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Ocean Science Discussions

Interactive comment on "Effects of the 2003 European heatwave on the Central Mediterranean Sea surface layer: a numerical simulation" *by* A. Olita et al.

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General comments

I have had some difficulties in reading this paper because it's not clear what is its aim. Is it a study on the effects of the 2003 heat-wave on the surface ocean? Is it a test on a high resolution circulation model when extreme events occur? Is it an investigation on the anomalous sea surface warming during 2003 summer?

The title suggests that the goal is to investigate the effects of the 2003 European heat-wave on the Mediterranean Sea surface layer by means of a numerical simulation. To do this, the Authors use a high resolution circulation model applied over the Sicily Channel region. The model runs for 5 years using as input the atmospheric data ob-

tained by the ECMWF operational analysis from January 2000 to December 2004. The Authors devote a large section for describing the variability of the surface forcing parameters by using both Fourier Transform(FT) and the Continuous Wavelet Transform (CWT).

However, in my opinion, this work is not a good test of an high resolution model circulation in a critical region under significant variations of the atmospheric forcing because the tests are few and incomplete, does not give information on the effects of the heatwave on the surface circulation because the results are not supported by observations nor gives any new contribution to the knowledge of the 2003 anomalous sea surface warming because the mechanisms that generate this anomaly are not well discussed. At least, it may be a good exercise to show the advantages in the joint use of FT and CWT analysis, but nothing else.

Thus, in order to improve their paper, I suggest that the Authors focus better the subject and enlarge the comparison with the observations.

Specific comments

The results obtained by the model show SST anomalies and modifications in the circulation of the sub-surface currents as well as in the coastal upwelling. However, these results are questionable because they are not well supported.

Particularly, the skill of the model under this extreme condition has to be demonstrated. On the contrary, notwithstanding in the Introduction the Authors write that in situ measurements will be used, any test is performed on the layers below the surface and the only validation is a comparison between the computed SST and the monthly mean AVHRR Ocean Pathfinder SST data. This is insufficient for validating the model and its outcomes when extreme events occur, especially because the Authors use in their analysis the computed daily values.

Furthermore, although the agreement between the computed and the satellite monthly

OSD

3, S39–S42, 2006

EGU

mean SST is generally good, the results of this comparison shows that the model skill decreases during the period affected by the heat-wave. The Authors suggest that this could be due to the relaxation term in the computation of the heat fluxes, but they do not support this conclusion with any effective arguments.

The obtained disagreement may be not particularly significant from a numerical point of view, but it becomes important if we want to use this model to analyse the effects due to the 2003 heat-wave because it indicates that the used parametrizations might be not able to correctly simulate the phenomenology under this specific condition. Thus, having doubts on the model performances when the heat-wave occurs and lacking any reference to, or comparison with, in situ observations, the conclusions obtained for the sub-surface layers during 2003 summer are questionable.

Taking into account the anomalies in the input parameters, the SST produced by the model shows a surface warming during 2003 summer as it could be easily expected. This result leads the Authors to conclude that the high sea surface temperatures recorded during that summer were due to the low wind and the high air temperature. This conclusion is not original. The paper adds nothing to what is already known. It does not explain how and why these factors contribute to the warming of the sea surface.

Additionally, the inter-annual variability of the surface atmospheric and sea parameters is analysed by using an approach based on a joint use of FT and CWT analysis. This method is the most interesting aspect of the paper. Nevertheless, the time series are too short for a significant study of the inter-annual variability. Analogously for what concerns the analysis on the heat fluxes variability.

Furthermore, this analysis shows the easily predictable anomalies of the air-sea fluxes, but it does not put in evidence how these contribute to the development of the anomalous warming of the sea surface as response to the heat-wave event.

Minor comments

OSD

3, S39–S42, 2006

The Introduction should be reduced. Perhaps the Authors do not quoted some papers that have been already published on the 2003 anomalous warming of the Mediterranean sea surface (Sparnocchia et. al, Ann. Geoph., 2006, Marullo et al, Energia, Ambiente e Innovazione, 2003.)

Pag 87 -20: It is necessary a better description of the three-layer system.

Some statements are banality. In particular: Page 99 row 5: at the latitude of the Sicily Channel it's normal to observe the strong seasonal variability of the solar radiation and its minumum in the period between January and February; Page 99 row 12: it's normal that the upward heat fluxes strongly depend on air temperature and wind. Even more so when they are computed by empirical equations.

Interactive comment on Ocean Sci. Discuss., 3, 85, 2006.