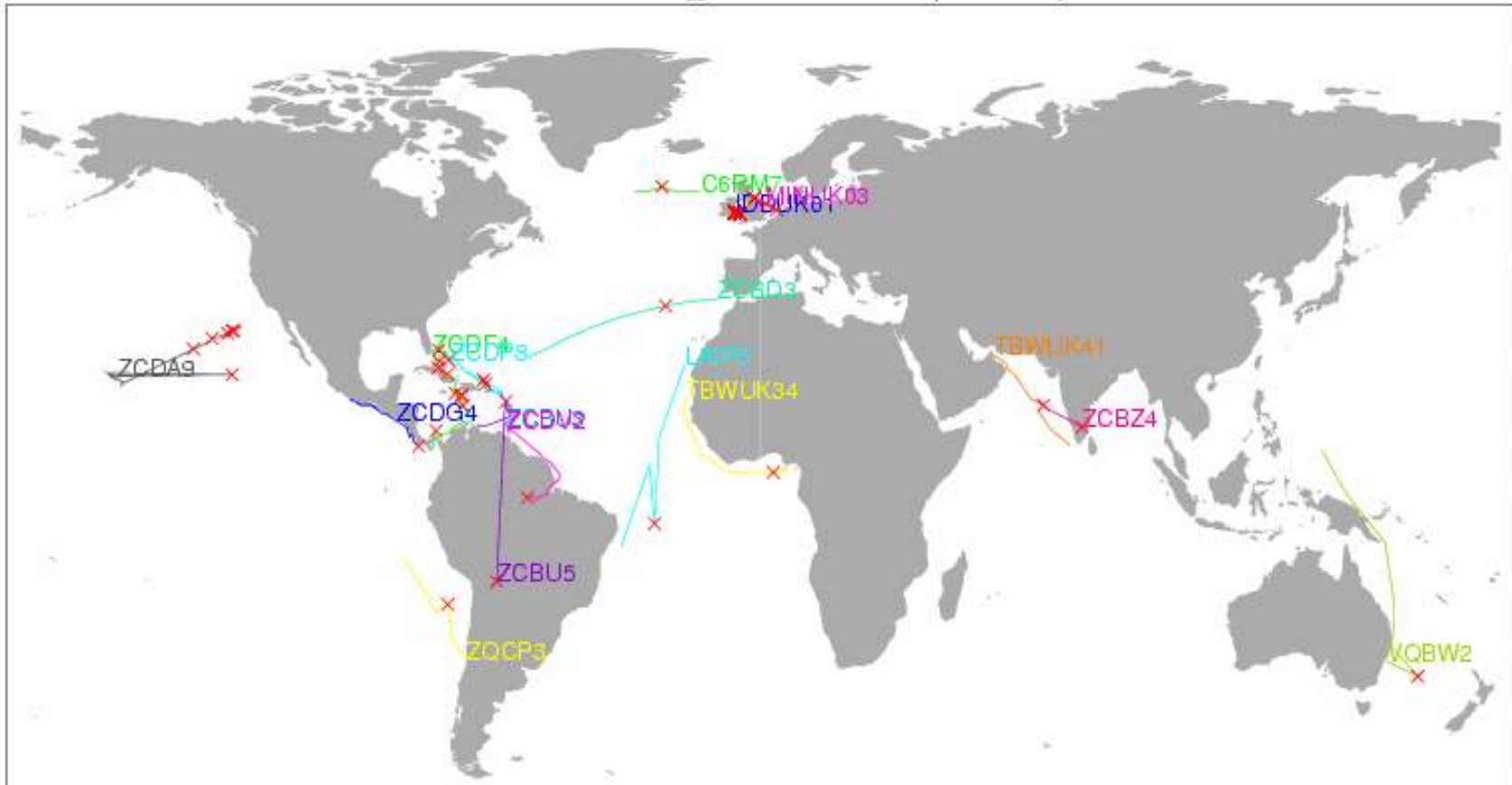
- Results for 2007 and 2008
- Met Office global model: 50 levels * 40 km
 - Now 70 levels * 25 km
- Time interpolation from T+3/6/9 to ob. time
- “Background” used for quality control
 - 15 m/s and 7.5°C threshold in this study
- Forecast has errors/biases
 - Usually similar to observation errors now
- Very useful reference (use full sample not a few collocations)



Position errors – an old problem

N

All track errors 20100316_20100322 17 ships 86 rejections



Mainly a problem with manual reports. Sometimes automated systems use old GPS position. Feedback to GB recruited ships (shown) has recently reduced errors.



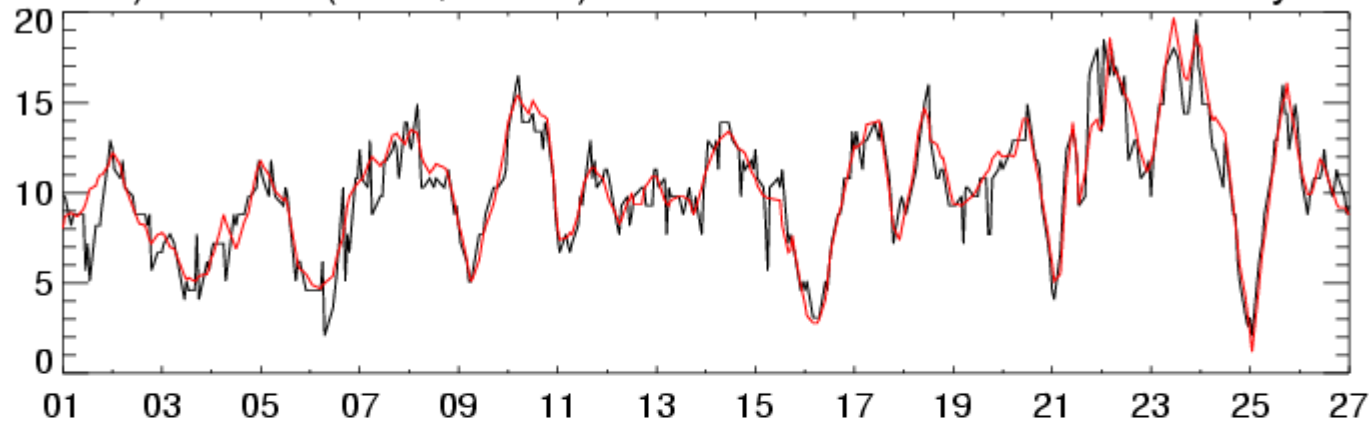
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Ship and buoy wind speeds



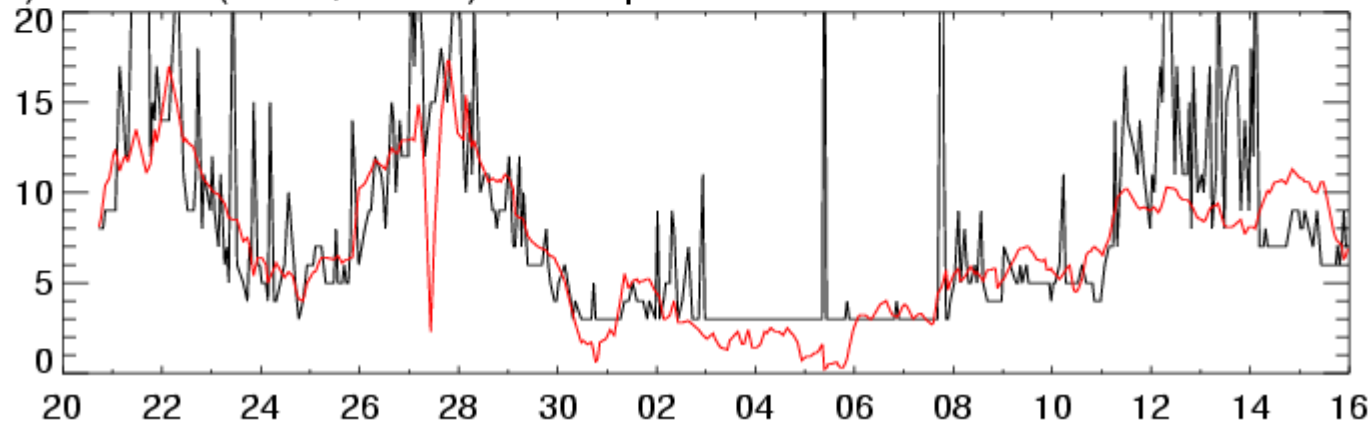
Buoy wind speed vs forecast

a) 48400 (50.1, -144.9) 1-26 October 2008. Moored buoy.



Good agreement between moored buoy (black) and background (red)

b) 41591 (18.8, 125.7) 20 Sept - 15 Oct 2008. Drifter acoustic winds



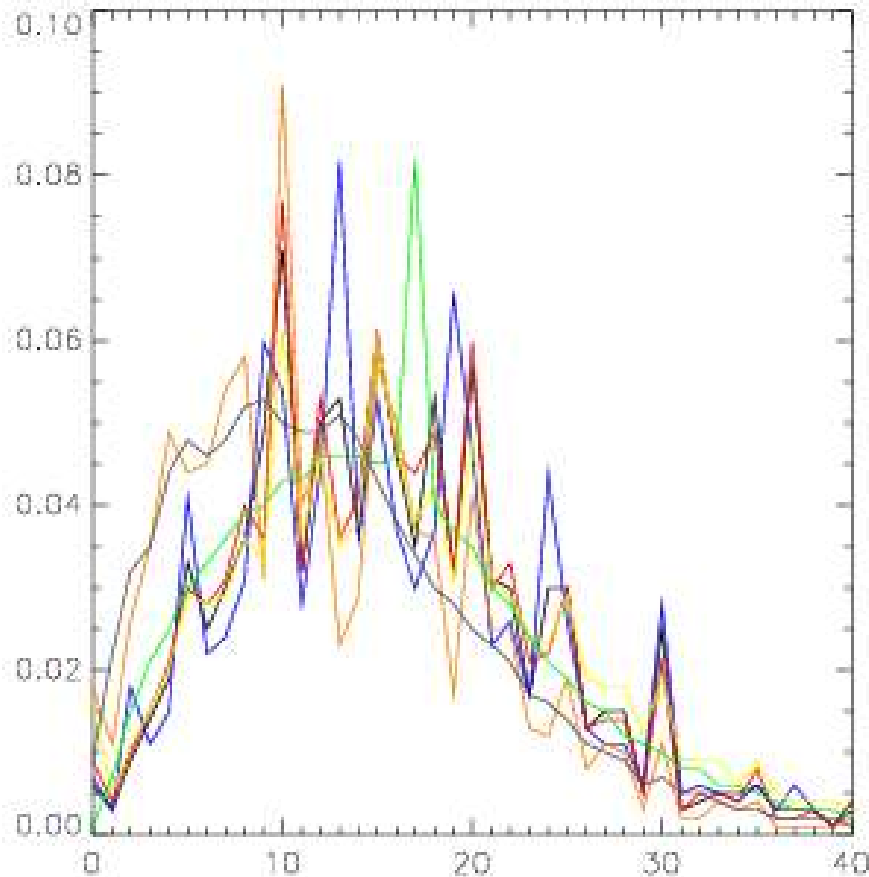
Quality issues with drifter winds – not assimilated.

Alternative technologies being explored

(Niiler)



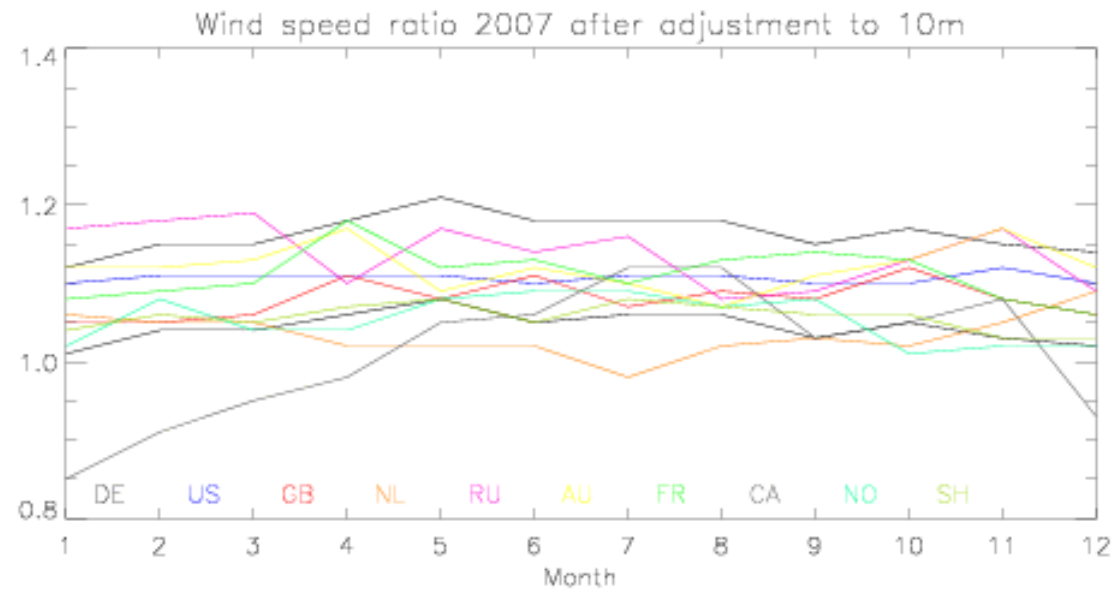
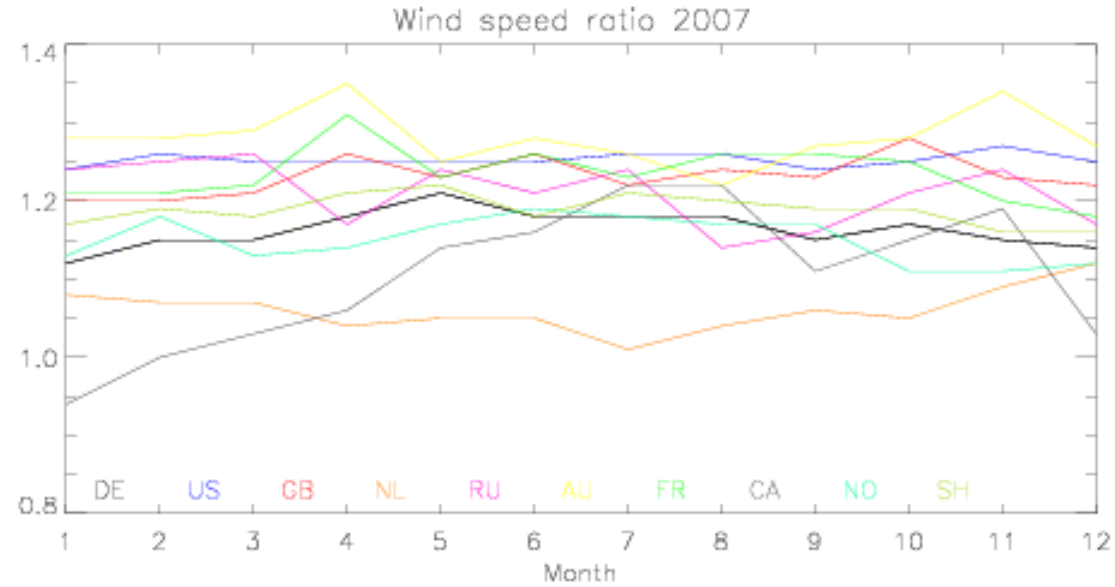
Rounding of ship winds



- Unadjusted speeds (in knots) by country
- Rounding to nearest 5 or 10 – auto better
- Too many calm winds? – worse for Synops, anemometer friction etc
- Resolution (1 knot or 1 m/s) a bit coarse



Wind speed O/B by country





Measured/Estimated winds

- 70% of winds now measured
- 80% of Dutch winds still estimated – lower proportions from GB, US, DE
- Many ‘estimated’ winds (except Dutch) appear to be influenced by anemometer readings (Thomas et al, 2008, IJC) – adjust to 10m
- Canada: many automated reports near to coast, seasonal cycle in bias?
- France: many automated reports (Batos) – generally good quality
- Distance from coast important – new field



CoastDist field (10 km res.)

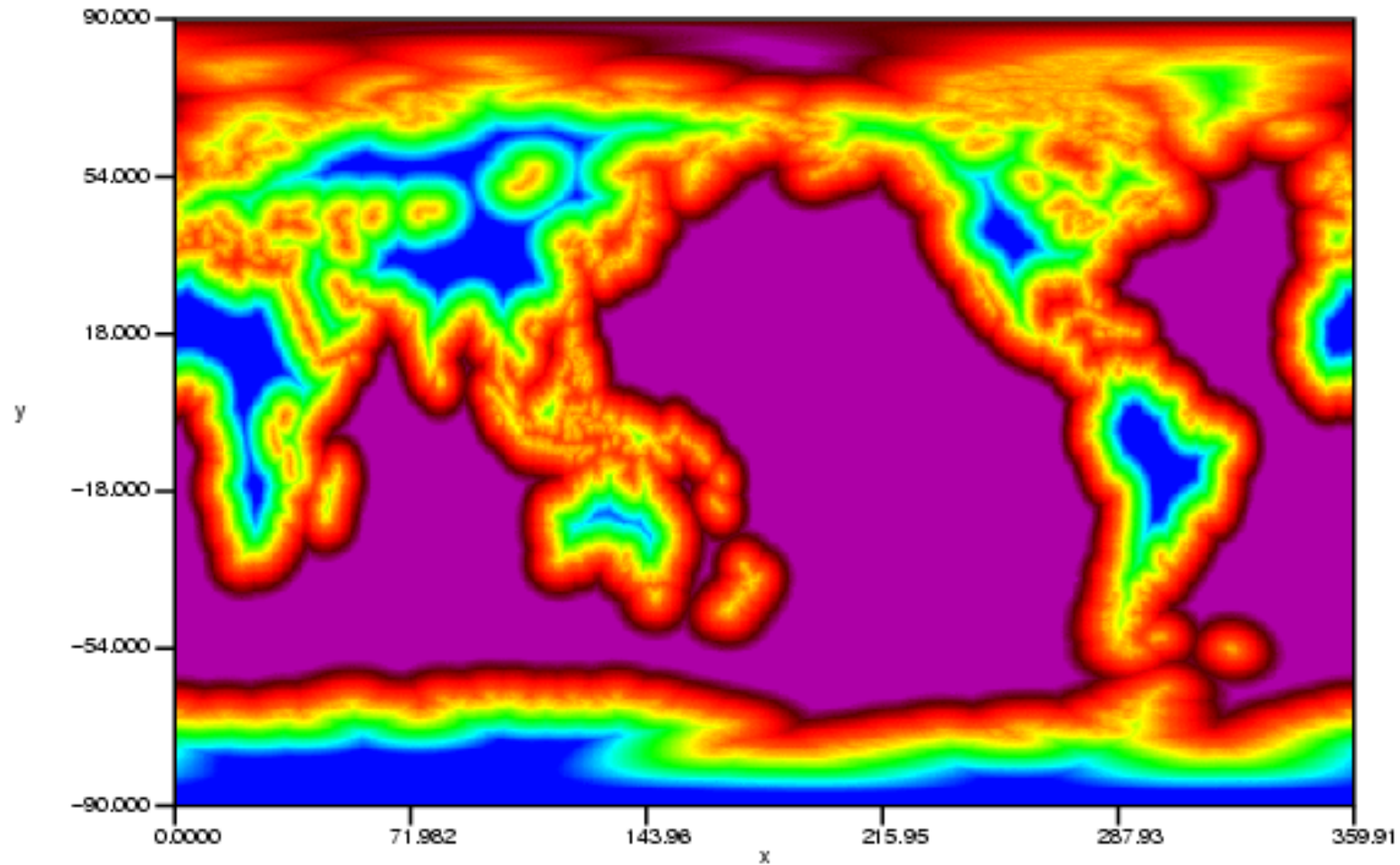
Unified Model Output(Vn 7.2): Stash code = 44011

x: longitude (degrees_east)

y: latitude (degrees_north)

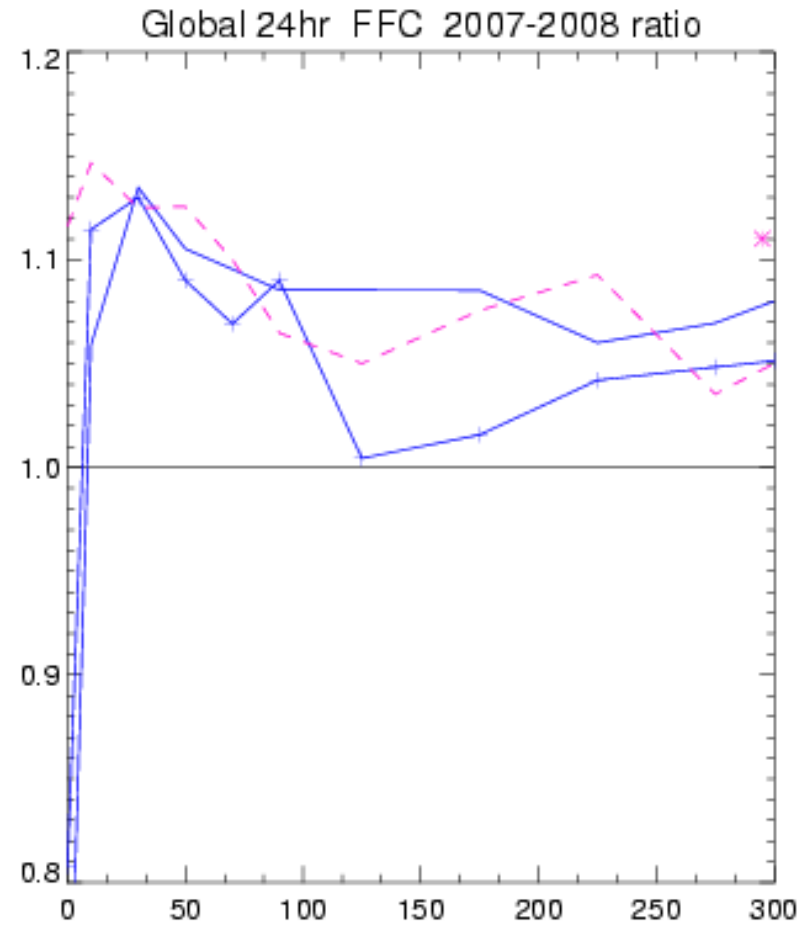
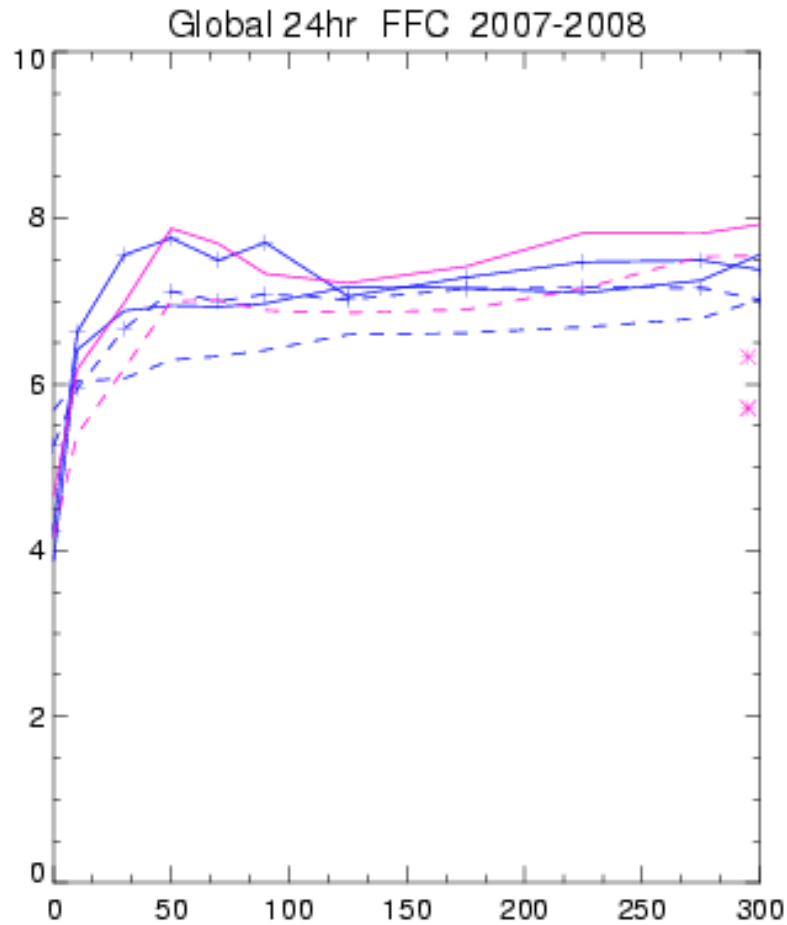
z: surface 0.0 (level)

t: date / 1 0000/01/01 00.00 / 0.000000 (days since 0000-01-01 00:00:00)





Speed vs distance from coast





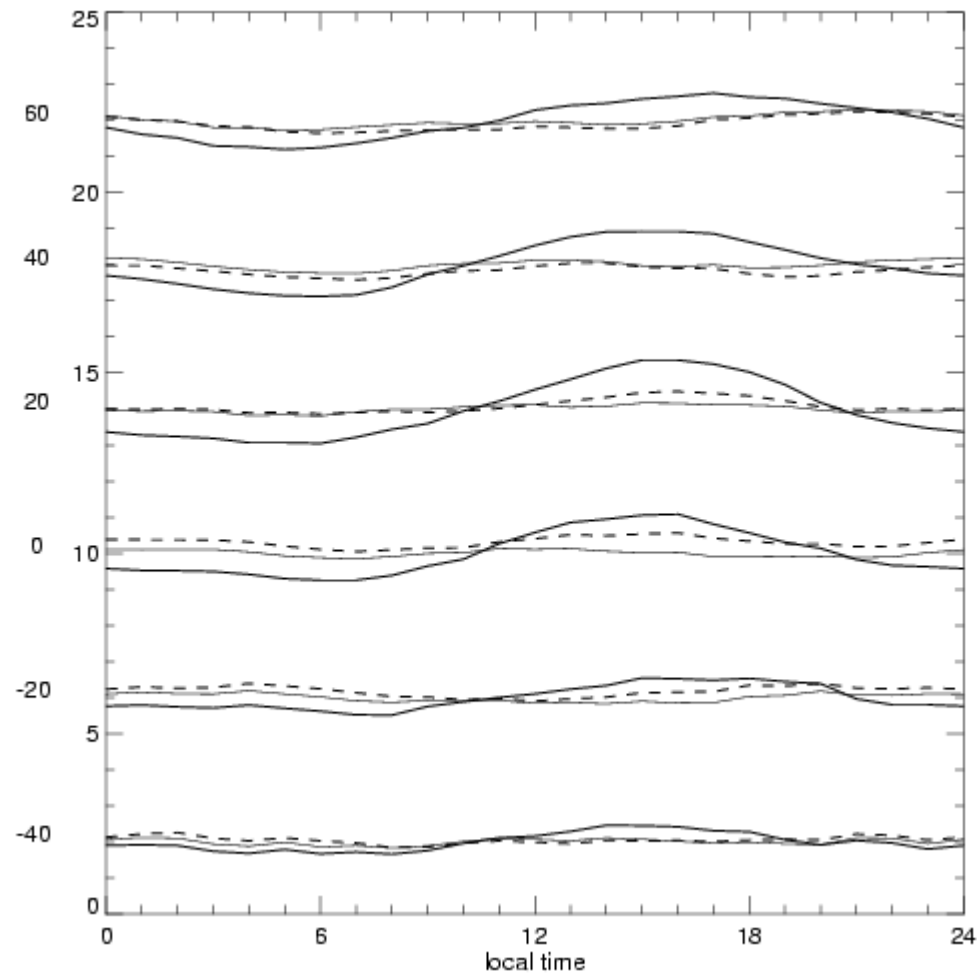
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Temperature data

Diurnal heating and Arctic buoys



Solar heating - ships



- Ship T (6 hour smoothing) June 2007 by lat. band. Manual reports with cloud
- Dashed - background
- Thin – after Berry et al correction: improves mean, rms hardly improves
- Mainly heating of ship body – buoys OK
- Ship_auto bias and rms better than ship_manual. Better exposed sensors, further from bridge.

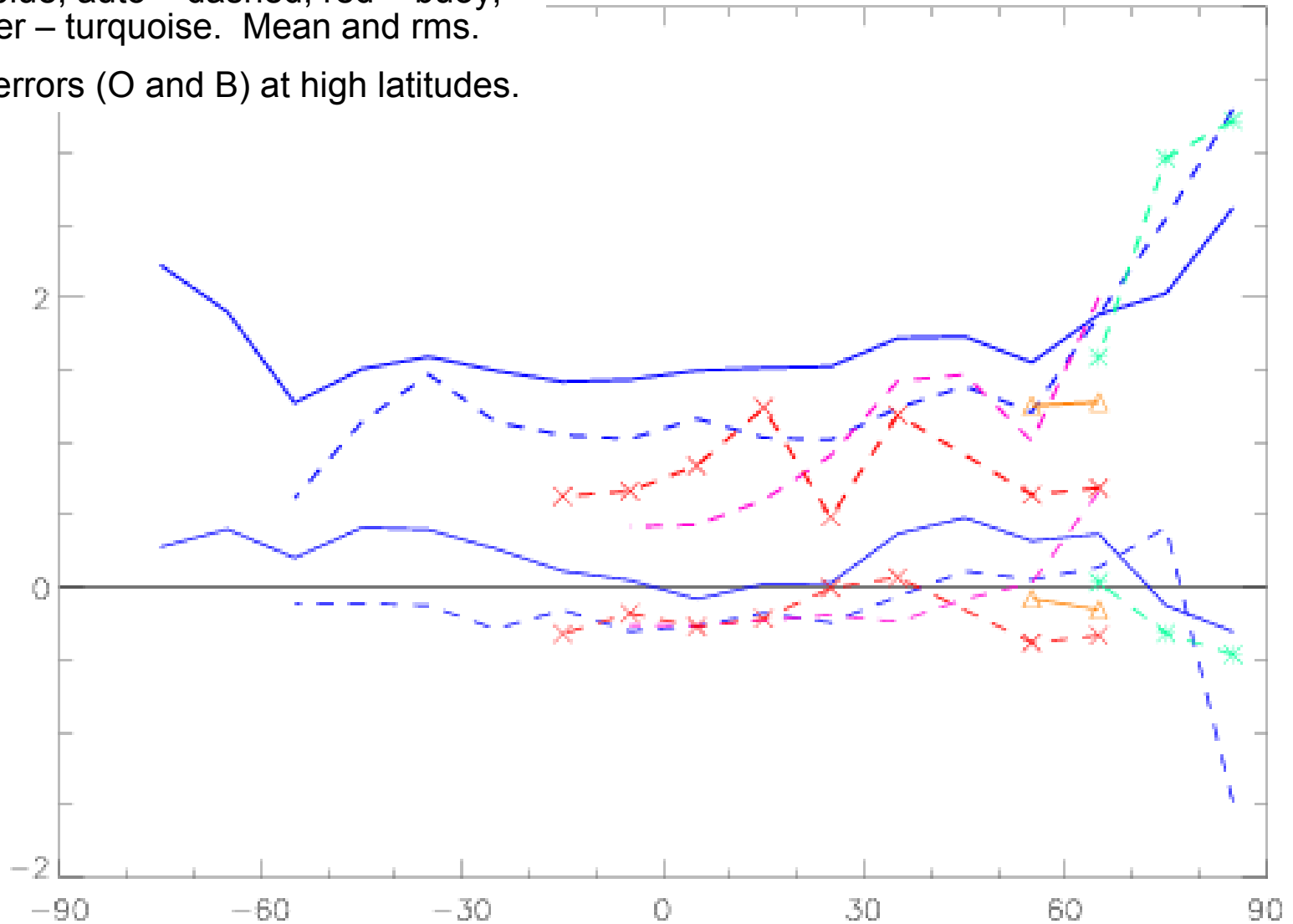


T (O-B) vs latitude

M Ship – blue, auto – dashed, red – buoy, ice drifter – turquoise. Mean and rms.

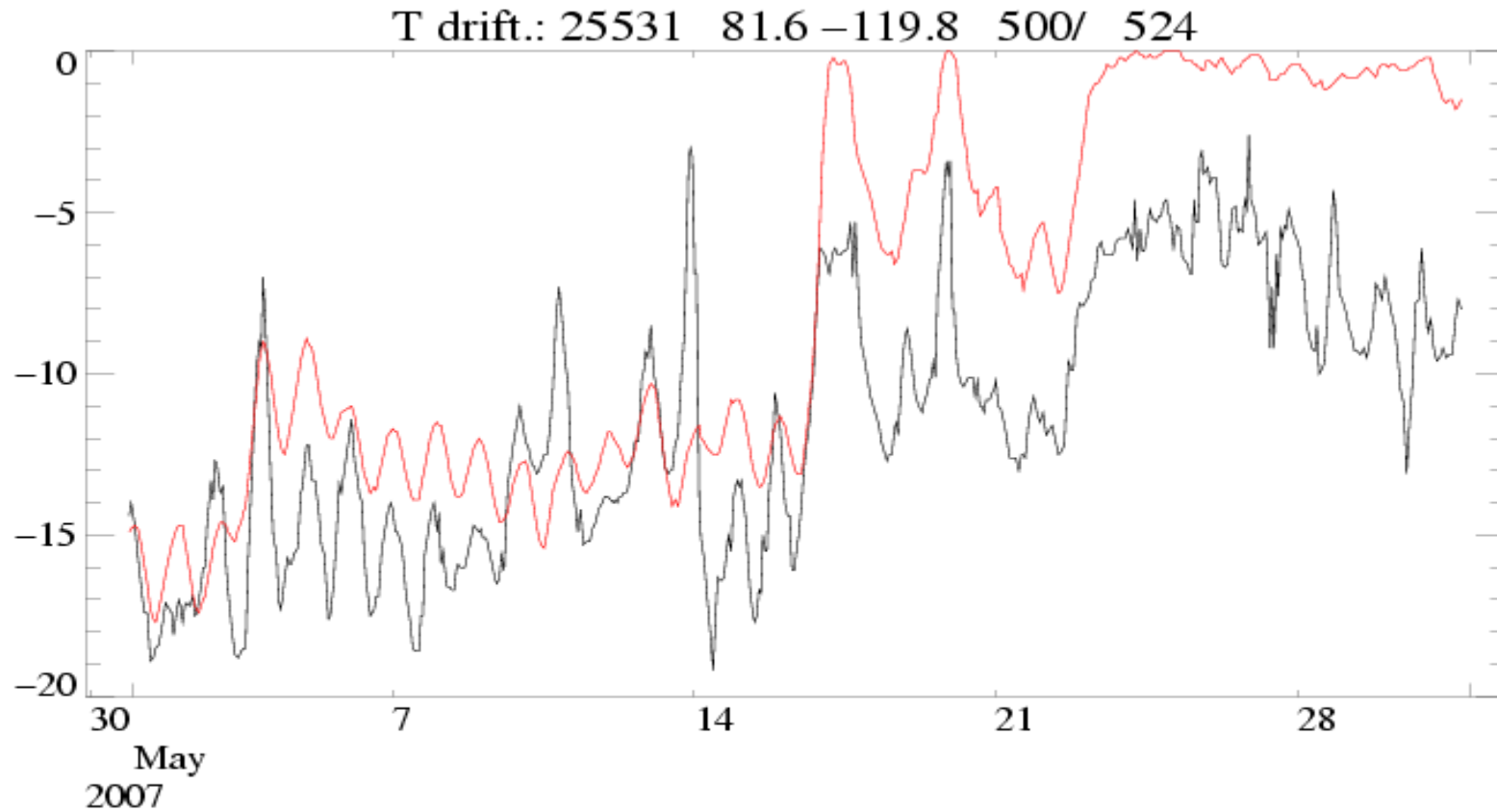
T7 2007–2008

Larger errors (O and B) at high latitudes.





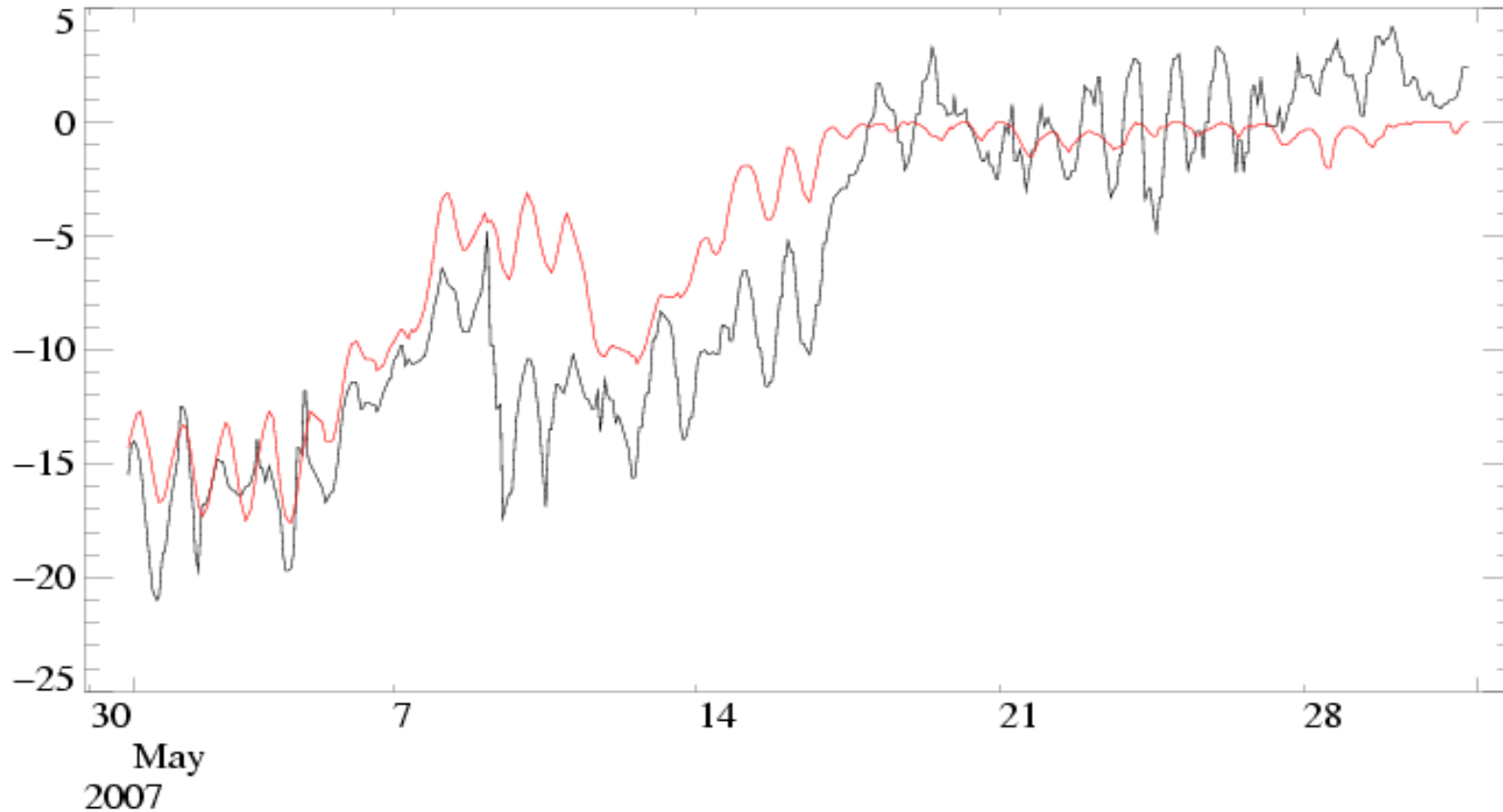
Arctic buoy (black), Model (red) thaws too soon





Another Arctic buoy, diurnal cycle too large?

T drift.: 48624 75.7 -158.0 433/ 434





Data assimilation improvements

And operational issues



Met Office DA improvements

- April 2008: started assimilation of Tair and RH from ships/buoys (already used P, wind)
- March 2010: tighter QC and better adjustment of winds to 10m, also started assimilation of Arctic buoy Tair
 - Background winds 6-10% too weak
 - T/RH/wind worse comparison near coast - exclude
 - Minor improvements to forecasts
- Weekly standalone track check – feedback to data producers (GB VOS)
- Regular monitoring at <http://research.metoffice.gov.uk/research/nwp/observations/monitoring/marine/index.html>



Operational issues

- Ship metadata: WMO Pub 47 not updated recently
- E-SURFMAR list updated monthly (covers about half global VOS)
- Masked call signs – need to know decode
- Suggested check against previous position in TurboWin software – always better to avoid/fix errors at source
- Change to BUFR codes by 2012 – challenges and opportunities



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Summary



Summary

- Trends towards bigger ships, more automation
- Automated reports generally better than manual
 - Avoid silly typing errors and most position errors
 - T and humidity generally better exposed
 - Most 'visual' winds seem to measured (except NL)
- Moored buoy data mainly very good
 - Under reading of very strong winds
- Drifting buoy SST and Pmsl mostly good
 - The few drifter winds are poor quality
- More details: Ingleby (2010) JTech, accepted



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Questions and answers