

**UPDATE ON THE SEVERE WEATHER FORECASTING DEMONSTRATION
PROJECT (SWFDP):
Improving Severe Weather Forecasting and Warning Services
in Developing Countries**

In response to CGMS Actions 38.11, 38.12 and 38.33, and Recommendation 38.02

The Severe Weather Forecasting Demonstration Project (SWFDP) aims to enhance the use of outputs of existing numerical weather prediction (NWP) systems to improve severe weather forecasting and warning services. While improving the lead-time of alerting severe weather in the medium-range, the current experience indicates a gap in the forecasting and provision of warning services of rapidly developing and localized phenomena such as heavy rain and strong winds associated with convective systems, in the absence of operational radar coverage. Satellite data represent powerful tools to support very-short range forecasting, including nowcasting. However, there are difficulties in the uptake of new products into weather forecasting daily routines of the forecasters.

The SWFDP strategy for improving the use of satellite data in SWFDP regional subprojects consists in:

- (1) inviting relevant satellite operators to participate in the meetings of the Regional Subproject Management Teams to advise on relevant satellite data and products responding to their needs,
- (2) identifying opportunities for tuning products, developing improved products and services,
- (3) supporting the distribution of data and products for SWFDP regional subprojects.
- (4) working with the WMO / CGMS Virtual Laboratory (VLab) in the development of the satellite aspects of the SWFDP Training programmes and in the delivery of the training.

Action/Recommendation proposed:

Recommendation: CGMS Satellite Operators are invited to support the strategy for improving the use of satellite data in SWFDP regional subprojects as described in CGMS-39 WMO-WP-05.

Action: CGMS Satellite Operators are invited to provide a contact point(s) for SWFDP, in order to inform the SWFDP regional sub-projects on relevant satellite data and products responding to their needs, help identifying opportunities for tuning products, developing improved products and services, and supporting the distribution of data and products for SWFDP (Replaces former Action 38.12 and Recommendation 38.02).

UPDATE ON THE SEVERE WEATHER FORECASTING DEMONSTRATION PROJECT (SWFDP)

Improving Severe Weather Forecasting and Warning Services in Developing Countries

1 INTRODUCTION

The Severe Weather Forecasting Demonstration Project (SWFDP) is a project carried out by WMO/CBS to further explore and enhance the use of outputs of existing numerical weather prediction (NWP) systems, including ensemble prediction systems (EPS). It aims to contribute to capacity building helping developing countries to access and improve their use of existing NWP products for improving warnings of hazardous weather conditions and weather-related hazards. The SWFDP is built on the Global Data Processing and Forecasting System (GDPFS) programme in collaboration with the Public Weather Services (PWS) programme to improve severe weather forecasting and warning services. The expected outcomes include achieving longer lead-times and reliability for alerting the public and national disaster management and civil protection authorities. Global-scale products, as well as data and information provided by other regional centres, are integrated and synthesized by a regional centre (typically a designated Regional Specialized Meteorological Centre (RSMC)), which, in turn, provides daily guidance for short-range (days 1 and 2) and medium-range (out to day-5) on specified hazardous phenomena (e.g. heavy rain, strong winds, damaging waves, etc) to participating National Meteorological Centres of the region. This is a “Cascading” concept of the forecasting process.

The SWFDP has successfully improved severe weather forecasting through improved access to, and more effective use of outputs of numerical weather prediction systems for weather forecasters, who in turn have improved the delivery of warning services.

2 UPDATE ON SWFDP DEVELOPMENTS

The SWFDP is currently in progress in four regions: (a) sixteen countries of the southern Africa region (“SWFDP – Southern Africa”), in transition to operations; (b) nine countries of the South Pacific Islands (“SWFDP – South-west Pacific”), in a full demonstration phase; (c) six countries of the Eastern Africa region (“SWFDP- Eastern Africa”), in the first demonstration phase; and (d) four countries of Southeast Asia (“SWFDP – Southeast Asia”), in the first demonstration phase. Other projects are in consideration or development (e.g. in Bay of Bengal; Central Asia; Central America and the Caribbean).

Noting the need for ensuring the long-term sustainability of the benefits gained with mature SWFDPs (for example in Southern Africa), through making the transition into

routine operations of the project's successful elements, the Steering Group for the SWFDP developed an additional project phase entitled: "Continuing Development Phase" (referred to as "Phase 4"), when the project has developed sufficiently its framework through its initial phases for it to be fully assumed under the responsibility of the respective Regional Associations including the raising of necessary resources to sustain the project.

The SWFDP approach has been used to implement a series of ready-for-production enhancements to the forecasting process and to provide benefits to other scientific and technological developments that are intended for operational implementation (e.g. transfer of relevant promising research outputs from the WWRP/TIGGE project "Global Interactive Forecast System" (GIFS) into operations through trials at the SWFDP).

With a high likelihood of the globe experiencing changing climatology of extreme weather events, the goals of the SWFDP, and the results being achieved, contribute to climate change adaptation through ever more skilful and useful prediction services with increasing resolution of all scales of modelling including for climate, increasing forecast lead-times in the medium-range, and beyond, and increasing accuracy to widen the scope of applications.

The World Meteorological Congress, at its sixteenth session (Cg-XVI, May 2011), approved a vision for the SWFDP as an end-to-end, cross-programme collaborative activity led by the GDPFS, in which the participants in the Projects:

- (a) Make best possible use of all existing and newly developed products and facilities at the global, regional and national levels, including high-resolution NWP and ensemble prediction products, and very-short-range forecasting, including nowcasting, tools;
- (b) Establish sustainable services of reliable and effective early warnings tailored to the needs of the general public and a wide range of socio-economic sectors in LDCs, SIDSs and developing countries;
- (c) Ensure a continuous improvement cycle and quality assurance of services, including efficient and responsive feedback loops between the NMHSs and the end users at the national level.

3 SATELLITE SUPPORT TO SWFDP

Data and products for very short-range forecasting, including nowcasting

At a very early stage of the SWFDP implementation, in Southeast Africa, in 2006, it was confirmed that the SWFDP was able to improve the lead-time of alerting severe weather in the medium-range. However, the current experience with the SWFDPs in Southern Africa, South-west Pacific, Eastern Africa and Southeast Asia, indicates a gap in the forecasting and provision of warning services of rapidly developing and localized phenomena such as heavy rain and strong winds associated with convective systems. Many NMHSs point out the weakness of the present model output to forecast the convective events or to accurately forecast rainfall (or snowfall)

amounts. There is no doubt that forecasting severe convective events accurately remains a challenge likely among the most important “shortfall” in these regions.

While noting that many NMHSs in developing countries do not have operating weather radars and/or national-wide radar coverage to support timely and accurately forecasts and warnings of severe convective situations in the very short-range forecasting period, including nowcasting, satellite data represent powerful tools to support forecasting in this forecast range, especially rainfall, wind and sea state for widely dispersed islands (large ocean areas).

In the initial range of the forecast, the forecasting process depends heavily on systems that process observational data and analyses (radar and satellite products, in-situ surface observations) and extrapolated into the immediate future. The Eumetsat SAF on Nowcasting (<http://www.nwcsaf.org/HD/MainNS.jsp>), for instance, makes its products and software available for implementation upon request, including recognition and evolution of objects. Some products are aimed at early detection of potential development zones, which are particularly relevant for the Tropical Regions. Satellite products, however, could be more effectively used, especially by NMHSs of developing and Least Developed Countries where weather radars are few or non-existent, and expertise and capacities need to be dramatically increased.

Within the framework of the SWFDP, training is provided annually to forecasters and end-users, and therefore very short-range forecasting tools (how to use and interpret them) are being introduced in the training programme for these events. Progress has been done in engaging the WMO / CGMS Virtual Laboratory Management Group (VLMG) in the development of the satellite aspects in the Training programme for the upcoming SWFDP – Eastern Africa Training Workshop (Arusha, Tanzania, November-December 2011) and in the delivery of the training. Hopefully this collaboration will continue in this and other SWFDP regional subprojects.

Southern Africa

In Southern Africa, most of the SWFDP participating countries do not have operating radars to support timely warnings in the very short-range forecasting period. In 2008, following the outcome of the first phase of the project, the SWFDP in Southern Africa has introduced the use of EUMETSAT MSG products prepared hourly at RSMC Pretoria that estimate cumulative rainfall amounts, i.e., the “hydroestimator” and posted on the RSMC’s web site. A diagnostic product was added, i.e., the “global instability index “GII” (see Figure 1 below), primarily used for tracking and “nowcasting” convective storms in real-time, especially those of rapid onset and with the potential to develop into severe thunderstorms.

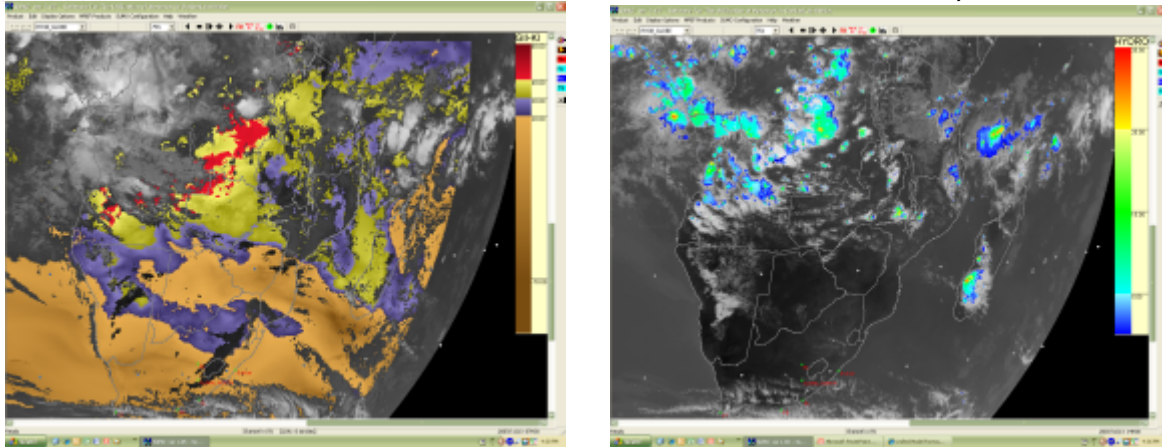


Figure 1 – The K-Index of the satellite-based GII predicting the development of severe convection at 07:30 on 13 November 2007, and the verifying satellite image of 14:00 the same day.

South-west Pacific

In South-west Pacific, nearly all SWFDP participating islands do not have operating radars to support timely warnings in the very short-range forecasting period. In 2010, following the meeting of the Regional Subproject Management Team (Wellington, New Zealand, November 2010), the Meteorological Satellite Centre (MSC) of JMA, in support to the SWFDP, has developed a new satellite product intended to support severe weather monitoring in the South-west Pacific region, in addition to MTSAT real-time images for various areas in RA V (see http://mscweb.kishou.go.jp/sat_dat/img/reg/sat_img.htm). The new product (Imagery with Heavy Rainfall Potential Area) is a satellite product in imagery format providing information about probability of heavy rainfall associated with deep convective clouds. The area with potential or probability of heavy rainfall is identified by detecting deep convective clouds (see Figure 2 below).

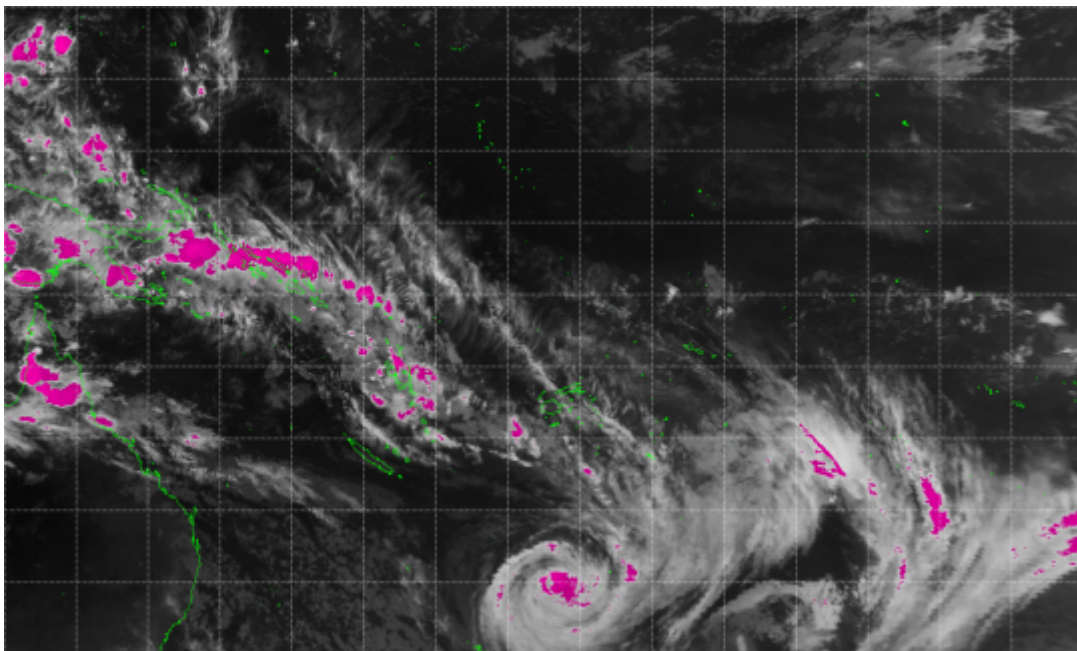


Figure 2 – Imagery with Heavy Rainfall Potential Area.

Southeast Asia

The SWFDP – Southeast Asia is in an early stage of implementation. It would certainly benefit from liaising with the *Pilot Project to Develop Support for NMHSs in Satellite Data, Products and Training in RA II*, which facilitates the timely provision of satellite-related information by satellite operators themselves to users, i.e., NMHSs in RA II, especially in developing countries including LDCs. The meeting of the Regional Subproject Management Team (RSMT) of the SWFDP – Southeast Asia, is now planned to be held in Ha Noi, Viet Nam, from 10 to 13 October 2011, and a representative from the Satellite Operators in the RA II (i.e. JMA) will attend in order to ensure the synergies between the SWFDP – Southeast Asia and the above-mentioned RA II Pilot Project.

Eastern Africa

The SWFDP – Eastern Africa is also in an early stage of implementation. It focuses on severe weather forecasting and warning services for the benefit of the general public and socio-economic sectors, in particular agriculture and fisheries. The beneficiaries are countries in Eastern Africa, bordering on Lake Victoria or within its basin.

In addition to severe weather forecasting and warning services for the benefit of the general public and socio-economic sectors, in particular agriculture, for the entire project footprint, the SWFDP – Eastern Africa includes a specific component addressing severe weather forecasting and warning services over the Lake Victoria, addressing marine meteorological aspects for the safety and protection of fishers, living in nearshore communities and operating daily in small vessels in the coastal zones. Specific SWFDP needs for satellite products for the Lake Victoria Basin region are described in CGMS-39 WMO-WP-21.

4 STRATEGY TO ENHANCE THE USE OF SATELLITE CAPABILITIES

Collaboration with satellite operators should be strengthened by points of contacts.

4.1 Product implementation, tuning and improvement

The EUMETSAT Nowcasting SAF products should be implemented within the framework of the SWFDP, in Southern and Eastern Africa. Further engagement of the CGMS Satellite Operators covering the Southwest Pacific, Southeast Asia, and the Bay of Bengal, is suggested in order to support the SWFDP in these regions and to advise on these aspects.

Satellite Operators are encouraged to help identifying opportunities for tuning satellite products to SWFDP regional subprojects' footprints.

4.2 Data and product dissemination

The SWFDP should take advantage of the possibility, through the IGGDS project, of enhancing satellite broadcasting to improve the reach of time-critical forecasting guidance products, including satellite and other products, which are made available through the SWFDP regional subprojects in various regions of the world.

4.3 Capacity building

While noting the benefits of using real-time satellite-based products in very short-range forecasting, in particular for nowcasting, the SWFDP regional subprojects have shown that there are difficulties in the uptake of new products into weather forecasting daily routines of the forecasters. The SWFDP provides an appropriate model for introducing these new elements, as it includes verification and reporting mechanisms, and training aspects. However, there is a need to develop guidelines on how to use and interpret these products at the regional level, taking into account regional and national requirements (tuned to a particular region). These guidelines should be focused on practical use of such products by forecasters, including showcases and examples on strengths and weaknesses of the various products.

5 CONCLUSIONS AND PROPOSED ACTIONS

CGMS Satellite Operators are encouraged to keep abreast of the SWFDP developments, to advise on its regional subprojects and provide support as appropriate.

In particular, CGMS Satellite Operators are invited to provide a contact point for SWFDP, in order to inform the SWFDP regional subprojects on relevant satellite data and products responding to their needs, and help identifying opportunities for development of improved products and services. CGMS Satellite Operators are furthermore encouraged to support the distribution of data and products for SWFDP through their broadcast schemes.

The VLab, through its Management Group (VLMG), is encouraged to continue supporting SWFDP training activities and share training resources.

Points of contacts	
The contact points for the SWFDP regional subprojects are the chairpersons of the Regional Subprojects Management Team, as follows:	
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<u>Eastern Africa</u>	James Kongoti (Kenya) - kongoti@meteo.go.ke Hamza Kabelwa (Tanzania) - hkabelwa@meteo.go.tz
<u>Southeast Asia</u>	Yuki Honda (Japan) - honda.yuuki@met.kishou.go.jp (for the time being)
The points of contact for SWFDP at the <u>WMO Secretariat</u> are: Peter Chen, Chief, Data-Processing and Forecasting System (DPFS) Division pchen@wmo.int Alice Soares, Scientific Officer, Data-Processing and Forecasting System (DPFS) Division - asoares@wmo.int	