RAPID DEVELOPMENT THUNDERSTORM (RDT)

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ABSTRACT

1. RDT DESCRIPTION

RDT (Rapid Development Thunderstorm) product is an object-oriented diagnostics for convective clouds or cells. RDT is mainly based on satellite data.

RDT software has been developed in the context of Eumetsat's Satellite Application Facility for Nowcasting (SAF/NWC) by the Nowcasting Department of Météo-France. RDT software tracks clouds, identifies those that are convective (discrimination), and provides some descriptive attributes for their dynamics.

2. INPUT DATA

The main and non-optional satellite channel is IR10.8 µm (used for detection, tracking and discrimination). Additionally WV6.2, WV7.3, IR8.7 and IR12.0 µm channels can be used for convective discrimination. Other SAF-NWC products allow to establish a cloud mask (to operate RDT detection only on cloudy areas) and to describe RDT attributes (pressure an temperature at the cloud top, cloud type, CRR convective Rain rate) [Autonès, 2011a].

NWP data can be used to elaborate instability masks, improving the detection of warm systems by RDT. Ground truth is given by lightning detection network (for validation and tuning). Lightning data, if available in real time, greatly contribute to the discrimination of convective systems.

3. USERS

Météo-France is one of the users of RDT MSG data (over western Europe and Africa). RDT is processed over French oversea territories with different satellites: GOES-E for Martinique, Guadeloupe and Guyane, METEOSAT 7 for La Réunion, GOES-W for Tahiti and Wallis et Futuna.

RDT appears as a very satisfying product widely used for Research and Operations, by Météo-France and NWCSAF users. The survey distributed to SAF/NWC users early July 2008 has showed that RDT is mainly used for Research activities (7 answers) and operations for forecasting issues (8). Results are quite the same for the 2010 survey. RDT is used by the French Army (CISMF, *Centre interarmées de soutien météo-océanographique des forces*) over Africa. RDT is the chosen MCS tracking system over the HyMeX domain (hydrological cycle in Mediterranean experiment, http://www.hymex.org/RDT/). RDT has been proposed in various research projects in aeronautical domain**.** The judgment on overall quality of RDT product is very satisfying.

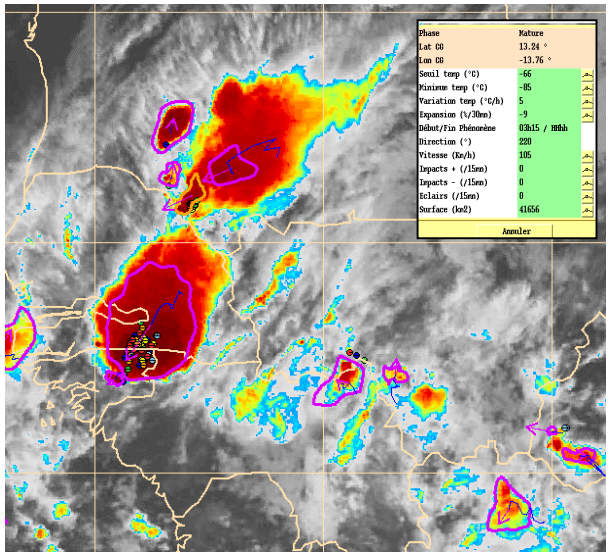

Figure 1: RDT Example. Visualisation through « Synergie » system (Météo-France forecasters' tool): RDT and MSG enhanced IR10.8µm brightness temperature (standard colour enhancement) over West Africa. Mature systems are outlined in purple. Past trajectory of the object in blue and motion vector in purple/. On the upper right part of the image, a gauge that allows forecasters to easily identify characteristic of a system.

4. VERIFICATION

Case studies exhibit a satisfying behaviour of RDT for different kinds of meteorological configurations and for different areas

[Moisselin, 2011a]. An objective validation was conducted in 2011. Results fulfil the target accuracy requirements over a large domain and for summer and intermediate seasons: detection is superior to 70% and finally 25% of convective systems are diagnosed before lightning activity [Autonès, 2011b]

5. EVOLUTION

Next generation of RDT will be developed in the framework of the SAF/NWV CDOP2 (Continuous Development and Operations Phase) period; from 2012 to 2017 [AEMET, 2011]. It will provide more attributes; will prepare the upcoming of MTG Lightning Imager. A nowcasting of RDT systems, up to 1 hour, will be proposed for the 2015 version. Adaptation and tuning to other satellite are also key points for CDOP2. A new product strongly linked to RDT will be developed: convection initiation, which will provide the probability of a satellite pixel to become a thunderstorm.

For the next generation of EUMETSAT satellite, MTG, the Flexible Combined Imager (FCI) FCI instrument is eagerly expected. The number of channels is a crucial point for a quality RDT. In previous years, RDT algorithm always made the most of the increase of the number of channels. The increase of resolution will also be a key point for small-scale phenomena associated with RDT, for example Overshooting Top (OT) [Moisselin, 2011b]

Lightning Imager (LI) instrument is also eagerly expected to improve many components of RDT: statistical scheme (tuning), validation, real time mode, enhancement of characteristics for a more complete description of convection, monitoring.

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