User's Guide for the NMM Core of the Weather Research and Forecast (WRF) Modeling System Version 2.1

Chapter 1: Overview

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Introduction

The Nonhydrostatic Mesoscale Model (NMM) core of the Weather Research and Forecasting (WRF) system was developed by the National Oceanic and Atmospheric Adminstration (NOAA) National Centers for Environmental Prediction (NCEP). The current release is Version 2. The WRF-NMM is designed to be a flexible, state-of-the-art atmospheric simulation system that is portable and efficient on available parallel computing platforms. The WRF-NMM is suitable for use in a broad range of applications across scales ranging from meters to thousands of kilometers, including:

- Real-time NWP
- Forecast research
- Parameterization research
- Coupled-model applications
- Teaching

The NOAA/NCEP and the Developmental Testbed Center (DTC) are currently maintaining and supporting the WRF-NMM portion of the overall WRF code (Version 2) that includes:

- WRF-NMM dynamic solver
- WRF-NMM Standard Initialization package (WRF-NMM SI)
- Numerous physics packages contributed by WRF partners and the research community
- Scripts for producing images in several graphics programs.

Other components of the WRF system will be supported for community use in the future, depending on interest and available resources.

The WRF modeling system software is in the public domain and is freely available for community use.

The WRF-NMM System Program Components

Figure 1 shows a flowchart for the WRF-NMM Modeling System Version 2. As shown in the diagram, the WRF-NMM Modeling System consists of these major components:

- WRF Standard Initialization (WRF- NMM SI)
- WRF-NMM solver
- WRF Post-processing and graphics tools

WRF-NMM SI

This program is used for real-data simulations. Its functions include:

1. Defining the simulation domain;
2. Interpolating terrestrial data (such as terrain, land-use, and soil types) to the simulation domain;
3. Degribbing and interpolating meteorological data from another model to the simulation domain and the model coordinate.

WRF-NMM Solver

The key features of the WRF-NMM model are:

- Fully compressible, non-hydrostatic model with a hydrostatic option (Janjic, 2003a).
- Hybrid (sigma-pressure) vertical coordinate.
- Arakawa E-grid.
- Forward-backward scheme for horizontally propagating fast waves, implicit scheme for vertically propagating sound waves, Adams-Bashforth Scheme for horizontal advection, and Crank-Nicholson scheme for vertical advection. The same time step is used for all terms.
- Conservation of a number of first and second order quantities, including energy and enstrophy (Janjic 1984).

(For more details and references, see Chapter 5 .)

The WRF-NMM model code contains an initialization program ***(real_nmm.exe***; see Chapter 4) and a numerical integration program (***wrf.exe***).

WRF-NMM FLOW CHART

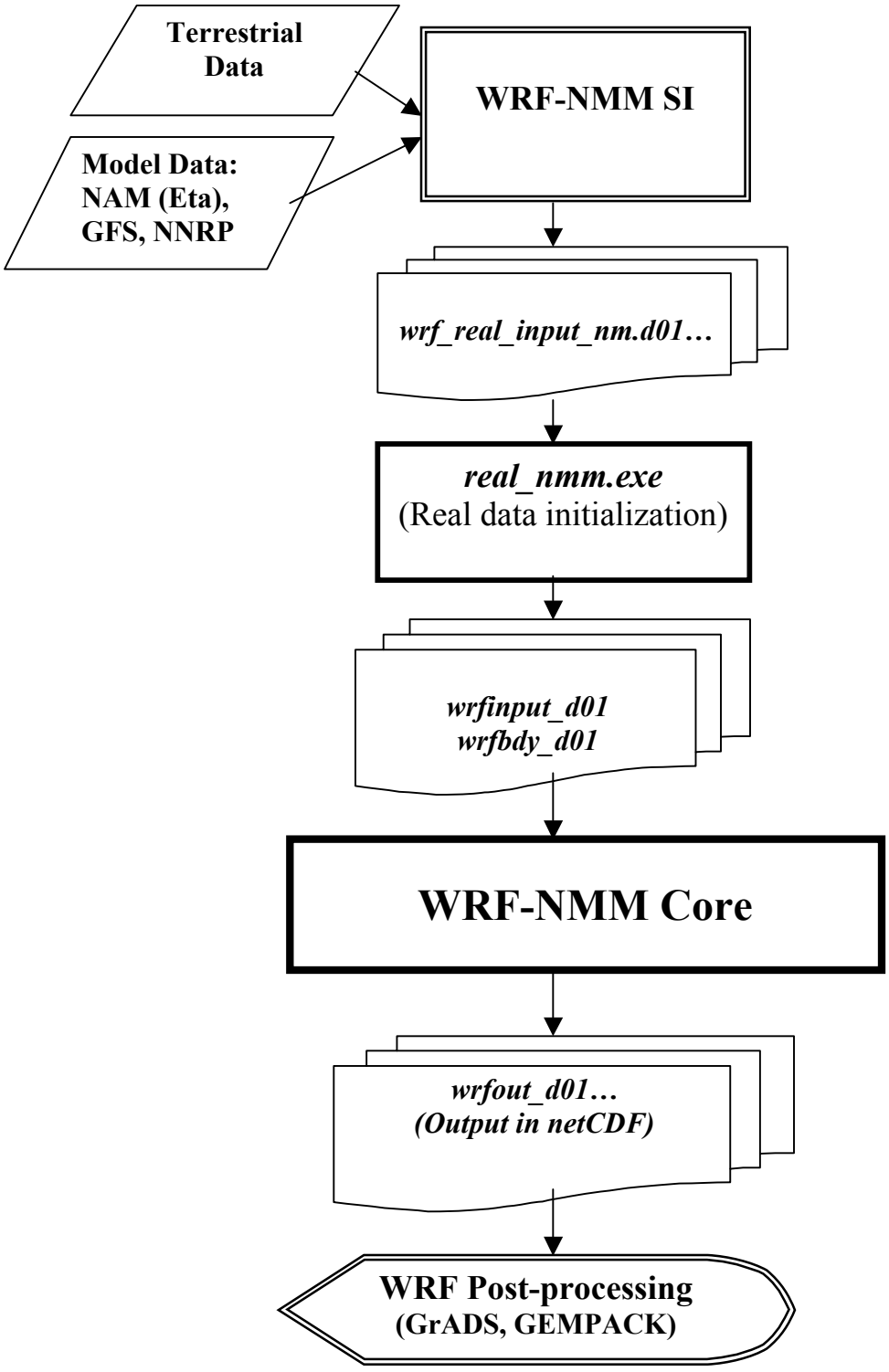

Figure 1: WRF-NMM flow chart for Version 2.