Nowcasting in India—Current and Future Prospects

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S.C. Bhan. Soma SenRoy and K. Srivastava
Strength of Nowcasting

- Provides location-specific forecasts of initiation, growth, movement and dissipation of weather events, which allows for specific action/preparation for given weather event by people.
Importance of Nowcasting:

- Reduction of fatalities and injuries due to weather hazards
- Reduction of private, public, and industrial, property damage
- Improved efficiency and savings for industry, transportation and agriculture.
- Aviation weather forecasts in both the terminal and en-route environment
- Sports
- Water and power management
- Off-shore oil drilling
- Construction industry
- Urban flooding
- Leisure industry /Tourism/Event Management
- Satellite lunch
Nowcasts leads to a “call to action”

- **SRF (NWP) > Outlook**
  - Stand by
  - Keep in mind
- **VSRF (Anal+NWP) > caution**
  - Ready to take action
  - preparation
  - 1-2 days before
- **Nowcast (Anal) > warning**
  - Action for disaster prevention
  - evacuation
  - 3-6 hours before
- **Cancel warning**
  - Action for recovery
  - Back to normal (recovery)

**Precip. Intensity**

**disaster**

(Flood/Landslide)

Is the skill of our forecast fulfilling their needs?

- Citizen
- Local Government
- Met. Information

Courtesy, Shingo Yamada JMA

India Meteorological Department
Evolution of Nowcasting in India

- Nowcasting in Aviation at Airports based on
  Airport Aviation Climatology
  Statistical Techniques
  Check-lists/Decision Trees for Fog, Thunderstorm etc

- In the last five years, in India, automatic real-time nowcasting capability has increased with the incorporation of new and sophisticated observing systems which provide better quality data of greater spatial and temporal resolution and more rugged communication systems.
Evolution of Nowcasting in India

- Nowcasting System now includes:
  - Doppler radar network
  - INSAT satellite series
  - Automatic Weather Station network
  - GPS sondes
  - Wind profilers
  - Advanced Nowcasting models
  - Forecasters’ Interactive Workstations
Recent improvement in Real Time Monitoring and Forecasting

Introduction of

(i) Every 10’ observation of location, intensity (wind), quantitative precipitation estimate (QPE), reflectivity etc, from Doppler Weather Radar,

(ii) Dense Automatic Weather Station (AWS) network,

(iii) Half hourly satellite observations from Kalpana and INSAT satellites in addition to microwave imageries,

(iv) Better analysis tools at Forecaster’s Workstation

(v) Use of Nowcast models,

(vi) Computational capabilities : HPCS

(vii) Real Time Dissemination : Web, SMS, Radio, TV.
Components of Nowcasting

- Observing systems
- Numerical models for mesoscale weather prediction
- Forecasters
- Dissemination

Quality control
Observations

Dristi
(RVR measurement)

Hourly RVR measurement at Runways
25-26 Jan 2010
Radar for Nowcasting

Cyclone ‘SIDR” from DWR Kolkata
15 Nov 2007

Thunder Storm with Hail from DWR Delhi (19 April 2010)

Hail from C- Band, Delhi
6th June 2012
Tornado of 31 March 2009 over Orissa

Satellite and Radar can gives few hours lead time to the Disaster Managers
From NOAA:
Difference of channels 4 and 3B is used

From MODIS:
Difference of channels 20 and 31 is used
Observing Systems (AWS Network for Delhi and neighbourhood)
NWP & Nowcasting models used for Commonwealth Games 2010

- ARPS
- WDSS-II
- SWIRLS
- DelhiPP
Mesoscale Assimilation for RSMC domain
- Hor. Res. : 27 km
- Ver. Res. : 51 Eta levels
- Time Interval: 6 hourly cycling

High-resolution double nested forecast
- RSMC Domain : 27 km
- India Domain : 9 km
- Forecast length: 3 days

Nest down to
- 3 km
- Event specific (e.g. CWG 2010)
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**NEW Observations:**
- AWS; DWR; Wind Profiler, GPS sounding,
- Satellite radiance etc
Data used:
1. IMD GFS
2. DWR DELHI

Following Diagram is showing 20 minutes assimilation cycle for first 1 hour (08-09 UTC) & then 3 hours ARPS Model forecast -
NOWCAST AND SPECIAL NWP PRODUCTS FOR
DELHI COMMONWEALTH GAMES (CWG) - 2010

NOWCAST SYSTEM - WDSSII (Based on Delhi Radar Data)

NOWCAST SYSTEM DELHI PP

NOWCAST SYSTEM - SWIRLS

MESOSCALE MODEL ARPS (with Assimilation of Delhi Radar Data)

Location Specific Meteograms (WRF-VAR (3 KM Resolution))

Any suggestions, comments or feedback may be given to skrb.imd@gmail.com
Sample products of SWIRLS based on (08:52 UTC) of 01-09-2010
3 KM CAPPI Observation

Delhi Max Z Observation at 1.0 elevation

30 min FCST

1000 Z
Nowcast reflectivity and corresponding observed field of 31 July 2010 for Delhi
IND nowcast(DelhiPP) 0000 mln Precipitation rate (mm/hr)
valid for 2010-10-22 1048 UTC

Delhi
IMD WDSSII 00 min Reflectivity Forecast for Delhi and neighbourhood based on 20110815 AT 0530 hrs IST

Adopted from NSSL, USA
(based on DELHI Radar Data)

Image Superposed with Wind & RH at 850 hPa from WRF-VAR Model
Areas with Reflectivity > 30 dBZ have high probability of rainfall occurrence
WRF hourly Rainfall Forecast: Based on 00 UTC 15-08-2011
Nowcast Products in
imd.gov.in
Weather Report for NCR Delhi

(Minimum and Maximum Temperatures past 24 hours IST Dated 13.01.2010)

(Temperature in °C and Rainfall in mm)

Rohtak
Max: 11.4
Min: 05.8
R/F: 00.9

Mungeshpur
Max: 10.6
Min: 05.4
R/F: 01.0

Delhi Univ
Max: 12.1
Min: 06.4
R/F: 01.0

Hindon
Max: 12.7
Min: 05.7
R/F: 00.4

NCMRWF NOIDA
Max: 13.4
Min: 07.4
R/F: 10.0

Jafarnpur
Max: 11.6
Min: 06.4
R/F: 01.0

Nazafgarh
Max: 12.2
Min: 06.8
R/F: 00.0

Pusa
Max: 12.6
Min: 06.6
R/F: 01.0

Ridge
Max: 12.6
Min: 07.2
R/F: 02.2

Sports Cplx
Max: 13.0
Min: 07.2
R/F: 03.0

Palam
Max: 14.1
Min: 07.6
R/F: Trace

Safdarjung
Max: 14.9
Min: 08.1
R/F: 04.6

Gurgaon
Max: 13.4
Min: 06.5
R/F: 00.0

Ayungar
Max: 15.0
Min: 06.8
R/F: 07.6

Lodhi Road
Max: 14.4
Min: 08.2
R/F: 04.4

Weather Report for CWG- NCR Delhi
### CWG 2010 Venue Forecast

#### Indira Gandhi Sports Complex

**Friday 08 Oct 2010**

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<td>Humidity (%)</td>
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**Saturday 09 Oct 2010**

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**Map of CWG 2010 Venues**

- **Yamaha Sports Cplx**
- **JLN Stadium**
- **Games Village**
- **Thiragaraj Stadium**
- **Kadarpur Shooting Range**
- **RK Khanna Tennis C Plx**
- **Dr. Kiran Singh Shooting Range**
- **Siri Fort Stadium**
- **National Stadium**
- **National Sports Complex**
- **Tughlakpur & SP Muniruz Stadium**

**Valid for: 09 Oct 2010**
**Issued at: 1000 IST 09 Oct 2010**

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**India Meteorological Department**

**Weather Forecast**

- **Rains in the morning.**
Real Time Dissemination in Local Language: SMS

Nowcast Icon
Future Prospects of ‘Nowcasting’ in IMD

- Standard Operating Procedure
- Mumbai, Kolkata, Pune and Chennai to start Nowcast as part of Mega-city Project
- Air Quality Monitoring and Forecast
- Radars, Mesonetwork and profilers
- Field Progerammes
Challenges

- Improve reliability and speed of communication of data between observation platforms and forecasters.
- Educate forecasters in basic data analysis.
- Document the accuracy of present available thunderstorm nowcasting techniques to establish a baseline for monitoring future progress.
- Improve Radar Data pre-processing.
- Assimilation of all available data
- Improve communication of nowcasts from the forecasters to users and also obtain feedback of usage.