Nowcasting in data sparse regions

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Content

1. Introduction
2. Satellite (MSG) based nowcasting tools for Southern Africa:
   • 2.1 Satellite based instability indices
   • 2.2 Satellite based rainfall estimation
   • 2.3 Nowcasting SAF products
3. SWFDP
4. Summary
1. Introduction

- **Strength of nowcasting** - location-specific forecasts of the initiation, growth, movement and dissipation of weather phenomenon
- **Ideal world** - radar systems
- Reality, however, is that many developing countries (DC) and even more so Least Developed Countries (LDC) do not have operational radar systems at all, and the countries which are fortunate enough to have radar systems, are struggling to maintain and sustain these powerful data sources.
1. Introduction

• The Global Humanitarian Forum states:
  • “Developing countries, which are most likely to suffer the brunt of climate change impacts, have the least number of ground-level weather data observation systems, the critical basis for efficient delivery of weather information.
  • Despite covering a fifth of the world's total land area, Africa has the least developed land-based weather observation system of all continents, and one that is in a deteriorating state.
  • NWP and satellite data are easier to obtain than radar and lightning systems in DC and LDC

WMO Nowcasting symposium (Whistler, 2009)

1. Plan purchasing of expensive system in order to be sustainable
2. Plan the dissemination of datasets via the internet, GEONETCAST etc.
3. Start by getting access to satellite data…”it is an efficient poor man’s nowcasting system”.
4. Plan how to develop the expertise and technical support staff in your service necessary to keep these systems operational.
5. Develop and document a sustainable plan for incorporating very short term forecasting in the operational setting.
6. Provide and document end-to-end training taking into account end-user requirements and needs.
7. Regional/international sustainable cooperation is crucial.
2. Satellite based nowcasting tools for southern Africa

2.1.1 MSG MPEF Product: Global Instability Index GII

MSG – 6 channels and ECMWF as NWP input

K Index for 08:45 on 6 Nov 2005 from GII product
MSG Convection RGB (Ch5-6, Ch4-9, Ch3-1) at 14:42 on 6 Nov 2005

6-9 hour lead time on areas of instability and possible convective development

2.1.2 Regional instability indices (RII) over southern Africa: Lifted Index over southern Africa on 3 August 2009

Real time Instability parameters available in all cloud free regions (without upper air soundings)
2.1.3 A probability map for convection

- Combination of satellite based parameters as well as topography was created to give a probability map for seeing lightning later in the day – Combined Instability Index (CII)
- For a forecaster this is one easy step to get an indication for where to expect convective development later in the day in probabilistic fashion
- Calculation only possible in cloud free areas, thus early morning values are used when it is as cloud free as possible.
Example: 31 Jan 2010

6-9 hours lead time on most probable areas of convection

IR108 and lightning at 1500 UTC

2.2. Satellite based precipitation estimation - Hydroestimator

- Hydroestimator (HE) using IR108 and NWP input
- HE is operational in SA since October 2007, available every 15 minutes, using MSG IR108 as well as Unified Model input

Real time precipitation estimation using 1 MSG channel and NWP
2.3 Nowcasting SAF products

- Amongst the list of products developed by the Nowcasting SAF (NWC SAF) are:
  - 2.3.1 Rapidly Developing Thunderstorms product (RDT)
  - 2.3.2 Convective Rainfall Rate (CRR)

- The RDT and CRR products can be extremely useful for convection and severe convection nowcasting in data sparse countries.

- These products are using MSG and the local version of the UKMO Unified Model data as NWP input to the algorithms.
2.3.1 Example: RDT for 9 October 2012 from 1200 to 2000 UTC

Real time identification of intense and rapidly developing thunderstorms in growing and mature phases.
Advantage of RDT in areas without radar – 8 Aug 2014

IR108 colour enhanced with Lightning
2.3.1 Results of 10 cases over South Africa in summer season

% of Moderate lightning inside RDTpolygons - Average of 10 cases

Moderate lightning = >20 lightning strokes in grid box
2.3.2 Example: Daily rainfall: CRR vs rain gauges for 23 Feb 2010

Average of RMSE, MAE and BIAS for all 10 cases
3. Severe Weather Forecasting Demonstration Projects (WMO CBS SWFDP)

- Current status of SWFDPs around the world –
  1. Southern Africa
     - South Eastern Africa 2006-2007 (5 countries involved)
     - Southern Africa expansion 2008-2011 (16 countries involved)
     - RSMC established in Pretoria, South Africa
  2. South Pacific islands
     - Pilot project 2009-2010
     - Full demonstration 2011
     - RSMC established in Wellington
  3. Eastern Africa initiated
  4. Under development – Southeastern Asia and Bay of Bengal
Satellite based Nowcasting products on RSMC website
4. Summary

- In regions without radar systems and/or lightning detection networks, satellite and NWP products will certainly benefit nowcasting procedures.
  - Satellite based instability indices – lead time of 6-9 hours (RII and CII)
  - Satellite based precipitation – near real time (Hydroe and CRR)
  - Satellite based identification/tracking of more intense thunderstorms – near real time (RDT)
- SWFDP websites (RSMC) provide easy access by forecasters in NMHSs to use the information received from the global and regional centers to issue nowcast information on probability of convection and/or severe convection (RDT).
- The importance of developing and maintaining collaboration between weather forecasters and hydrologists, and between weather forecasters and disaster managers (end users), in each country for the successful use of nowcasting tools is and will remain, of course, fundamental.