# WRF Software Framework (WSF) v2.1

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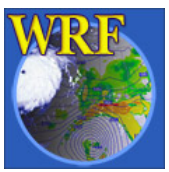
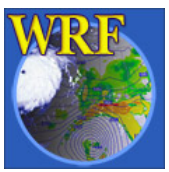


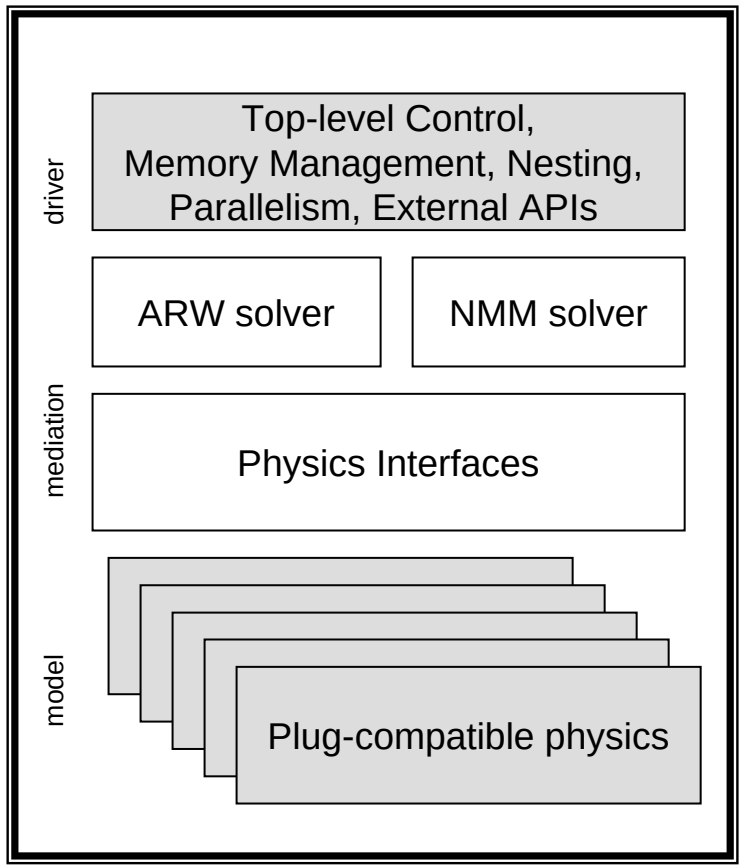
# Acknowledgements


- Significant support
  - Air Force Weather Agency, esp. Jerry Wegiel
  - DoD HPCMO
  - USWRP (NOAA and NSF)

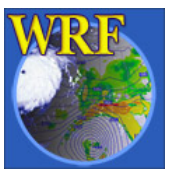
# WRF Software Framework Overview

- Implementation of WRF Architecture
  - Hierarchical organization
  - Multiple dynamical cores
  - Plug compatible physics
  - Abstract interfaces (APIs) to external packages
  - Registry for managing model state
  - Performance-portable



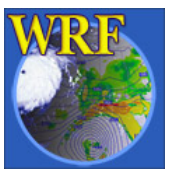
# WSF Enhancements for V2.1 (Highlights)

- Inclusion of NMM-Core in source distribution (with Tom Black, S. Gopal, NCEP)
- WRF DA-VAR and Model version synchronization
- GRIB 1 (Todd Hutchinson, WSI)
- Generalized physics interface (with Sue Chen et al. NRL-MRY)
- Nest init option similar to MM5's IOVERW=2 (for AFWA)
- Comprehensive regression testing for quality control
- **Performance and Efficiency**
- **Nesting and Moving Nests**
- **ESMF Integration**

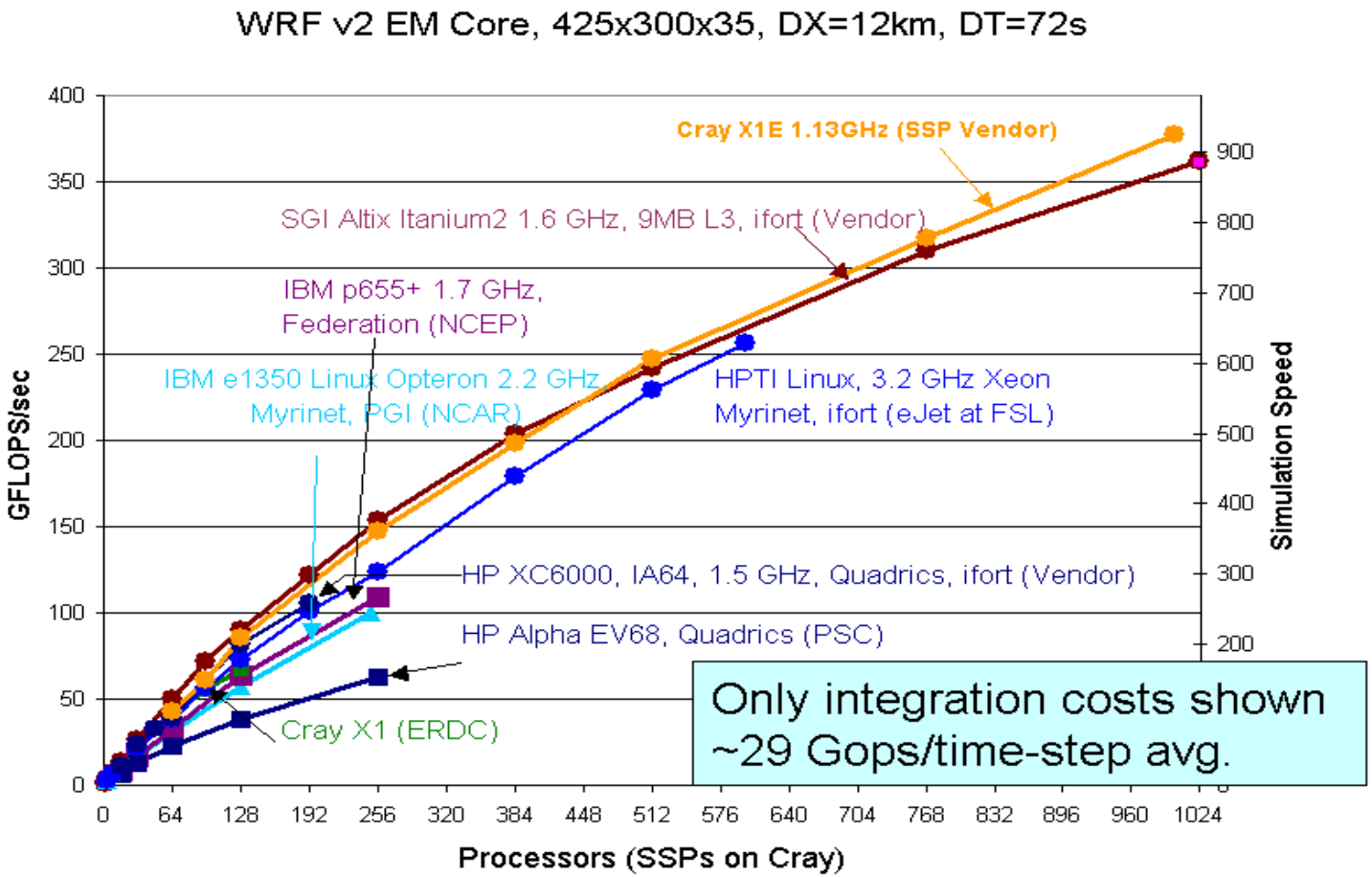


# Performance and Efficiency

- New external communication package: RSL LITE
  - Select during configure/compile
  - Very light-weight, scalable
    - No upper limit on domain size (RSL was 1024x1024)
    - No upper limit on number of processors
    - Low memory overhead
    - Fast model initialization
  - Example: 7% performance improvement on Hurricane Ivan 5-Day Moving Nest Simulation
- New ports
  - IBM: Blue Gene/L (no performance data available yet)
  - Cray: X1e (vector) and XD1 (Opteron) series
  - Apple: G5 (no DM-parallel yet)



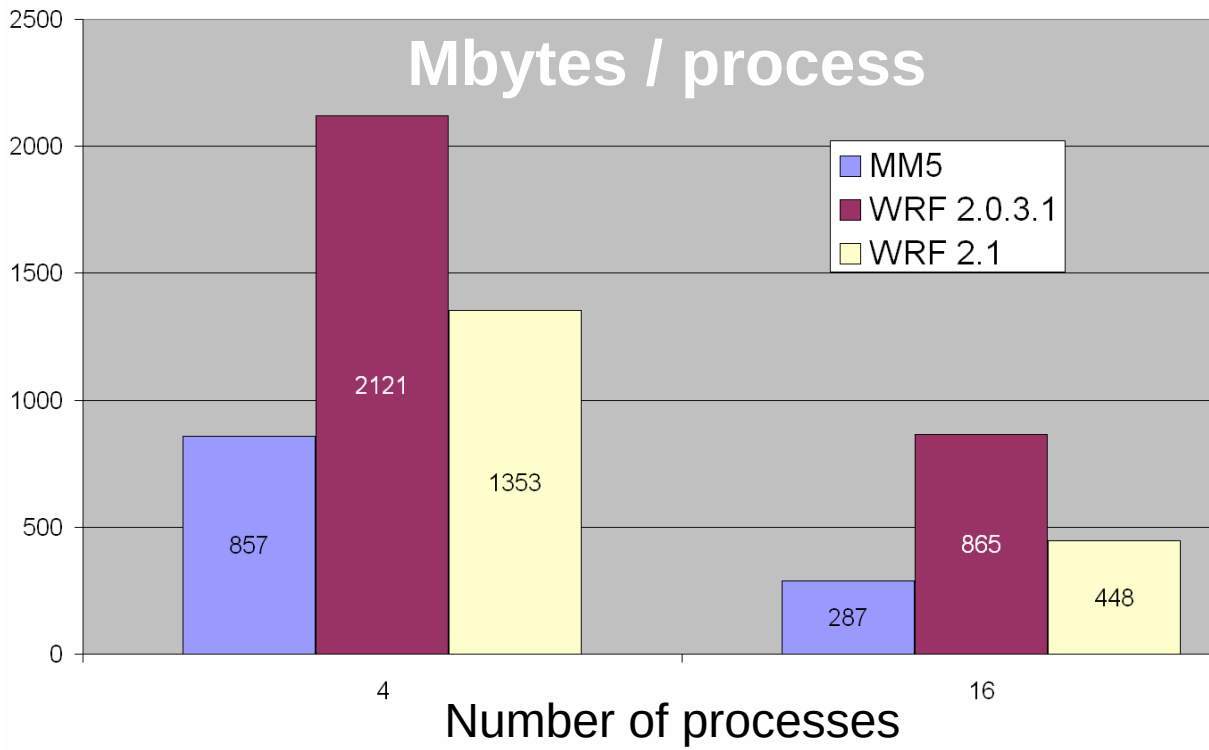
# Performance (v2.0.x)




- New v2.1 based standardized benchmark cases will be released in coming weeks, with release of WRF v2.1

# Improved Memory Utilization in v2.1

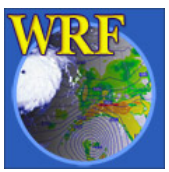
- Reduced temporary data for nesting
- Removed 2nd time-level for tracer arrays
- Smaller, lighter-weight comm package RSL LITE




2 domain configuration
425 x 300 x 35 each

# Moving Nests

- Augment 2-way interactive nesting in WRF to allow reorientation of nested domain with respect to parent
  - Automatic movement algorithms such as U. Miami vortex following scheme
  - Automatic ingest of nested-resolution terrain and other lower boundary data to initialize leading edge of moving nest
  - HyCOM coupling (UNDER DEVELOPMENT)
  - Supports 2 or more nest levels in telescoping configuration
  - Parallel and efficient: small additional overhead (~2%) on top of 5-8% overhead for non-moving 2-way nesting.
- With S. Chen, J. Cangialosi, W. Zhao (RSMAS, U. Miami) and S. Gopal at NCEP. Software infrastructure development supported by NOAA/NCEP (for use with NMM).
- Fully implemented in ARW Core for use in RAINEX and real-time hurricane forecasting this coming season…

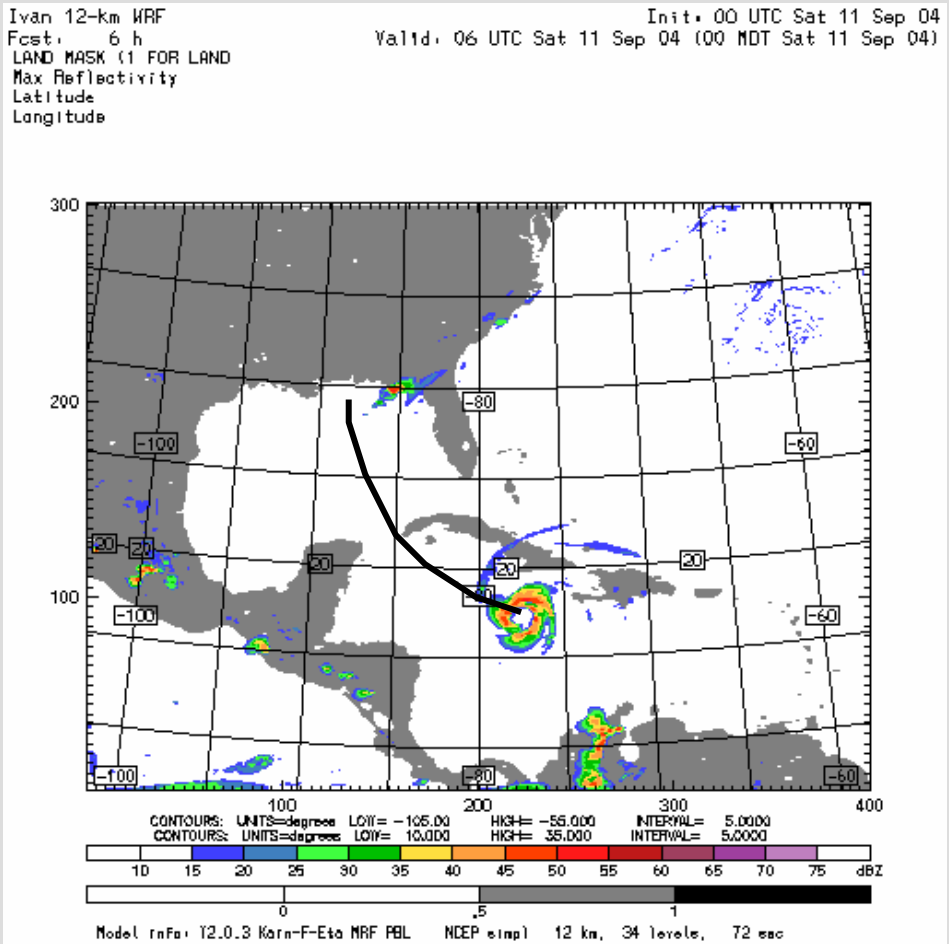


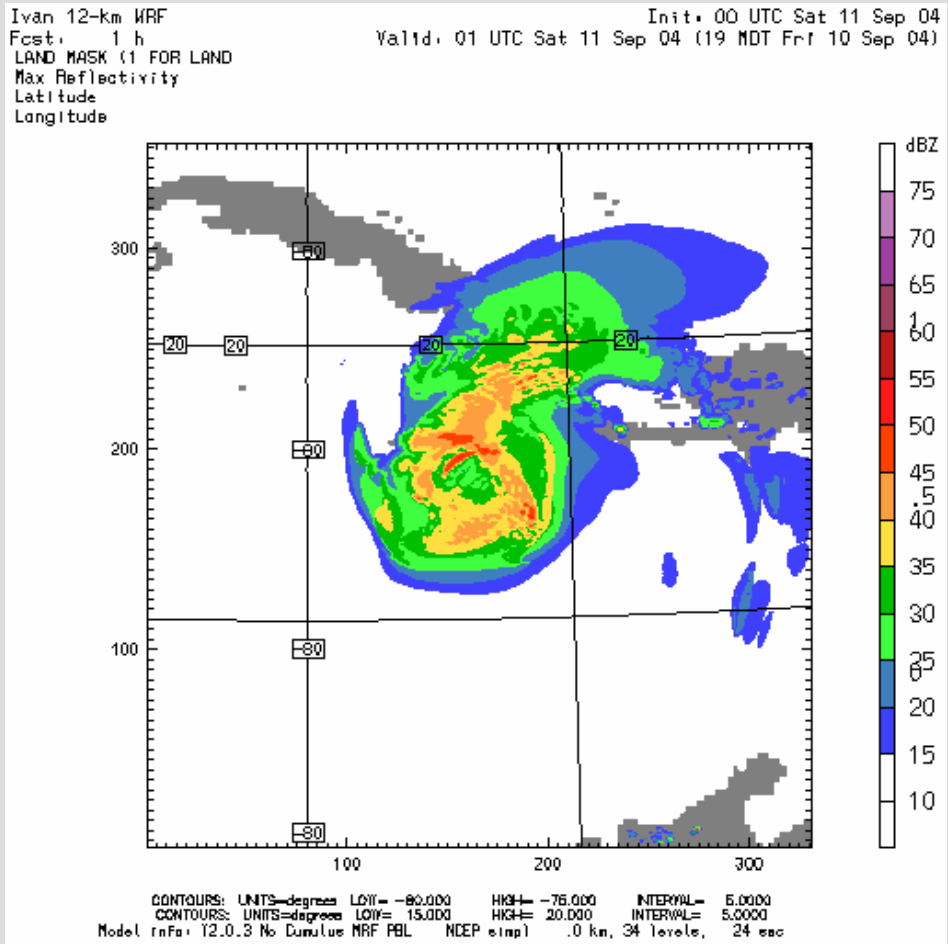
# Five-day Hurricane Ivan 12km/4km Moving Nest

Two-way interacting nest with high-resolution terrain ingest at leading edge

400 x 301 x 35, dt = 72 sec

331 x 352 x 35, dt = 24 sec




Run time: 8.6 hours on 64p IBM Power 4 (AFWA), including 20 minutes I/O

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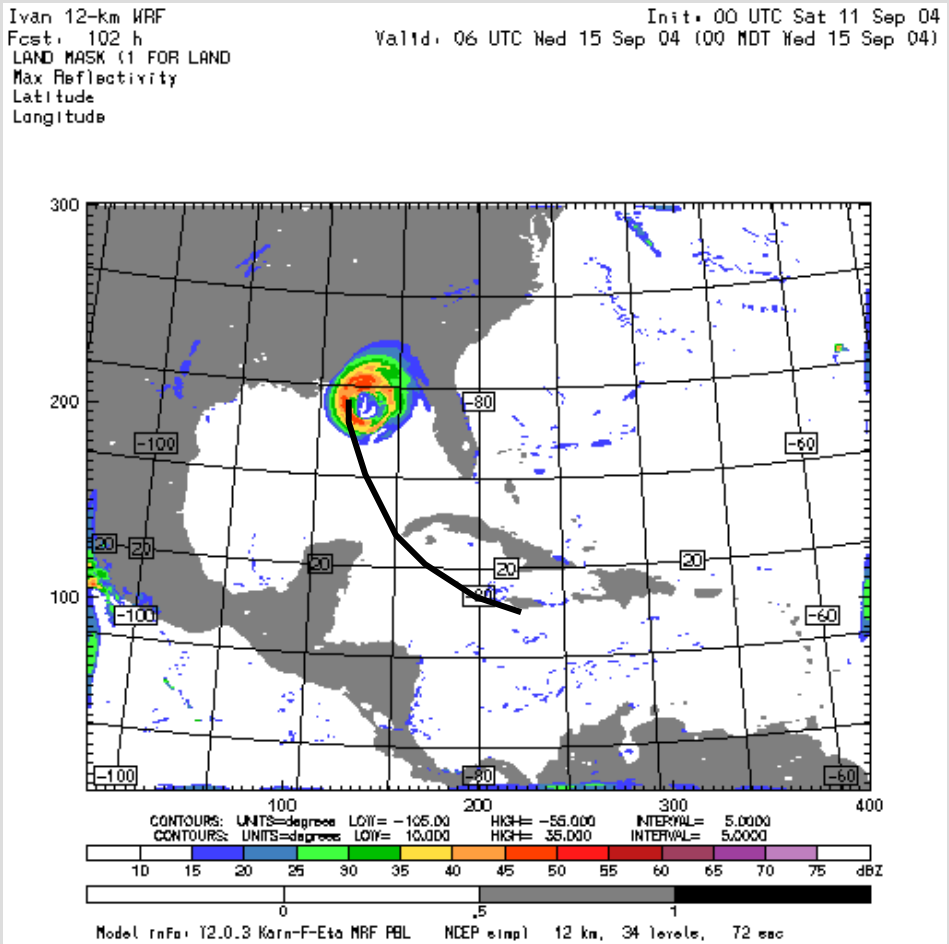
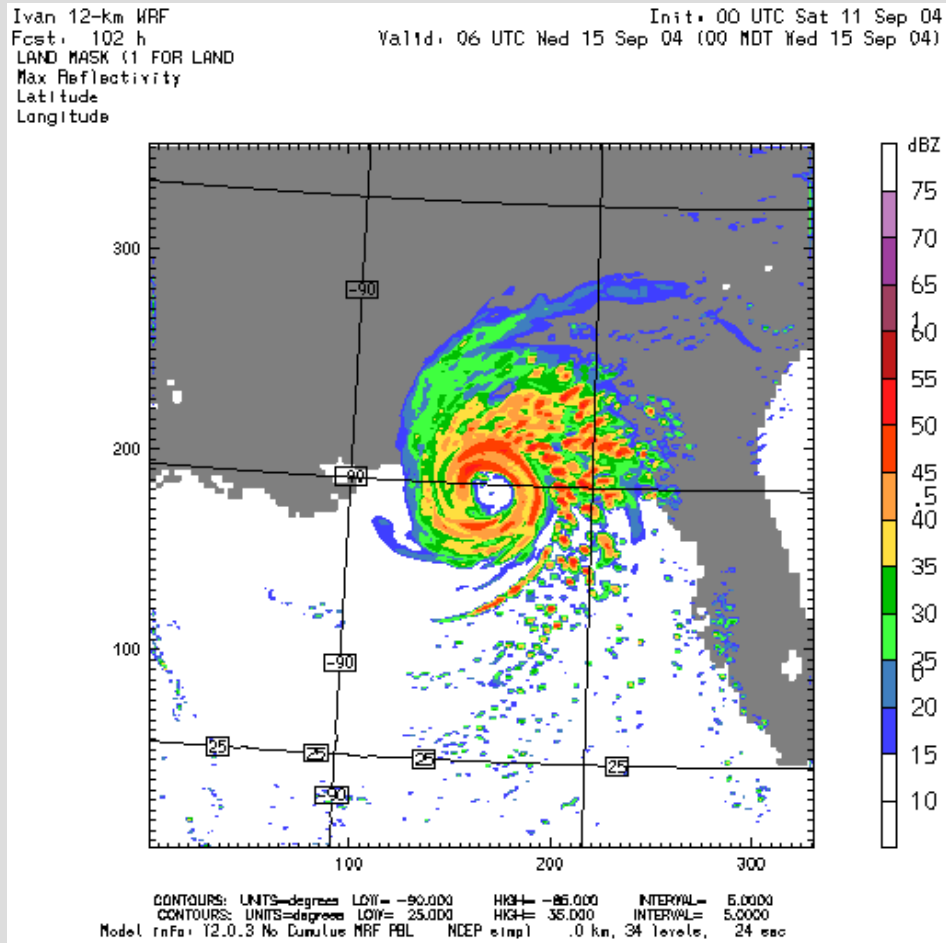


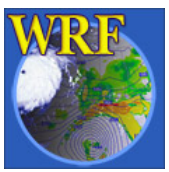




**Click here to see the full animation**
***(if supported by your computer)***

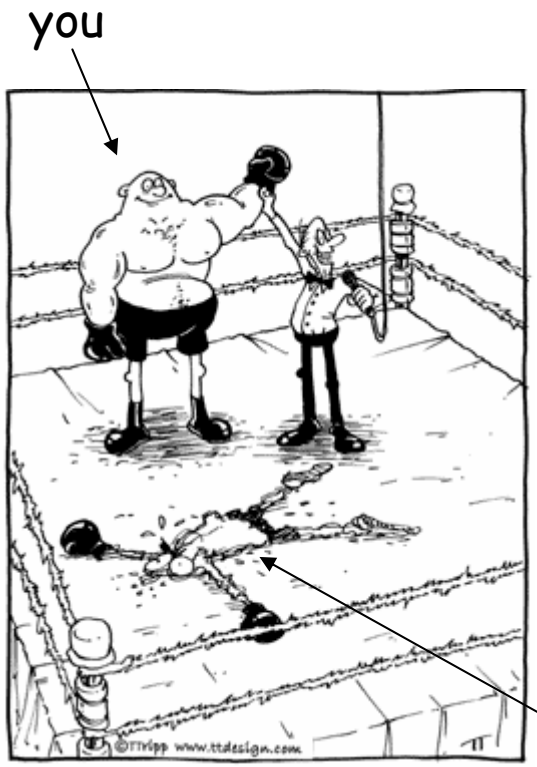
Run time: 8.6 hours on 64p IBM Power 4 (AFWA), including 20 minutes I/O

# ESMF Integration

- WRF as an ESMF component model
  - WRF v2.1 can operate as an ESMF component
  - Full coupling functionality through ESMF in-progress (initial target: HyCOM)
- Also:
  - ESMF Time Management Utility
  - ESMF Error Logging Utility
  - WRF I/O has been adopted in ESMF
  - Participating in CF metadata convention standardization
- ESMF can be used with v2.1 (but is not required)



# WRF Software Support and Documentation



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http://www.mmm.ucar.edu/wrf/WG2/software_v2

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Coming soon:
SourceFORGE.net® based code repository