

## 4<sup>th</sup> Workshop of the Diurnal Variability Working Group

Chair:	C J Merchant	Edinburgh, UK
Members attending:	S Castro	Boulder, US
	G Wick	Boulder, US
	C Gentemann	RSS, US
	P Minnett	Miami, US
	S Lavender	Argans, UK
	J Stark	Met Office, UK
	D Poulter	NOCS, UK
	W Wimmer	NOCS, UK
	P Le Borgne	Meteo-France, Fr
Guests attending:	H Beggs	Bluelink, Aus
	G Corlett	Leicester, UK
	C Donlon	Met Office, UK
	K Casey	NOAA, US

Held prior to and during the ASLO 2008 conference, Orlando, FL.

### Highlight

Three partners in the GHRSSST/DVWG are planning experimental hourly analyses of ocean surface diurnal variability within the next two years. These new products will benefit from the significant progress (recent and ongoing) in fast physical and novel statistical models of diurnal warming.

### Meeting summary

#### Day 1:

#### Update presentations from group members on progress on DV science

GW & SC:

GW reported progress on reconciling modified Kantha-Clayson model of near surface with cruise data at different wind regimes, by blending a background convective mixing term across a wind speed boundary of 2 m/s. Biases much improved in model-obs comparisons, although RMS remains 1 K. GW and SC have embarked on experiments in synthesising look-up tables in terms of wind and insolation parameters, with two objectives highly relevant to DVWG's goals: to identify theoretically the most efficient simple predictors; as a step towards reconciling physical models and satellite measurements on a statistical basis (can physical models driven with realistic fields and appropriate errors recreate LUTs consistent with observations?).

MF:

Presented statistics of a LUT based on >2 years of SEVIRI observations, stratified by hour since foundation, wind speed and integrated net surface solar irradiance, sourced from MW winds and SEVIRI SSI respectively. LUT gives an unbiased mean DV estimate in a global sense, and a SD that is linear in predicted warming. Locally, LUT is unbiased except near some coasts and Gulf of Guinea, for reasons not yet determined.

JS:

Showed results from relaxing thresholds in the OSTIA analysis that operationally screening out potentially diurnally affected SST observations, using MF's LUT to correct of DV of the ~30% increase in data. Impact is essentially neutral, which suggests: LUT is successful in reducing scatter in extra DV-affected observations; but since extra observations only lead to a 6% increase in coverage (the obs tending to be where night time obs are also available), overall impact on analysis is not large. May be able

to look more carefully by targeting analysis-error analysis on areas where coverage is increased by additional data. A twin experiment with a perfect forward model to explore if analysis is improvable in principle was also suggested, as was an experiment synthesising the situation with only polar observing platforms available (where use of day time observations may be more critical) – the latter being highly relevant to whether DV is important in the OSTIA re-analysis back to 1985 that is planned.

CM:

Showed an alternative formulation of a statistical model for DV in the ALADIN+ domain that is constrained to give the correct overall DV distribution. Of particular note: this empirical model can capture events that surpass 3 K, which is highly relevant to the Mediterranean in particular. Model is based on hourly curves that relate DV amplitude to the maximum wind since 0900 h. Qualitative features are comparable to full model results.

DP:

Previewed poster showing DV events in the GHRSSST DDS.

## **Day 2:**

### **Break-out working and discussions**

- DP, PLB
  - freq. distributions of DSST, U in DDS & Aladin+
- GW, SC, MF
  - LUTs, formulations, testing, comparisons
- CG
  - POSH into Aladin+
- FW, DP, PLB
  - Aladin+ cf DDS and ISAR DV events
- CM, HB, PLB
  - Plans for hi-res data set in tropical Australian waters
- CM
  - Refine empirical model for ALADIN+ domain
- JS, HB
  - Intercomparison of analysis DV experiments

### **Additional presentations**

HB:

Use of MF's LUT in RAMSAA has a beneficial effect on observations-analysis bias and neutral effect on RMS despite significant day-time data input.

GC:

Using ECMWF or Met Office winds to separate low (DV) and high (no DV) cases in ATSR MDB gives remarkably different results, for reasons not clear.

### **Feedback presentations & discussion**

DP:

Examples of DDS locations that display credible DV distributions.

CM:

Showed results of trying empirical model formulation with wind fields other than ALADIN; technique also seems to work with ECMWF, less convincing using nearest microwave winds.

The analysis experiments of JS and HB are important tests of the principle of using daytime observations for foundation SST analysis. Discussion led to proposals for several further experiments to explore

whether LUT or DV models are improving RMS(obs-analysis) of the additional data stream. Because of bias correction procedures in analyses, it may be difficult to interpret impacts of DV models on bias.

Significant progress to narrowing the gaps between physical models, in situ observations and satellite observations. By Perros GHRSSST (June 2008) should be in a position to define an exercise for inter-comparison of full models (GOTM, MKC), fast models (ZB, POSH) and empirical models (sensor-specific curves, SEVIRI LUT, max-wind).

MISST, Meteo France and Bluelink all plan experimental DV hourly analysis experiments. Work towards these will be starting around time of 5<sup>th</sup> Workshop.

Agreed on a half-day DV session at GHRSSST-9 and 5<sup>th</sup> workshop in the interval Dec 08 to Mar 09, either Europe or Caribbean.

### **Closing “open” workshop session (during ASLO conference)**

The closing session of the DVWG 4<sup>th</sup> meeting was an open session, advertised at the conference session 105 (on Diurnal Variability in the Surface Ocean and in Air-Sea Interaction, chaired by CM and Carol-Anne Clayson). 30+ scientists attended, including many not previously associated with GHRSSST. The session was lively with ideas and debate.

### INTRODUCTION

CM:

Introduced the terms of reference and approaches of the DVWG.

### REPORTS OF SCIENCE PROGRESS DURING WORKSHOP

GW:

Showed progress on the objective of linking full physical modelling with statistical LUTs, by identifying that realistic hourly variability in wind and other variables forcing the full models is essential to creating a realistic synthetic LUT.

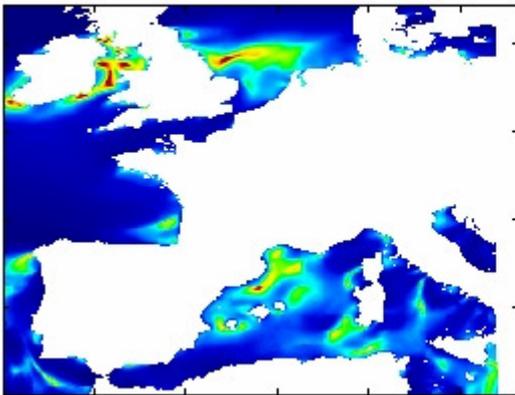
SL:

Outlined plans for exploring ocean colour-DV relationships using the ALADIN+ data set (which is now augmented by GlobColour products).

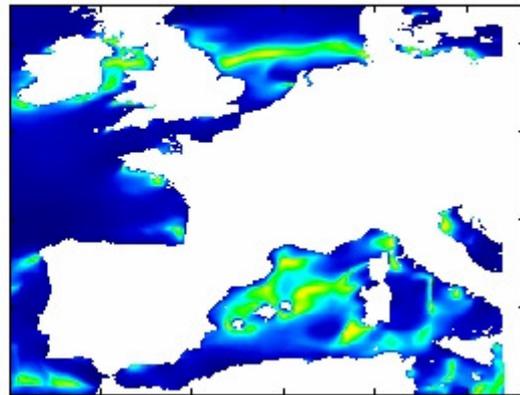
CG:

Showed comparisons between 7 different models (physical and statistical) of diurnal variability applied to a test day (17/7/6). Included was the first run of the new fast model POSH over an area image. CG will add evaluations of all 7 models on ALADIN+, augmented by runs of other models by other members (CM, GW, MF).

POSH



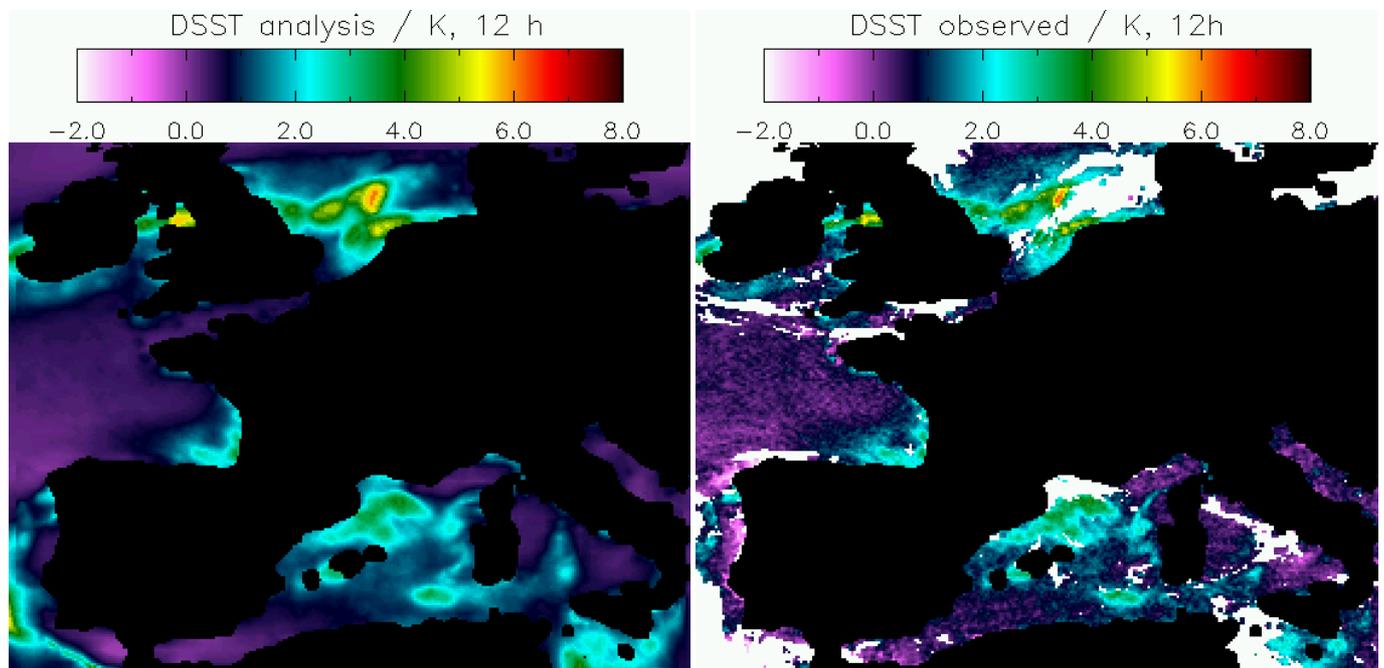
CG04



Above: Comparison of fast model (POSH) with statistical model (Gentemann, 2004). In common with most statistical models CG04 underestimates peak warming (yellow = 3°C warming) compared to the POSH model, which, with peak warming in excess of 4°C is more realistic compared to the matching SEVIRI observation (right panel below).

CM:

In the light of the move towards hourly DSST analysis, CM presented a toy implementation of a DSST analysis for 17/7/6 in the ALADIN+ data set. The method was to update the ECMWF wind field with wind minima inferred from SEVIRI DSST observations, and then derive a spatially complete hourly DSST analysis from the corrected wind field (below). Hourly DSST analysis was found to be convincing and effective using the hourly observations of SEVIRI, and future experiments will explore the effectiveness of the approach where data are sparser in time. Interestingly, the technique outputs a revised surface wind field as a by product.



Above: Left, first spatially complete hourly DSST analysis based on a ‘toy’ optimal interpolation of ECMWF and SEVIRI-DSST-derived winds. Right, corresponding SEVIRI-observed DSST for the same hour.

## DISCUSSIONS

HB: briefly presented plans for a Tropical Warm Pool Diurnal Variability data set developed along the lines of ALADIN+. HB showed examples of why diurnal warming of the waters to the north of Australia is significant for analysis and may not be adequately understood at present.

DP: showed strikingly different outcomes of diurnal warming analysis tool newly incorporated into the Diagnostic Data Set facility of GHRSSST. Clearly made point that DSST is very different at different locations and that DDS can be used to explore that.