

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 6140 (DSI-6140)

**Nested Grid Model (NGM) and Medium Range Forecast (MRF) Archive
January 1991 - April 1997**

December 4, 2002

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1. **Abstract:** The National Weather Service's [National Center for Environmental Prediction](#) (NCEP) runs a series of computer analyses and forecasts operationally. One of the primary operational systems is the Global Data Assimilation System, which uses the spectral Medium Range Forecast model (MRF) for the forecast. Another primary system is the Regional Analysis and Forecast System (RAFS), which uses the Nested Grid Model (NGM) for the forecast. Output from the RAFS covers North America. In simple terms, for each run, observations are assimilated with "first guess" data fields (forecasts from the previous model run), and dynamic imbalances in the data are reduced, resulting in "analyzed" data fields. Then the forecast is made. The analyzed data should provide a better representation of the real atmosphere than observations alone because of limitations in the observations. Some of these limitations are due to measurement error or other instrument problems, and nonuniform spatial and temporal distributions of the observations.

At NOAA's [Air Resources Laboratory](#) (ARL), the NCEP model data are used for air quality transport and dispersion modeling. ARL archives both NGM and GDAS data using an ARL packing method and both archives contain basic fields such as the u- and v-wind components, temperature, and humidity. However, the archives differ from each other in the number of surface fields and vertical levels as provided by NCEP.

ORIGIN OF DATA

The enclosed 2-hourly data come from NCEP's RAFS. The data may be referred to as NGM data because the forecast component of the system is the NGM model. The RAFS was designed to provide improved numerical guidance over the United States out to 48 hours. Improvements over the existing limited-area fine-mesh model (LFM) included improved horizontal and vertical resolution (especially in the lower layers) and better use of observations. Details of the RAFS are described by Hoke, et al. (1989).

NCEP post-processing of the RAFS routinely provides NGM forecast output at 6 hour intervals on approximately a 180 km grid (a few fields such as precipitation are output at 91 km) to the NAS 9000 mainframe computer. ARL archives the NGM forecast data at 2-hour intervals on a 180 km grid (although the data are available to ARL at 1 hour intervals on a 91 km operationally, due to space limitations only 2 hourly, 180 km data are archived). The higher temporal resolution of the data has been found to result in less transport error in an atmospheric dispersion model.

ARL PROCESSING

The ARL archiving program extracts the 2 hourly, 180 km data from the 1 hour, 91 km data onto a 33 by 28 polar stereographic grid covering the United States, Southern Canada, and immediate coastal waters. The ARL program runs on the NAS 9000 mainframe and outputs the data to disk.

The Archive data file contains the data in synoptic time sequence (UTC), without any missing records (missing data will be represented by -1 and the forecast hour by -1). Therefore, it is possible to position randomly to any point within a data file. At each time period on the surface (or single level) data come first, followed the data at each sigma level from the ground up. A sigma level (Phillips, 1957) is defined as:

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$$\text{Sigma} = \frac{P - P_t}{P_s - P_t}$$

Where P is the reference pressure, P_t is the top model pressure (0 mb for the NGM), and P_s is the model surface pressure along the model terrain surface. NGM data are archived at 10 sigma levels ranging from 0.9823 to 0.43414, or approximately 980 to 434 mb.

2. Element Names and Definitions:

ELEMENT/FIELD	UNIT	LABEL
Ice Covered Water Areas (0=no, 1=yes)	----	ICWT
Snow Covered Areas (0=no, 1=yes)	----	SNOW
Terrain Height	m	SHGT
Mean Sea Level Pressure	hPa	MSLP
Convective Precipitation	m	CPPT
Total Precipitation	m	TPPT
Exchange Coefficient at surface	kg/m2/s	EXCO
Upward Turbulent Flux of Sensible Heat	W/m2	HFLX
Upward Turbulent Flux of Water	kg/m2/s	WFLX
Surface Pressure	hPa	PRSS
Number of Mixed Layers next to surface	-----	MXLR
U Component of Wind wrt Grid	m/s	UWND
V Component of Wind wrt Grid	m/s	VWND
Vertical Velocity (dp/dt)	hpa/s	WWND
Specific Humidity	kg/kg	SPHU
Temperature	K	TEMP

The MRF archive adds:

Surface Temperature	K	TMPS
Geopotential height in meters	gpm	HGTS
Relative Humidity	%	RELH

3. Start Date: 19910101

DATA AVAILABILITY -- January - April 15, 1997

NOTE: THIS IS THE END OF THE NGM ARL ARCHIVE.

Month/Year	Date	Time	Missing data
JAN 97			None
FEB 97			None
MAR 97	09	00Z	initialization*
	12	12Z	initialization*
APR 97	04	02-12Z	Missing
	16-30		Missing

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived. DATA AVAILABILITY -- July - December, 1996

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Month/Year	Date	Time	Missing data
JUL 96			None
AUG 96			None
SEP 96	06	14-22Z	All data missing
	07	00Z	initialization*
OCT96	10	12Z	initialization*
NOV 96			None
DEC 96			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived. DATA AVAILABILITY -- January - June, 1996

Month/Year	Date	Time	Missing data
JAN 96			None
FEB 96			None
MAR 96			None
APR 96			None
MAY 96			None
JUN 96	4	00Z	initialization*

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- July - December, 1995

Month/Year	Date	Time	Missing data
JUL 95			None
AUG 95	11	12Z	Initialization*
SEP 95			None
OCT 95			None
NOV 95			None
DEC 95			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- January - June, 1995

Month/Year	Date	Time	Missing data
JAN 95	26	14-22Z	All data missing

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		27	00Z	initialization*
FEB	95			None
MAR	95			None
APR	95			None
MAY	95	27	00Z	initialization*
JUN	95	24	00Z	initialization*

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- July - December, 1994

Month/Year	Date	Time	Missing data
JUL 94	28	00Z	Initialization*
AUG 94			None
SEP 94			None
OCT 94			None
NOV 94	16	00Z	Initialization*
DEC 94	21	12Z	Initialization*

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- January - June, 1994

Month/Year	Date	Time	Missing data
JAN 94	17	14-22Z	All data missing
	18	00Z	initialization*
FEB 94			None
MAR 94			None
APR 94			None
MAY 94			None
JUN 94			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- July - December, 1993

Month/Year	Date	Time	Missing data
JUL 93			None

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AUG 93	None
SEP 93	None
OCT 93	None
NOV 93	None
DEC 93	None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- January - June, 1993

Month/Year	Date	Time	Missing data
JAN 93	08	00Z	Initialization*
FEB 93	17	00Z	Data missing only this hour
MAR 93	08	12Z	Initialization*
APR 93			None
MAY 93			None
JUN 93			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- July - December, 1992

Month/Year	Date	Time	Missing data
JUL 92			None
AUG 92			None
SEP 92			None
OCT 92			None
NOV 92	01	14-22Z	All data missing
	02	00Z	initialization*
DEC 92			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

NOTE: on December 29, 1992, the surface level was changed from level 1 to level 0. This also implies that all sigma levels were reduced by one as well.

DATA AVAILABILITY -- January - June, 1992

Month/Year	Date/Time	Missing data or comments
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JAN 92	01/01Z - 17/11Z	Odd hours written instead of even hours (1,3,5...)
	17/12Z	Initialization*
FEB 92		None
MAR 92	04/02Z - 04/12Z	Missing data
	26/14Z - 27/22Z	Missing data
	28/00Z	Initialization*
	28/14Z - 28/22Z	Missing data
	29/00Z	Initialization*
	29/14Z - 29/22Z	Missing data
	30/00Z	Initialization*
APR 92		None
MAY 92		None
JUN 92		None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

DATA AVAILABILITY -- July - December, 1991

Month/Year	Date	Time	Missing data
JUL 91	03	12Z	initialization*
	04	12Z	initialization*
	06	12Z	initialization*
	07	12Z	initialization*
AUG 91	17	00Z	initialization*
	18	00Z	initialization*
SEP 91			None
OCT 91	25	12Z	all data
	29	00Z	all data
NOV 91	26	12Z	initialization*
DEC 91	02	12Z	initialization*
	04	12Z	initialization*

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

Note: During 1991 the odd hour (01,03,...11) convective and total precipitation fields were inadvertently added to the even hour (02,04,...12) precipitation fields. Therefore, to estimate the correct accumulated precipitation one should divide the convective and total precipitation by 2. This error was corrected on January 1, 1992.

DATA AVAILABILITY -- January - June, 1991

Month/Year	Date	Time	Missing data
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JAN 91			None
FEB 91			None
MAR 91			None
APR 91	04	12Z	initialization*
	05	00Z	initialization*
	22	12Z	all data
	23	00Z	initialization*
	24	00Z	initialization*
MAY 91	07	12Z	all data
	08	00Z	initialization*
	23	12Z	all data
JUN 91			None

* Initialization means that the 0 hour data were written instead of the 12 hour forecast data. In these cases, a few of the surface (or single) level fields may be filled with 0's. The NGM does not compute these fields at the initialization hour, which is why the 02- to 12-hour forecast fields are normally archived.

Note: During 1991 the odd hour (01,03,...11) convective and total precipitation fields were inadvertently added to the even hour (02,04,...12) precipitation fields. Therefore, to estimate the correct accumulated precipitation one should divide the convective and total precipitation by 2. This error was corrected on January 1, 1992.

4. **Stop Date:** 19970415

5. **Coverage:** North America

- a. Southernmost Latitude: 25N
- b. Northernmost Latitude: 50N
- c. Westernmost Longitude: 125W
- d. Easternmost Longitude: 65W

6. **How to Order Data:**

Ask NCDC's Climate Services about the cost of obtaining this data set.
 Phone: 828-271-4800
 FAX: 828-271-4876
 E-mail: NCDC.Orders@noaa.gov

7. **Archiving Data Center:**

National Climatic Data Center
 Federal Building
 151 Patton Avenue
 Asheville, NC 28801-5001
 Phone: (828) 271-4800.

8. **Technical Contact:**

National Climatic Data Center
 Federal Building
 151 Patton Avenue
 Asheville, NC 28801-5001

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Phone: (828) 271-4800.

NOAA Air Resources Laboratory
SSMCII, Rm. 3463
1315 East West Highway
Silver Spring, MD 20910
Phone: (301) 713-0295 x134
<http://www.arl.noaa.gov>

9. **Known Uncorrected Problems:** None.

10. **Quality Statement:** No information was provided with original documentation.

11. **Essential Companion Datasets:** None.

12. **References:**

Gerrity, J., 1977: The LFM model - 1976: A documentation. NOAA Tech. Memo. NWS NMC 60, 68 pp.

Hoke, J.E., N. A. Phillips, G.J. DiMego, J.J. Tuccillo, and J.G. Sela, 1989: The Regional Analysis and Forecast System of the National Meteorological Center, Weather and Forecasting, 4 (323-334).

Kanamitsu, M., 1989: Description of the NMC Global Data Assimilation and Forecast System, Weather and Forecasting, 4(335-342).

Newell, J.E. and D.G. Deaven, 1981: The LFM-II Model - 1980. NOAA Tech. Memo. NWS NMC 66, U.S. Department of Commerce, Washington, D.C., 20 pp.

Petersen, R.A. and J.D. Stackpole, 1989: Overview of the NMC Production Suite, Weather and Forecasting, 4 (313-322).

Phillips, N.A., 1957: A Coordinate System Having Some Special Advantages for Numerical Forecasting. J. Meteor., 14 (184-185).

Rolph, G.D. and R.R. Draxler, 1990: Sensitivity of Three-Dimensional Trajectories to the Spatial and Temporal Densities of the Wind Field, Journal of Applied Meteorology, 29 (1043-1054).

Sela, J.G., 1980: Spectral modeling at the National Meteorological Center, Mon. Wea. Rev., 108 (1279-1292).

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