# Strategic Implementation Plan (SIP) for a Community-based Unified Modeling System

## *Dynamics and Nesting WG*

*Presented by*

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# Dynamics & Nesting WG *Membership*

## *SIP WG Team Members*

| Last Name | First Name | Org |
|---|---|---|
| **Tallapragada** | **Vijay**** | **NCEP/EMC** |
| **Harris** | **Lucas**** | **GFDL** |
| **Gopalakrishnan** | **Sundararaman**** | **HRD/AOML** |
| **Jablonowski** | **Christiane**** | **U. of Michigan** |
| Black | Tom | NCEP/EMC |
| Trahan | Samuel | NCEP/EMC |
| Mehra | Avichal | NCEP/EMC |
| Juang | Henry | NCEP/EMC |
| Viereck | Rodney | NCEP/SWPC |
| Yudin | Valery | CIRES/CSU |
| Mahajan | Rahul | NCEP/EMC |
| Kleist | Daryl | NCEP/EMC |
| Fuller-Rowell | Tim | NCEP/SWPC |

***SIP D&N WG Co-Chairs*

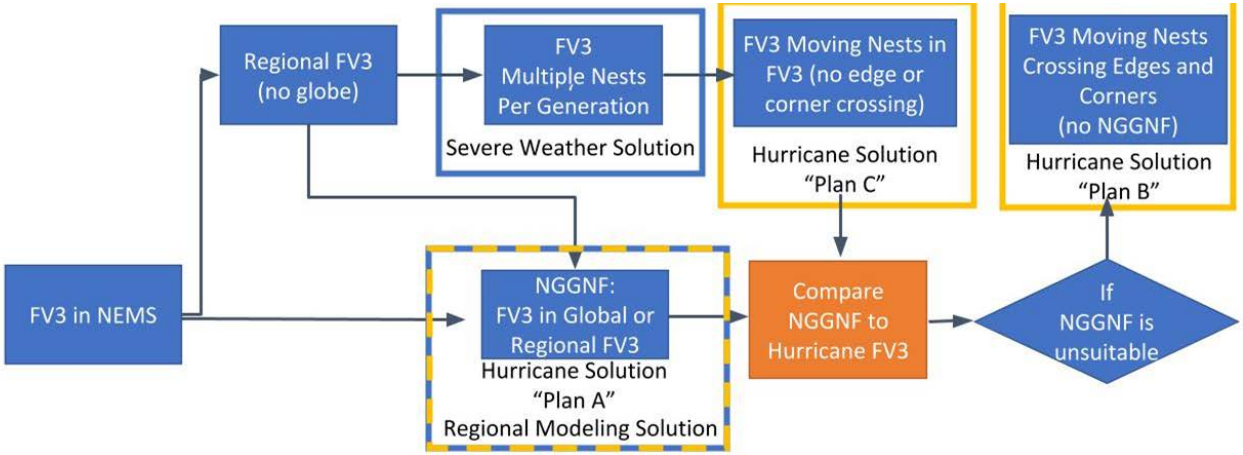
## *NGGPS D&N Team Members*

| Last Name | First Name | Org |
|---|---|---|
| Wicker | Lou | NSSL |
| Sun | Shan | ESRL/GSD |
| Govett | Mark | ESRL/GSD |
| Putnam | Bill | NASA/GMAO |
| Goldhaber | Steve | NCAR/CGD/CESM |
| Zhang | Xuejin | HRD/AOML |
| Liu | Fei | NESII/ NEMS |
| Lin | Shian-Jiann | GFDL |
| Reinecki | Alex | NRL Monterey |
| Wang | Ning | ESRL/GSD |
| Jovic | Dusan | NCEP/EMC |
| Michalakes | John | UCAR (NRL) |
| Diaz | Steven | HRD/AOML |
| Bender | Morris | GFDL |
| Doyle | Jim | NRL Monterey |

# Dynamics & Nesting WG

## *Plans for Static and Moving Nests in FV³*

- Path forward is clear. This is a “doing” group not a “talking” group. Tasks include:
  - *Implementation of moving nests for hurricane modeling purposes. Two potential solutions have been identified and will begin development.*
  - *Further improvements to nesting and stretching for regional applications, especially for high-resolution CAM modeling and WoF.*
  - *Model infrastructure (NEMS and FMS) support for these tasks*
  - *Computational efficiency and ease of use for research and operations drive the developments*



# Dynamics & Nesting WG

## *Plan for Deep Atmosphere Dynamics*

***Scope:*** A deep atmosphere and variable-composition option, consistent with existing $FV^3$ algorithm, for space weather prediction.

***Philosophy:*** Minimizing changes to $FV^3$ dycore and introduce changes incrementally; utilize what we have done previously with WAM-GSM, except maintain use of potential virtual temperature rather than enthalpy

***Requirements and Plan:***

- Variable gas constant $R_i$ & specific heats $Cp_i$ with five tracers
- Extend vertical extent to ~$10^{-7}$ Pa (~600 km) and add additional physical processes, including strong 3D molecular diffusion, interaction with plasma (ionosphere) on different magnetic field grid system, regridding with ESMF
- Deep atmosphere dynamics, variable geocentric distance r, gravity g(z), and extra terms in Coriolis force
- Ensure tolerance for T > 2000 K and U, V >1000 m/s, W >100 m/s

# Dynamics & Nesting WG
## *Key issues to resolve*

- How can physics suites (new or from other models) and DA systems be best integrated with FV$^3$? How can they take advantage of FV$^3$'s variable-resolution capabilities?
  - **This is where the community can contribute the most!!**
- What further improvements can be made for nesting and grid refinement?
- What features do physics/DA/ensembles developers need from FV$^3$? Stochastic physics, IAU, adjoints, WAM, etc.
  - WAM Physics including horizontal diffusion and fast transport of major species; rapid response of thermosphere and ionosphere to space weather drivers; rapid updates to DA to resolve tides and meet space weather driver requirementsd

***•Any changes to the dynamics would require close collaboration with FV$^3$ core developers at GFDL and/or NASA-Goddard to ensure correctness of implementation.***