

# „Air stability indices derived from satellite data as convection and storm predictors”

Marianne König<sup>1</sup>, Monika Pajek<sup>2</sup>, Piotr Struzik<sup>2</sup>

<sup>1</sup> EUMETSAT, Am Kavalleriesand 31, D-64205 Darmstadt, Germany,

<sup>2</sup> Institute of Meteorology and Water Management, Satellite Research Department, P. Borowego Str.14, 30-215 Krakow, Poland

## I. INTRODUCTION

Detailed storm prediction makes still great troubles in operational activities of forecasting offices. Convection is still not properly predicted, specially area and intensity of convection important for further storm development. Early detection of the unstable air and possible deep convection with use of satellite information may help with operational storm prediction. Atmospheric stability indices are certain solution for nowcasting of deep convection and issuing storm warning with acceptable lead time. Among many possible solution, satellite sounding capabilities and relation between satellite derived air stability indices and storm occurrence are still not completely known and tested. The first results on this topic with use of TOVS/NOAA and SEVIRI/METEOSAT instruments were already presented at EUMETSAT Conferences. Taking into account repetition time, MSG stability products are more interested for continuous observations of air properties and nowcasting applications. More detailed validation studies based on 2005-2007 storm seasons is presented.

## II. PRESENTATION OF RESEARCH

In frame of cooperation between EUMETSAT and IMWM, classic air stability indices: K Index and Lifted Index included in operational GII MPEF product (Global Instability Indices) were tested. Local processing of those indices with full SEVIRI resolution were tested. Relation between estimated air stability and storm development in following hours were analysed, taking into account area of convection development and storm intensity. Area of Poland used for this analysis suffers from great many storms since April to September with highest storm activity in May to August period. Satellite GII products for storm season of 2005-2007 were compared against convection development observed on satellite images and lightning detection as an indicator of storm occurrence. The results were statistically analysed.

The satellite retrieved GII requires data from NWP model for first guess atmospheric profiles. Therefore, it is interesting to investigate the possible influence of individual model data for final results of the GII product and possible propagation of model information through the GII processing scheme. For this purpose selected case studies were analysed with use of different NWP models results as input data, both ECMWF used for creation of operational product and other models used for local installations of GII retrieval software e.g. ALADIN.

Results of investigations and validation studies are presented together with the issue of the spatial resolution of the GII product. Selected case studies of both unstable and very stable conditions were presented in details. Quality of storm predictions based on air stability retrieved from satellite data were analysed for whole storm seasons using classical indexes from contingency table.

## III. RESULTS AND CONCLUSIONS

There is lack of perfect tool for determination of storm initiation area but stability indices are certain solution. Both unstable air presence and its dynamical changes are used as storm predictors.

MPEF GII product gives very promising results. Important 15 min sampling. Spatial resolution 15x15 SEVIRI pixel is not sufficient for operational use. Tested better resolutions up to SEVIRI pixel are more efficient specially in case of partial cloud cover.

KI is more sensitive to early instability but shows much larger unstable areas than LI and gives more false alarms. LI gives reasonable information just before convection. More detailed area of possible convection. More missed prediction than KI.

## IV. AKNOWLEDGMENTS

Presented work was done in cooperation between IMWM and EUMETSAT Organization.

## V. REFERENCES

- Koenig M. Pajek M., Struzik P. „Use of MSG Global Instability Indices (GII for Storm Prediction in Poland – Validation Study”, Proc. The 2006 EUMETSAT Meteorological Satellite Conference, Helsinki, Finland, 12-16 June 2006, EUMETSAT 2006, EUM P. 48, 8 pages.
- Struzik P. - „Use of satellite information for early warning and disaster management in Poland – Invited lecture”, 4 Forum Katastrophenvorsorge, German Committee for Disaster Reduction, Munich, 2003, pp. 18-20.
- Struzik P. – “The use of satellite information for storm detection and monitoring”, Contemporary problems of extreme threads for environment, IV Polish School, Jachranka, 28-030.10.2002, IMGW Warszawa, 2002, pp. 163-172 (in Polish),

P. Struzik, „Storm early detection and monitoring with use of satellite data at the IMWM”, The 2004 EUMETSAT Meteorological Satellite Conference, Praha 30.05-4.06.2004, EUMETSAT 2004, EUP-P41 pp. 209-217,

Struzik P. „Information from meteorological satellites In natural disaster state”, Annals of Geomatics, Vol. IV, No.1. Polish Association for Spatial Information, Warszawa 2006, pp. 137-144, (in Polish),