WWW TECHNICAL PROGRESS REPORT ON GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM (GDPFS), AND THE ANNUAL NUMERICAL WEATHER PREDICTION (NWP) PROGRESS REPORT FOR YEAR 2006

ISLAMIC REPUBLIC of IRAN

Islamic Republic of Iran Meteorological Organization (IRIMO)

This report summarises the global data processing system activities carried out at the numerical weather prediction section of IRIMO weather forecasting centre.

1. Summary of highlights

- o The numerical weather prediction system has stepped into operational phase at the IRIMO in the recent years. One major event during 2006 was the implementation of the first phase of a project for flood forecasting. In this phase the MM5 output for precipitation and 2-meter temperature was used to drive a hydrological model for a basin in the southwest of Iran. Preliminary results showed very promising for better management of water resources.

3. Equipment in use at centre

- o Two PC-Cluster systems
  - 1- 8-Nodes with dual 3.8GHZ Intel CPU for research in research center.
  - 2- 32-Nodes with dual 3.2GHZ Intel CPU for operational (recently installed) in IRIMO.

4. Data and products from GTS in use

- o Data in use:

SYNOP + SYNOP / SHIP	: 1800
TEMP + TEMP /SHIP	: 140

- o Products in use:

GRID KWBC	: 200
GRID EGRR	: 200
GRID ECMWF	: 200
GRIB ECMWF	: 1400
GRIB EGRR	: 1400

4. Forecasting system

- o The MM5 modelling system is operationally launched once a day (00GMT), providing 102 hours forecasts.

4.1 System run schedule and forecast ranges

- The forecasting system at the NWP section of IRIMO is based on MM5 model, which is launched once a day (00GMT), providing 102 hrs forecasts. The initial and boundary conditions are available through outputs of GFS model.

4.2 Medium range forecasting system (4-10 days)

- IRIMO does not run a medium range forecasting system.

4.2.1 Data assimilation, objective analysis and initialization

- Not available

4.2.2 Model

- Not available

4.2.3 Operationally available Numerical Weather Prediction (NWP) Products

- The numerical weather prediction products in use at IRIMO are as follows:

  - ECMWF {(00 -168), time step: 24hr,twice a day(0000,1200 UTC) }:
P	MSLP
H	500
Humidity	850, 700
Wind	850, 700, 500, 200
Stream lines	850, 700, 500, 200

  - GFS {(00 -168), time step: 3hr, levels: 1000, 950, 925,900, 850,750, 700, 600, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, 10 HPA}:
    H
    Stream lines
    Abs. vorticity
    Wind
    Temp.

Humidity	1000, 950, 925, 900, 850, 750, 700, 600, 500, 400, 300, 250, 200, 150, 100
Vert. Velocity	1000, 950, 925, 900, 850, 750, 700, 600, 500, 400, 300, 250, 200, 150, 100

    P, Conv. rain Accu. Rain, MSLP, Total rain accu. ICVV and Lsea :   For GRND

4.2.4 Operational techniques for application of NWP products (MOS, PPM, KF, Expert Systems, etc…)

4.2.4.1   In operation

- Not available

4.2.4.2   Research performed in this field
- Not available

4.2.5 Ensemble Prediction System (EPS) (Number of members, initial state, perturbation method, model(s), and number of models used, perturbation of physics, post processing: calculation of indices, clustering)

4.2.5.1   In operation
- Not available

4.2.5.2   Research performed in this field
- Not available

4.2.5.3   Operationally available EPS Products
- Not available

4.3   Short-range forecasting system (0-72)

4.3.1 Data assimilation, objective analysis and initialization
- Not available

4.3.2 Model

4.3.2.1   In operation
- The MM5 modelling system is adopted for operational short rang (up to 3 days) forecasts over Iran. model configuration is as follows:
- Dynamics: None hydrostatic with three dimensional Coriolis force
- Main prognostic variables: u, v, w, T, p, and q
- Central point of the domain: 30N, 50E
- Number of horizontal grid points: 150 and 120 grid points for x, y respectively
- Horizontal grid distance: 30 km
- Number of vertical levels: 23 half sigma levels
- Horizontal grid system: Arakawa B grid
- Time integration scheme: Time-splitting
- Physical parameterizations:
  - Blackadar PBL scheme
  - Betts Miller convection scheme

4.3.2.2   Research performed in this field

4.3.3 Operationally available NWP products

- o Products of MM5 modelling system are:

  - • Geopotential height, horizontal wind vector, vertical motion, temperature, relative humidity and vorticity at some pressure levels

- o Products in use are:

  - • UK model outputs {(06-36), time step: 6 hrs}:
H	850, 700, 600, 500, 300, 250, 200, 150, 100 hpa
T	same as above
Wind	same as above
Stream lines	same as above
Humidity	850, 700, 600, 500

- • ARPEGE model outputs (ARP/1.5) {(00-72), time step: 6 hrs}:

  For upper levels:
T	1000, 950, 925, 900, 850, 800, 700, 600, 500, 400, 300, 250, 200 HPA
Wind	same as above
H	same as above
Humidity	same as above
Stream lines	same as above
Vert. velocity	same as above
Wet bulb Pot. T	100, 950, 850, 600, 400, 300, 250, HPA
Abs. vorticity	850, 500, 300, 200
PV	850, 600, 500, 300, 250, 200

  For GRND:
  MSLP-Pressure
  Cape
  Total cloud
  Total rain acc.
  Total snow acc.

  For Height:
T, Humidity	2M
Wind, Stream lines	10M

- • ARPEGE model outputs (ARP/.5) {(00-72), time step: 3 hrs}:
  In addition of ARP/1.5 following products are in use:

  For GRND:
  Conv. Rain acc.
  Dyn. Rain acc.
  Conv. Snow acc.
  Dyn. Snow acc.
  High lev. Cloud

Medium lev. Cloud
Low lev. Cloud
Conv. Cloud

For Height:
 T   2, 20, 50, 100, 250, 500, 750, 1000, 1250, 1500 M
Humidity   same as above
Pressure   20, 50, 100, 250, 500, 750, 1000, 1250, 1500 M
Wind   10, 50, 100, 250, 500, 750, 1000, 1250, 1500 M
Stream line   same as above
PV   1.5 PVU, 2.0 PVU

4.3.4 Operational techniques for application of NWP products (MOS, PPM, KF, Expert System, etc.)

4.3.4.1 In operation
o Not available

4.3.4.2 Research performed in this field
o Kalman filtering is applied for post processing of MM5 modelling system outputs for near surface parameters including 2-meter temperature, maximum and minimum temperature and 10-meter wind speed. This research will be in operational phase in near future.

4.3.5 Ensemble Prediction System (Number of members, initial state, perturbation method, model(s), and number of models used, perturbation of physics, post-processing: calculation of indices, clustering)

4.3.5.1 In operation
o Not available

4.3.5.2 Research performed in this field

o Using a super-ensemble and Bayesian Model Averaging (BMA) in order to calibrate the ensemble members' outputs. First phase of research is dealing with 5 member ensembles;   each of them obtains from running MM5 model with different   physics, PBL and cumulus schemes but with the same initialisation (GFS model outputs).

4.3.5.3 Operationally available EPS products

4.4 Nowcasting and Very Short-range Forecasting System (0-6 hrs)

4.4.1 Nowcasting system

4.4.1.1   In operation
- o Short range forecasting for aeronautical purposes and public by subjective analysis of synoptic reports, satellite and RADAR images, actual and prognostic sea level and P_level charts, vertical profiles and instability indices.

4.4.2 Models for Very Short-range Forecasting Systems
- o Not available

4.5 Specialized numerical predictions (on sea waves, sea ice, tropical cyclones, pollution transport and dispersion, solar ultraviolet (uv) radiation, air quality forecasting, smoke, sand and dust, etc.)

4.5.1 Assimilation of specific data, analysis and initialization (where applicable)
- o Not available

4.5.2 Specific models (as appropriate related to 4.5)
- o Running of TAPM model for some test cases mainly for numerical investigation of temperature and spatial variability of air pollutions in Tehran.

4.5.3 Specific products operationally available
- o Not available

4.6 Extended range forecasts (10 days to 30 days)(Models, Ensemble, Methodology)

4.6.1 In operation
- o Not available

4.6.2 Research performed in this field
- o Not available

4.6.3 Operationally available EPS products
- o using of ECMWF and GFS outputs up to 2 weeks

4.7 Long range forecasts (30 days up to two years)(Models, Ensemble, Methodology)

4.7.1 In operation
- o Not available

4.7.2 Research performed in this field
   o Not available

4.7.3 Operationally available products
   o Products are in use from ECMWF and IRI for MSLP, Temp, Precip anomaly, SST and SST anomaly.

5. Verification of prognostic products

5.1 Annual verification summary
   o Not available

5.2 Research performed in this field
   o There are two different projects in hands in this field:

Verification of meteorological data

In these work outputs of GFS and MM5 Models for 06, 12, 24, 36 and 48 hrs is compared against synoptic data. The verified variables include: surface pressure, 500 hpa geopotantial height and 850 hpa temperature. The domain of research is 20-60 N and 10-70 E. Important score and skill scores including mean error, mean absolute error, mean squared error and anomaly correlation will be analyzed.

Verification of accumulated precipitation

In this research this 24 to 72 hrs MM5 outputs for precipitation over Iran for a 3 months period (winter) is verified against observations. The contingency skill scores will be calculated for separate regions and different thresholds.

6. Plans for the future (next 4 years)

6.1 Development of the GDPFS
   o Not available

6.2 Planned Research Activities in NWP, Nowcasting and Long-range Forecasting

6.2.1 Planned Research Activities in NWP
   o Experiments are being conducted to evaluate the performance of the WRF. It is expected to replace the MM5 with WRF in the next year. MM5 and WRF with different physics and initial conditions are being tested in an ensemble prediction in the next two or three years behind.

7. References
   o None