National Climatic Data Center

DATA DOCUMENTATION

FOR
NOAA Operational Model Archive and Distribution System (NOMADS)

North America Regional Reanalysis (NARR) "Merge" data set

DATASET DSI-6175

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Prepared for
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1. Abstract

These files are from the North America Regional Reanalysis(NARR) Project and contain the analyses and selected quantities from the 0 to 3 hours forecast. The NARR is a reanalysis of historical observations using a 32 km version of the NCEP 1993 operational ETA model and ETA data assimilation system (EDAS). The domain of analyses includes North and Central America as well as small parts of the UK, Eastern Asia and South America and the oceans in between. The period of the reanalyses is from October 1978 to the present and analyses were made 8 times daily. Horizontal boundary conditions were derived from the NCEP/DOE Reanalysis.

The "merged" dataset provides a high spatial (32 km) and temporal (3 hour) analyses of North America and adjacent oceans and land masses from October 1978 to the present. Advantages over the widely used NCEP/NCAR Reanalysis are its higher resolution and a much better treatment of the land surface through a better land-surface model (NOAH), through the assimilation of more surface data (observed precipitation and surface winds) and through a better representation of the terrain (heights, vegetation, soil type).

This data set contains "conventional" atmospheric analyses as well as model-derived fields which contain estimates of subsurface, surface, and radiative properties.

This data set is encoded in WMO format GRIB version 1 using the NCEP GRIB table 131. The data are stored on a Lambert conformal grid (AWIPS grids 221) and efforts have been make to make the data GrADS compatible (http://grads.iges.org/grads).

2. Elements and Definitions

The files for each analysis time are named

```
merged_AWIP32.YYYYMMDDHH
and
merged_AWIPS32.YYYYMMDDHH.b
```

YYYYMMDDHH is the date code which corresponds to the analysis time or the starting time of the forecast for model predicted quantities such as flux or precipitation. The possible HH are 0,03, 06, 09, 12, 15, 18, and 21. All time are in UTC.

The data for each analysis time is split into two files so that the data will be compatible with the software program, GrADS. The ".b" file is much smaller and contains fields that are similar to those in the larger file except they have some differences that GrADS does not recognize. For example, the ".b" file contains 3 hour forecast of the sensible heat flux whereas the larger file contains the average from the 0-3 hour forecast.

These files are in GRIB 1 format using NCEP table 131. A copy of this table can be obtained from

ftp://wesley.ncep.noaa.gov/pub/wgrib/nceptab_131

the GRIB documentation from

http://www.nco.ncep.noaa.gov/pmb/docs/on388/

and a GRIB decoder from

http://wesley.ncep.noaa.gov/wgrib.html

The data is on in a Lambert conformal grid (AWIPS grid 221) and all vector components are earth relative rather than grids relative which is the convention for operational NCEP model. The list of fields produced by the NARR ETA model differs from the operational ETA model.

Inventory of main file

```
ACPCPsfc         ACC* Convective precipitation [kg/m^2]
ALBDOsfc         ANL* surface Albedo [%]
APCPsfc          ACC* Total precipitation [kg/m^2]
APCPNsfc         ACC* Total precipitation (nearest grid point)
[kg/m^2]
BGRUNsfc         ACC* Subsurface runoff (baseflow) [kg/m^2]
BMIXLhlev1       ANL* hybrid level 1 Blackadars mixing length scale
[m]
CAPEsfc          ANL* surface Convective available potential energy
[J/kg]
CAPE180_0mb      ANL* 180-0 mb above gnd Convective available
potential energy [J/kg]
CCONDsfc         ANL* Canopy conductance [m/s]
CDsfc            ANL* Surface drag coefficient [non-dim]
CDCONclm         AVE* atmos column Convective cloud cover [%]
CDLYRclm         AVE* atmos column Non-convective cloud [%]
CFRZRsfc         3hr* Categorical freezing rain [yes=1;no=0]
```

```
CICEPsfc         3hr* Categorical ice pellets [yes=1;no=0]
CINsfc           ANL* Convective inhibition [J/kg]
CIN180_0mb       ANL* 180-0 mb above gnd Convective inhibition [J/kg]
CLWMRprs         ANL* 29* Cloud water [kg/kg]
CNWATsfc         ANL* Plant canopy surface water [kg/m^2]
CRAINsfc         3hr* Categorical rain [yes=1;no=0]
CSNOWsfc         3hr* Categorical snow [yes=1;no=0]
DLWRFsfc         AVE* surface Downward longwave radiation flux [W/m^2]
DPT2m            ANL* 2 m Dew point temp. [K]
DSWRFsfc         AVE* surface Downward shortwave radiation flux
[W/m^2]
EVPsfc           ACC* surface Evaporation [kg/m^2]
FRICVsfc         ANL* Surface friction velocity [m/s]
GFLUXsfc         AVE* Ground Heat Flux [W/m^2]
HCDChcl          3hr* high cloud level High level cloud cover [%]
HGTprs           ANL* 29* Geopotential height [gpm]
HGThlev1         ANL* hybrid level 1 Geopotential height [gpm]
HGTclb           ANL* cloud base Geopotential height [gpm]
HGTclt           ANL* cloud top Geopotential height [gpm]
HGT0deg          ANL* 0C isotherm level Geopotential height [gpm]
HGTmwl           ANL* max wind level Geopotential height [gpm]
HGTtrp           ANL* tropopause Geopotential height [gpm]
HLCY0_3000m      ANL* 3000-0 m above ground Storm relative helicity
[m^2/s^2]
HPBLsfc          ANL* surface Planetary boundary layer height [m]
ICMRprs          ANL* 29* Ice mixing ratio [kg/kg]
LCDClcl          3hr* low cloud level Low level cloud cover [%]
LFTX500_1000mb   ANL* 500-1000 mb Surface lifted index [K]
LHTFLsfc         AVE* surface Latent heat flux [W/m^2]
MCDCmcl          3hr* mid-cloud level Mid level cloud cover [%]
MCONVprs         ANL* Horizontal moisture divergence [kg/kg/s]
MCONVhlev1       ANL* hybrid level 1 Horizontal moisture divergence
[kg/kg/s]
MCONV30_0mb      ANL* 30-0 mb above gnd Horizontal moisture divergence
[kg/kg/s]
MCONV60_30mb     ANL* 60-30 mb above gnd Horizontal moisture
divergence [kg/kg/s]
MCONV90_60mb     ANL* 90-60 mb above gnd Horizontal moisture
divergence [kg/kg/s]
MCONV120_90mb    ANL* 120-90 mb above gnd Horizontal moisture
divergence [kg/kg/s]
MCONV150_120mb   ANL* 150-120 mb above gnd Horizontal moisture
divergence [kg/kg/s]
MCONV180_150mb   ANL* 180-150 mb above gnd Horizontal moisture
divergence [kg/kg/s]
MSLETmsl         ANL* Mean sea level pressure (ETA model) [Pa]
MSTAV0_100cm     ANL* 0-100 cm undergnd Moisture availability [%]
PEVAPsfc         ACC* surface Potential evaporation [kg/m^2]
POTsfc           ANL* surface Potential temp. [K]
POT10m           ANL* 10 m Potential temp. [K]
POT30m           ANL* 30 m Potential temp. [K]
POThlev1         ANL* hybrid level 1 Potential temp. [K]
PRATEsfc         3hr* Precipitation rate [kg/m^2/s]
PRESsfc          ANL* surface Pressure [Pa]
PRES2m           ANL* 2 m Pressure [Pa]
PRES10m          ANL* 10 m Pressure [Pa]
PRES30m          ANL* 30 m Pressure [Pa]
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PREShlev1         ANL* hybrid level 1 Pressure [Pa]
PRESclb           ANL* cloud base Pressure [Pa]
PRESclt           ANL* cloud top Pressure [Pa]
PRESadcl          ANL* adiabatic lifting condensation level Pressure
[Pa]
PRESmwl           ANL* max wind level Pressure [Pa]
PREStrp           ANL* tropopause Pressure [Pa]
PRESNsfc          ANL* surface Pressure (nearest grid point) [Pa]
PRMSLmsl          ANL* Pressure reduced to MSL [Pa]
PWATclm           ANL* atmos column Precipitable water [kg/m^2]
RCQsfc            ANL* surface Humidity parameter in canopy conductance
[fraction]
RCSsfc            ANL* surface Solar parameter in canopy conductance
[fraction]
RCSOLsfc          ANL* surface Soil moisture parameter in canopy
conductance [fraction]
RCTsfc            ANL* surface Temperature parameter in canopy
conductance [fraction]
RH2m              ANL* 2 m Relative humidity [%]
RHhlev1           ANL* hybrid level 1 Relative humidity [%]
RH0deg            ANL* 0C isotherm level Relative humidity [%]
SFEXCsfc          ANL* surface Exchange coefficient [(kg/m^3)(m/s)]
SHTFLsfc          AVE* surface Sensible heat flux [W/m^2]
SNODsfc           ANL* Snow depth [m]
SNOHFsfc          AVE* Snow phase-change heat flux [W/m^2]
SNOMsfc           ACC* Snow melt [kg/m^2]
SNOWCsfc          ANL* Snow cover [%]
SOILL0_10cm       ANL* 0-10 cm Liquid volumetric soil moisture (non-
frozen) [fraction]
SOILL10_40cm      ANL* 10-40 cm Liquid volumetric soil moisture (non-
frozen) [fraction]
SOILL40_100cm     ANL* 40-100 cm Liquid volumetric soil moisture (non-
frozen) [fraction]
SOILL100_200cm    ANL* 100-200 cm Liquid volumetric soil moisture (non-
frozen) [fraction]
SOILM0_200cm      ANL* 0-200 cm Soil moisture content [kg/m^2]
SOILW0_10cm       ANL* 0-10 cm Volumetric soil moisture (frozen+liquid)
[fraction]
SOILW10_40cm      ANL* 10-40 cm Volumetric soil moisture
(frozen+liquid) [fraction]
SOILW40_100cm     ANL* 40-100 cm Volumetric soil moisture
(frozen+liquid) [fraction]
SOILW100_200cm    ANL* 100-200 cm Volumetric soil moisture
(frozen+liquid) [fraction]
SPFHprs           ANL* 29* Specific humidity [kg/kg]
SPFH2m            ANL* 2 m Specific humidity [kg/kg]
SPFH10m           ANL* 10 m Specific humidity [kg/kg]
SPFH30m           ANL* 30 m Specific humidity [kg/kg]
SPFHhlev1         ANL* hybrid level 1 Specific humidity [kg/kg]
SPFH30_0mb        ANL* 30-0 mb above gnd Specific humidity [kg/kg]
SPFH60_30mb       ANL* 60-30 mb above gnd Specific humidity [kg/kg]
SPFH90_60mb       ANL* 90-60 mb above gnd Specific humidity [kg/kg]
SPFH120_90mb      ANL* 120-90 mb above gnd Specific humidity [kg/kg]
SPFH150_120mb     ANL* 150-120 mb above gnd Specific humidity [kg/kg]
SPFH180_150mb     ANL* 180-150 mb above gnd Specific humidity [kg/kg]
SSRUNsfc          ACC* Surface runoff (non-infiltrating) [kg/m^2]
TCDCclm           3hr* atmos column Total cloud cover [%]
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TKEprs            ANL* 15* Turbulent Kinetic Energy [J/kg]
TKEhlev1          ANL* hybrid level 1 Turbulent Kinetic Energy [J/kg]
TMPsfc            ANL* surface Temp. [K]
TMPprs            ANL* 29* Temp. [K]
TMP2m             ANL* 2 m Temp. [K]
TMP10m            ANL* 10 m Temp. [K]
TMP30m            ANL* 30 m Temp. [K]
TMPhlev1          ANL* hybrid level 1 Temp. [K]
TMP30_0mb         ANL* 30-0 mb above gnd Temp. [K]
TMP60_30mb        ANL* 60-30 mb above gnd Temp. [K]
TMP90_60mb        ANL* 90-60 mb above gnd Temp. [K]
TMP120_90mb       ANL* 120-90 mb above gnd Temp. [K]
TMP150_120mb      ANL* 150-120 mb above gnd Temp. [K]
TMP180_150mb      ANL* 180-150 mb above gnd Temp. [K]
TMPclt            ANL* cloud top Temp. [K]
TMPtrp            ANL* tropopause Temp. [K]
TSOILdpl          ANL* Soil temp. [K]
TSOIL0_10cm       ANL* 0-10 cm undergnd Soil temp. [K]
TSOIL10_40cm      ANL* 10-40 cm undergnd Soil temp. [K]
TSOIL40_100cm     ANL* 40-100 cm undergnd Soil temp. [K]
TSOIL100_200cm    ANL* 100-200 cm undergnd Soil temp. [K]
UFLXsfc           ANL* surface Zonal momentum flux [N/m^2]
UGRDprs           ANL* 29* u wind [m/s]
UGRD10m           ANL* 10 m u wind [m/s]
UGRD30m           ANL* 30 m u wind [m/s]
UGRDhlev1         ANL* hybrid level 1 u wind [m/s]
UGRD30_0mb        ANL* 30-0 mb above gnd u wind [m/s]
UGRD60_30mb       ANL* 60-30 mb above gnd u wind [m/s]
UGRD90_60mb       ANL* 90-60 mb above gnd u wind [m/s]
UGRD120_90mb      ANL* 120-90 mb above gnd u wind [m/s]
UGRD150_120mb     ANL* 150-120 mb above gnd u wind [m/s]
UGRD180_150mb     ANL* 180-150 mb above gnd u wind [m/s]
UGRDmwl           ANL* max wind level u wind [m/s]
UGRDtrp           ANL* tropopause u wind [m/s]
ULWRFsfc          AVE* surface Upward long wave radiation flux [W/m^2]
ULWRFtoa          AVE* top of atmos Upward long wave radiation flux
[W/m^2]
USTM0_6000m       ANL* 6000-0 m above ground u-component of storm
motion [m/s]
USWRFsfc          AVE* surface Upward short wave radiation flux [W/m^2]
USWRFtoa          AVE* top of atmos Upward short wave radiation flux
[W/m^2]
VEGsfc            ANL* Vegetation [%]
VFLXsfc           ANL* surface Meridional momentum flux [N/m^2]
VGRDprs           ANL* 29* v wind [m/s]
VGRD10m           ANL* 10 m v wind [m/s]
VGRD30m           ANL* 30 m v wind [m/s]
VGRDhlev1         ANL* hybrid level 1 v wind [m/s]
VGRD30_0mb        ANL* 30-0 mb above gnd v wind [m/s]
VGRD60_30mb       ANL* 60-30 mb above gnd v wind [m/s]
VGRD90_60mb       ANL* 90-60 mb above gnd v wind [m/s]
VGRD120_90mb      ANL* 120-90 mb above gnd v wind [m/s]
VGRD150_120mb     ANL* 150-120 mb above gnd v wind [m/s]
VGRD180_150mb     ANL* 180-150 mb above gnd v wind [m/s]
VGRDmwl           ANL* max wind level v wind [m/s]
VGRDtrp           ANL* tropopause v wind [m/s]
VISsfc            ANL* surface Visibility [m]
```

```
VSTM0_6000m      ANL* 6000-0 m above ground v-component of storm
motion [m/s]
VVELprs          ANL* 29* Pressure vertical velocity [Pa/s]
VVELhlev1        ANL* hybrid level 1 Pressure vertical velocity [Pa/s]
VVEL30_0mb       ANL* 30-0 mb above gnd Pressure vertical velocity
[Pa/s]
VVEL60_30mb      ANL* 60-30 mb above gnd Pressure vertical velocity
[Pa/s]
VVEL90_60mb      ANL* 90-60 mb above gnd Pressure vertical velocity
[Pa/s]
VVEL120_90mb     ANL* 120-90 mb above gnd Pressure vertical velocity
[Pa/s]
VVEL150_120mb    ANL* 150-120 mb above gnd Pressure vertical velocity
[Pa/s]
VVEL180_150mb    ANL* 180-150 mb above gnd Pressure vertical velocity
[Pa/s]
VWSHtrp          ANL* tropopause Vertical speed shear [1/s]
WCCONVtoa_700mb  ACC* TOA-700 mb Water condensate flux convergence
(vert. int) [kg/m^2]
WCCONVclm        ACC* atmos column Water condensate flux convergence
(vert. int) [kg/m^2]
WCINCtoa_700mb   ACC* TOA-700 mb water condensate added by precip
assimilaition [kg/m^2]
WCINCclm         ACC* atmos column water condensate added by precip
assimilaition [kg/m^2]
WCUFLXtoa_700mb  ACC* TOA-700 mb Water condensate zonal flux (vertical
int) [kg/m]
WCUFLXclm        ACC* atmos column Water condensate zonal flux
(vertical int) [kg/m]
WCVFLXtoa_700mb  ACC* TOA-700 mb Water condensate meridional flux
(vertical int) [kg/m]
WCVFLXclm        ACC* atmos column Water condensate meridional flux
(vertical int) [kg/m]
WEASDsfc         ANL* surface Accum. snow [kg/m^2]
WVCONVtoa_700mb  ACC* TOA-700 mb Water vapor flux convergence
(vertical int) [kg/m^2]
WVCONVclm        ACC* atmos column Water vapor flux convergence
(vertical int) [kg/m^2]
WVINCtoa_700mb   ACC* TOA-700 mb water vapor added by precip
assimilation [kg/m^2]
WVINCclm         ACC* atmos column water vapor added by precip
assimilation [kg/m^2]
WVUFLXtoa_700mb  ACC* TOA-700 mb Water vapor zonal flux (vertical
int)[kg/m]
WVUFLXclm        ACC* atmos column Water vapor zonal flux (vertical
int)[kg/m]
WVVFLXtoa_700mb  ACC* TOA-700 mb Water vapor meridional flux (vertical
int) [kg/m]
WVVFLXclm        ACC* atmos column Water vapor meridional flux
(vertical int) [kg/m]
```

Inventory of .b file

```
DLWRFsfc      3hr* surface Downward longwave radiation flux [W/m^2]
DSWRFsfc      3hr* surface Downward shortwave radiation flux [W/m^2]
GFLUXsfc      3hr* Ground Heat Flux [W/m^2]
LHTFLsfc      3hr* surface Latent heat flux [W/m^2]
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```
PWATclm       3hr* atmos column Precipitable water [kg/m^2]
SHTFLsfc      3hr* surface Sensible heat flux [W/m^2]
ULWRFsfc      3hr* surface Upward long wave radiation flux [W/m^2]
USWRFsfc      3hr* surface Upward short wave radiation flux [W/m^2]
WEASDsfc      3hr* Accum. snow [kg/m^2]
```

ACC* = accumulation from a 0-3 hour forecast, flux become transports
ANL* = analysis
AVE* = average from a 0-3 hour forecasts
3hr* = 3 hour forecasts
29* = analyses available on the 29 pressure levels (hPA): 1000 975 950 925 900 875 850 825 800 775 750 725 700 650 600 550 500 450 400 350 300 275 250 225 200 175 150 125 100
15* = analyses available on the 15 pressure levels (hPA): 1000 975 950 925 900 875 850 825 800 775 750 725 700 650 600

3. Start Date: 1978100100

4. End Date: present

5. Coverage:

a. Southernmost Latitude: 8N
b. Northernmost Latitude: 85N
c. Westernmost Longitude: 150E
d. Easternmost Longitude: 5W

6. How to Order Data:

The cost for this data when accessed through NOMADS system servers or associated ftp web based services is free. For more information contact:

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9. Known Uncorrected Problems:

Gulf of California low level jet is too strong during summer.
Surface wind stress was written with insufficient precision.

10. Quality Statement:

Disclaimer

While every effort has been made to ensure that data are accurate and reliable within the limits of the current state of the art, NOAA cannot assume liability for any damages caused by any errors or omissions in the data, nor as a result of the failure of the data to function on a particular system.

NOAA makes no warranty, expressed or implied, nor does the fact of distribution constitute such a warranty.

The data used to produce these analyses and forecasts has undergone automated quality checks.

11. Essential Companion Data Sets

NCEP grib table 131,

ftp://wesley.ncep.noaa.gov/pub/wgrib/nceptab_131

12. References:

a. Mesinger, F., et al, 2004: NCEP North American Regional Reanalysis, 15th Symp. On Global Change and Climate Variations, Seattle, WA, 11-15 Jan 2004.

b. Shafran, P., J. Woollen, W. Ebisuzaki, W. Shi, Y. Fan, R. W. Grumbine, M. Fennessy, 2004: Observational Data Used for Assimilation in the NCEP North American Regional Reanalysis, 20th Intl. Conf. On Interactive Information Processing Systems for Meteor. Ocean. And Hydrology. Seattle, WA, 11-15 Jan 2004.

c. Ebisuzaki, W., J. Alpert, J. Wang, D. Jovic, P. Shafran, 2004: North American Regional Reanalysis: end user access to large data sets, 20th Intl. Conf. On Interactive Information Processing Systems for Meteor. Ocean. And Hydrology. Seattle, WA, 11-15 Jan 2004.

d. Mesinger, F., G. DiMego, E. Kalnay, P. Shafran, W. Ebisuzaki, Y. Fan, R. Grumbine, W. Higgins, Y. Lin, K. Mitchell, D. Parrish, E. Rogers, W. Shi, D. Stokes, J. Woolen, 2003: NCEP Regional Reanalysis, Symp. on Observing and Understanding the Variability of Water in Weather and Climate, Long Beach, CA, Feb.9-13, 2003.