

MEMORANDUM OF UNDERSTANDING

Between

Karnataka State Natural Disaster Monitoring Centre, Bengaluru
Autonomous Organisation of Revenue Department
(Disaster Management),
Government of Karnataka



AND

National Centre for Medium-Range Weather Forecasting
under Ministry of Earth Sciences
A-50, Sector 62, Noida, UP
Government of India



APRIL - 2022

KSNDMC

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NCMRWF

Preamble

National Centre for Medium-Range Weather Forecasting (NCMRWF) has a mission to continuously develop advanced numerical weather prediction systems, with increased reliability and accuracy over India and neighbouring regions through research and development. NCMRWF is also engaged in the development and demonstration of new and novel applications for weather forecasting. NCMRWF is working as the core centre for atmospheric Data Assimilation (DA) of MoES institutions. Presently, two global DA systems, viz., 4D-ENS-Var system with T1534L64 resolution and a grid-point 4D-Var system with 12 km resolution and other global/regional assimilation systems are operational at the Centre. All-weather and climate models run at various institutions of MoES utilise based on the initial conditions generated by NCMRWF from these DA systems. Continuous efforts are going on at the Centre to use maximum possible observations in its DA systems. The Centre acquires about 300 GB of global atmospheric observations per day from various sources viz., Global Telecommunication System (GTS) of WMO, EUMETCAST, NOAA /NESDIS, ISRO etc support its DA activities. With the advancement in convective-scale weather modelling and increase in high-performance computing resources, there are models with horizontal resolution increased up to a few hundred meters. As high impact weather events are increasing in recent periods, leading to various natural disasters, there are demands for the use of high-resolution models and bias-free dynamical downscaling of the model outputs. NCMRWF, apart from the DA systems, is running a unified modelling framework (Global at 12 km resolution to local at 330 m resolution) in real-time basis. NCMRWF also runs a 22 member ensemble prediction system at 12 km resolution to generate uncertainties associated with forecasts for up to 10 days. NCMRWF has also (i) real-time 4 km regional ensemble prediction system (ii) coupled extended (multi-week) and seasonal forecast systems. This in turn, demand very high-resolution observations for assimilation, dynamical downscaling, as well as validation of model output and high computing resources.

Karnataka State Natural Disaster Monitoring Centre (KSNDMC), an Autonomous Organisation of Revenue Department (Disaster Management), Government of Karnataka is responsible for providing Science & Technology(S&T) inputs for managing and mitigating natural disasters in Karnataka State. KSNDMC is engaged in a number of activities related to synergising S & T activities and



providing a common platform for the response players in Disaster Management in Karnataka State. KSNDMC has installed a network of weather monitoring stations which comprises Solar Powered GPRS enabled Telemetric Weather Stations (TWS) at 747 Hoblis (~200 sq km) and 173 Micro-Watersheds and Telemetric Rain Gauge Stations (TRG) at all the 6495 Grampanchayaths (~25 sq km). The data on Temperature, Relative Humidity, Wind Speed, Wind Direction, Rainfall Intensity and amount of Rainfall is being collected at every 15 minutes. The near-real-time data collected through the network is analysed, and maps and reports are generated in real-time. KSNDMC has employed various Dissemination systems to send Disaster-related information through Alerts, Advisories and Early Warnings to all the Government Executives & Communities in Realtime.

NCMRWF & KSNDMC are putting collaborative efforts in generating very high resolution weather forecasts over the Karnataka region and validating the same for various high impact weather phenomena for its possible real-time utilisation for disaster preparedness. KSNDMC will use NCMRWF's modelling and Assimilation capabilities to develop customised weather/climate products for Karnataka region. This collaborative effort would serve the mandate of both institutions. The near-real-time weather data, collected by KSNDMC through the weather monitoring stations network installed in Karnataka, have been shared with NCMRWF. NCMRWF will use the observations in its modelling framework and share the output with KSNDMC. To have a collaboration between both the organisations, it is agreed to sign an MoU for generating very high-resolution weather forecast uninterruptedly and validating the same over Karnataka region.

This MoU defines the mode and methodology of collaborative work and spells out the responsibilities of the parties.

ARTICLE-1: MoU

KSNDMC recognises the importance of utilising the latest developments in high resolution weather modelling to upgrade the skills of its personnel in environment state (weather) forecasting. KSNDMC also recognises that NCMRWF, by its focus on numerical weather modelling, is an organisation with a 'State-of-the-art' assimilation-forecast system, infrastructure, and a set of highly accomplished and reputed and reputed and reputed scientists. The purpose of this collaboration would be to



synergise the expertise of NCMRWF and the KSNDMC towards rapid development of the real-time high-resolution weather forecast over Karnataka and adjoining regions.

Therefore, in consideration of the mutual understanding and goodwill both NCMRWF, Noida and KSNDMC hereby agree to sign a Memorandum of Understanding (MoU) on mutually agreed scope/terms hereinafter mentioned.

ARTICLE-2: SCOPE OF THE MoU

This MoU defines the broad framework of interaction and engagement of the two parties and spells out the rights and responsibilities of the parties hereto. The broad scope of MoU includes the following areas but is not limited to:-

1. Sharing of the in-situ weather data for assimilation and model validation.
2. Utilisation of NCMRWF model products for KSNDMC operations.
3. Carry out joint validation of high resolution model products over Karnataka region.
4. NCMRWF to provide short-term specialised training on Numerical Weather Prediction and associated Data Assimilation Techniques to KSNDMC Scientific Personnel.
5. Deployment of newer data collection platforms and inter-comparison studies.
6. Institutionalising data sharing mechanisms.
7. Institutionalising mechanisms for capacity building in the field of application of high resolution weather models.

ARTICLE-3: SHARING OF FACILITIES/ RESPONSIBILITIES

Both NCMRWF and KSNDMC shall encourage interactions between personnel, scientists, research fellows, faculty members of both the organisations through the following arrangements: -

1. KSNDMC will share the non-confidential weather data with NCMRWF for assimilation, dynamical downscaling and model validation.
2. KSNDMC will use NWP and associated output generated by NCMRWF over Karnataka and adjoining region for improving/updating its operational activities.
3. Conduct short term specialised training capsules/programs by NCMRWF to KSNDMC Scientific Personnel at mutually agreed-upon locations.

4. Carrying out validation for atmospheric model outputs and dynamical downscaling products using in-situ data by KSNDMC and sharing the results between two organisations for research and operational purposes.

NCMRWF Responsibilities:

1. To share high-resolution model and dynamical downscaling output (upto 3 days) over Karnataka and adjoining region with KSNDMC.
2. If any problem occurs in sharing the daily data, NCMRWF will intimate KSNDMC.
3. NCMRWF will use the meteorological observation data obtained from the KSNDMC for operational and R & D in modelling/assimilation and verification of the NWP model. NCMRWF reserves the right to share secondary model data to a third party, for non-commercial purposes, duly acknowledging KSNDMC.
4. Nominate a single point of Technical Contact from the NCMRWF side for technical/operational activities. The contact person is expected to have a reasonably good understanding of the operations processes w.r.t. the project.
5. Provide training to the scientific personnel of KSNDMC.
6. To prepare and submit periodically the results achieved on the nature of work. .
7. NCMRWF will be responsible for providing regular, reliable quality NWP products to predict Thunderstorm & Lightning, heavy rainfall events & urban flooding forecast. Due to inherent forecast uncertainty in the NWP data, NCMRWF will not be held responsible for damages due to imprecise and inaccurate forecasts.

KSNDMC Responsibilities:

1. Share the location details of the weather observation stations installed in Karnataka.
2. Provide observational weather data collected from the weather monitoring stations.
3. If any problem occurs in sharing the daily data files, KSNDMC will intimate NCMRWF.
4. Ensuring availability of FTP server at KSNDMC for downloading and uploading of data.

5. A nodal officer is a single point of Technical Contact from the KSNDMC side for communication regarding technical/operational activities. The contact person is expected to have a reasonably good understanding of the operations, processes and requirements of KSNDMC.
6. KSNDMC to nominate a single point of contact for addressing the administrative activities under the purview of this project.
7. KSNDMC to prepare and submit periodic reports on the nature of work done and the results achieved.
8. Provide details on local urban flooding over Bengaluru.

Joint responsibilities and Coordination:

1. Each party shall pursue its own research and operational programmes that involve data from other sources.
2. Each party shall appropriately acknowledge the other party's contribution while publishing the work in National/International journals or in any other form.
3. Both KSNDMC and NCMRWF shall work together to provide science & technology-based inputs towards Disaster Risk Reduction, Resilient Agriculture in Karnataka.
4. Both KSNDMC and NCMRWF shall meet periodically for knowledge sharing.

General:

1. Any amendments to this MoU will be treated valid and effective if made in writing with the consent of both the parties of this MoU.
2. Either party will not assign its responsibilities to a third party without the consent of the other party.
3. This MoU will be in effect as long as there is no breach of responsibilities by the parties or till termination by the parties on mutual consent. Parties obligations, if any, will survive even after the termination of MoU.

ARTICLE-4: COORDINATION

NCMRWF and KSNDMC together will cooperate in the following areas:

1. Cooperation in utilising KSNDMC weather data and NCMRWF model outputs over the Karnataka region.
2. Participation in mutual training programmes and workshops conducted at KSNDMC and/or NCMRWF.
3. Mutual data sharing in identified areas.

ARTICLE-5: EFFECTIVE DATE AND DURATION

This MoU shall be effective from the date of signing of MoU and valid for five (05) years from that day. The validity of the MoU may be extended for a further period by mutual Agreement, which shall be in writing and signed by both parties.

ARTICLE-6: PRE-CLOSURE

This Agreement is signed in the interest of the Nation and the mutual professional benefits of the two organisations and is valid for the specified period agreed upon therein. However, if there is any requirement to pre-close this Agreement on reasons that warrant such an act, the same may be done with mutual consultations and prior intimation to the affected parties with a notice **not less than three months** in advance. The pre-closure of this Agreement shall not be liable for any compensation to or from either of the parties under this Agreement.

ARTICLE-7: Dispute Resolution

In the event of any dispute or difference relating to interpretation and application of the provisions of commercial contract(s) between central Public Sector Enterprises (CPSEs) / Port Trust inter se and also between CPSEs and Government Departments / Organisations (Excluding disputes concerning Railways, Income Tax, Custom & Excise Departments); such disputes or differences shall be taken up by either party for resolution through AMRCD as mentioned in DPE OM No : 4(1)/2013-DPE(GM)/FTS-1835 dated 22.05.2018.

ARTICLE-8: CONFIDENTIALITY

Information received/gathered in due course of performance of this MoU either written or oral in respect of but not limited to any software/hardware material, product specifications, designs, financial, information, documents etc., shall be deemed to be in private domain and it shall not be made public or shared with any other party without the prior written consent of the party which owns it. However, both NCMRWF and KSNDMC reserve the rights to share any secondary derived data to any third party.

ARTICLE-9: AMENDMENTS

This MoU represents the understanding between NCMRWF and KSNDMC in the present circumstances and supersedes any earlier

understanding, either oral or written, regarding the subject matter of the Agreement.

No amendments or modifications of the MoU shall be valid unless it is made in writing and signed by both the parties and specifically stating the same to be an amendment of the MoU. The modifications shall become part of the MoU from the date they are executed unless otherwise agreed to in writing.

ARTICLE-10: FORCE MAJEURE

In the event of any dispute arising out of Force Majeure wherein any of the parties under this Agreement is unable to meet the specific requirement due to the reasons beyond the control of the organisation, the same may be resolved on mutually agreeable terms and conditions, including waiver if applicable with regard to time, space, quantity or quality of the deliverables.

ARTICLE-11: INTELLECTUAL PROPERTY

KSNDMC and NCMRWF agree to respect and work within the Intellectual Property Policies of each Institution and, wherever necessary, agree to harmonise the policies to resolve special issues.

ARTICLE-12: MISCELLANEOUS

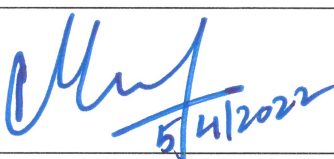
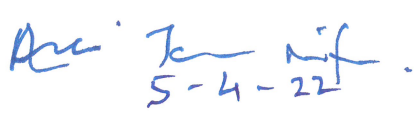
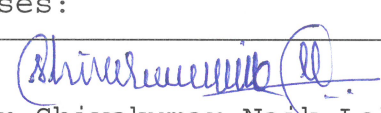
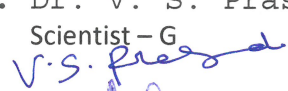
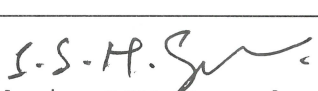
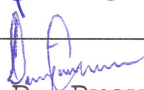
The headings and sub-headings are inserted for convenience only and shall not affect the construction of this Agreement.

After this Agreement has been signed, all preceding understandings/ negotiations and correspondence pertaining to it shall become null and void.

ARTICLE-12: FOCAL POINTS

NCMRWF: Dr. V. S. Prasad Scientist - G	KSNDMC: Shri. SSM. Gavaskar Junior Scientific Officer
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IN WITNESS WHEREOF PARTIES HERETO HAVE ENTERED INTO THIS AGREEMENT EFFECTIVE AS ON THE DATE AND YEAR FIRST WRITTEN ABOVE.

<u>KSNDMC</u>	<u>NCMRWF</u>
By:  5/4/2022	By:  5-4-22
Name: Dr. Manoj Rajan	Name: Dr. Ashis K. Mitra
Designation: Director	Designation: Head
Witnesses:	Witnesses:
1.  Dr. Shivakumar Naik Lal	1. Dr. V. S. Prasad Scientist - G 
2.  Shri. SSM. Gavaskar	2.  Dr. D. Preveen Kumar Scientist-G