# Review manuscript acp-2011-823 "Continuous detection and characterization of the sea breeze in clear sky conditions using Meteosat Second Generation"

by Lensky and Dayan

## **General comments**

This short study takes advantage of the continuous MSG thermal infrared data and field measurements in Israel to detect and characterize the sea-breeze (SB) in clear sky conditions during summer. Three different synoptic circulations are investigated (Weak Persian Trough WPT, High to the West HW and Deep Persian Trough DPT). An iterative algorithm is used to maximize the correlation between the measurements from the in-situ weather stations and the MSG brightness temperature (BT). Significant correlation is found (0.75) for WPT and HW synoptic situation (with weak large-scale horizontal pressure gradient), whereas the correlation is lower (0.5) for DPT. This method thus enables detection and timing of the SB over regions where clouds and field measurements are scarce, and is applicable worldwide.

The identification of the SB propagation and inland penetration in cloud-free situation is a real issue for fundamental studies but also real-time monitoring for air quality survey issues. This short article presents a method taking advantage of the geostationary MSG thermal infrared measurements which allows the determination of the SB penetration. This method complements the already existing methods which use cloud detection from satellite data to identify the SB front. This article is well written and concise but does not give enough detail on the methodology and its limits. There is no discussion about the expected uncertainty of the SB timing and penetration estimation. There is also no discussion about possible false alarm events (the method is based on surface temperature information which is not always associated with observable sea-breeze circulation, as for instance in the presence of sustained onshore synoptic flow). The calibration of the method is questionable at this stage and much care must be given to clarify the approach.

In conclusion, this short article contains information of sufficient originality to deserve publication in the Atmospheric Chemistry and Physics journal but after addressing my general and specific comments (see hereafter). I consider that significant additional work and major revision are needed before considering publication. In case this article goes through the reviewing process, I would be willing to review this paper again.

#### **Specific comments**

## Methodology

The use of in-situ surface measurements is an old and robust approach to investigate and characterize sea-breeze circulation. The fact that the threshold used to detect the sea-breeze from the surface stations are determined by an iterative process which includes MSG BT measurement is rather curious. This approach necessarily assumes a priori that the MSG measurement can produce reliable information on SB. The fact that a correlation exists between the threshold in-situ measurements and the MSG measurements is thus trivial if I understand correctly (since maximum correlation is sought). The question is then, are the final threshold still suited to investigate the sea-breeze? I think the authors should spend more time to detail the methodology, and especially the reference criteria which allows the identification of the sea-breeze and the MSG calibration based on this reference data.

The method also relies on BT anomaly at one pixel. There is no consideration of land/sea thermal contrast. Would there be any situation where the main signal is over the sea and not over the land?

## Uncertainty issues

There is no discussion about the uncertainty of the estimation of the SB timing. Above what value of the BT anomaly (instantaneous BT measurement with respect to the BT climatology) is the SB timing estimate reliable?

The authors do not discuss the uncertainty on the estimation of the SB inland range. Is it the MSG horizontal resolution? Is there any smoothing window which partly correlates adjacent pixels?

The surface weather stations used to validate/calibrate the method are located within a 100 km size area (Fig. 1) which is the typical length scale of sea-breeze circulation (typical Rossby deformation radius; see Rotunno, 1983; Drobinski and Dubos, 2009). Do the authors think the surface measurements to be sufficiently independent to consider the calibration of the method applicable to other parts of the word (as shown in the last figure)?

## Generalization of the results

In this article, only three synoptic situations are investigated. Independent of the synoptic conditions, how often does the MSG retrieval provide SB false alarm? In other words, a thermal gradient does not imply necessarily a sea breeze circulation. Synoptic flow can "hide" the breeze flow (sustained onshore wind for instance; see Estoque, 1062; Arritt, 1993).

Would there be any possibility to test the method against measurements collected in field campaigns in the Mediterranean area (Milan et al., 1996; Zerefos et al., 2002; Lelieveld et al., 2002; Drobinski et al., 2007; at least comparison with published information on SB penetration and timing)?

The use of only few days in July 2010 is rather frustrating to discuss the reproducibility of the method. With a geostationary satellite in space for several years, one could expect a systematic evaluation of the method to discuss in depth its limits (calibration issues, false alarms, uncertainty). I think the extension of the dataset used for calibration/evaluation would be of very large value to give more confidence on the robustness of the method.

## **Suggested references**

Arritt R.W., 1993: Effects of the large-scale flow on characteristics features of the sea breeze. J. Appl. Meteorol., 32, 116–125.

Drobinski P., Dubos T., 2009: Linear Breeze scaling: from large-scale land/sea-breezes to mesoscale inland breezes. Q. J. Roy. Meteorol. Soc., 135, 1766-1775.

Drobinski P. et al., 2007: Regional transport and dilution during high pollution episodes in southern France: summary of findings from the ESCOMPTE experiment. J. Geophys. Res., 112, D13105, doi:10.1029/2006JD007494.

Lelieveld J., et al., 2002: Global air pollution crossroads over the Mediterranean. Science, 298, 794-799.

Millan M., Salvador R., Mantilla E., Artinano B., 1996: Meteorology and photochemical air pollution in southern Europe: Experimental results from EC research projects. Atmos. Environ., 30, 1909–1924.

Rotunno R., 1983: On the linear theory of the land, and sea breeze. J. Atmos. Sci., 40, 1999–2009.

Zerefos C.S. et al., 2002: Photochemical activity and solar ultraviolet radiation (PAUR) modulation factors: An overview of the project. J. Geophys. Res., 107(D18), 8134, doi:10.1029/2000JD000134.