

# Recent research insights in forest biomass and carbon estimation

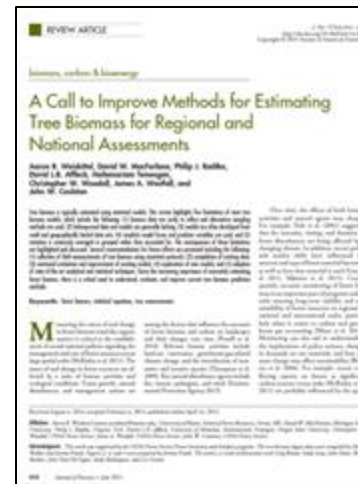
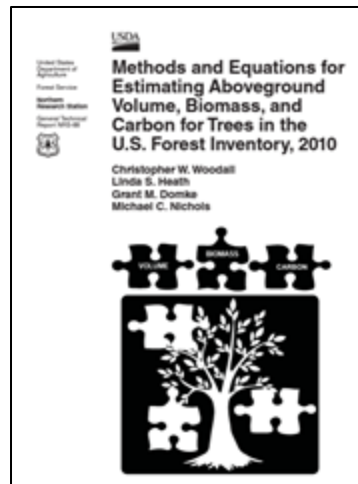
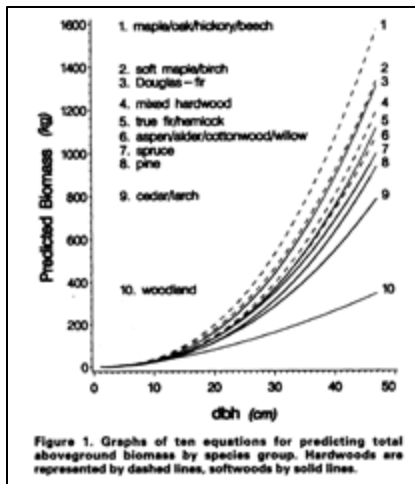
Matthew Russell

30 Nov 2022

California Air Resources Board -  
U.S. Forest Projects Compliance Offset Protocol Workshop

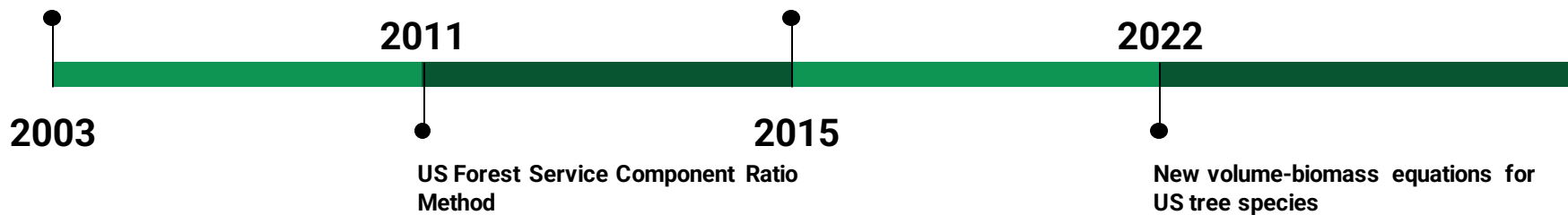


[arbor-analytics.com](https://arbor-analytics.com)

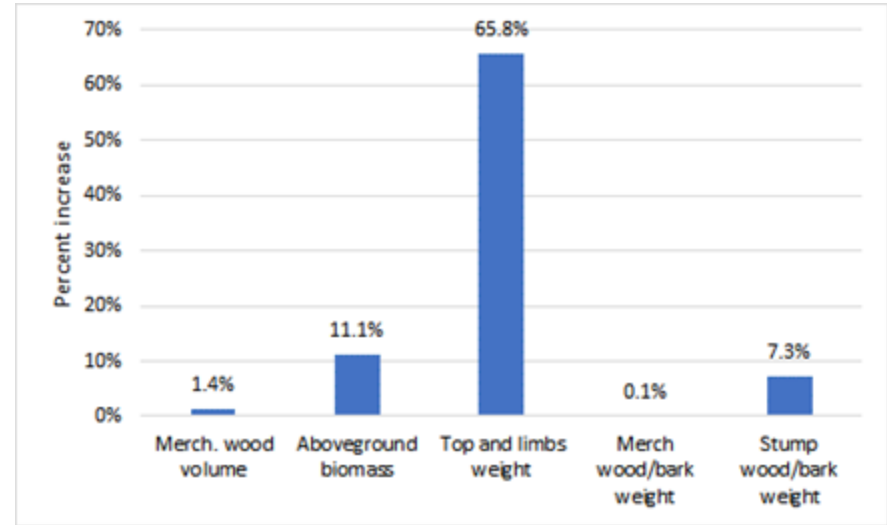
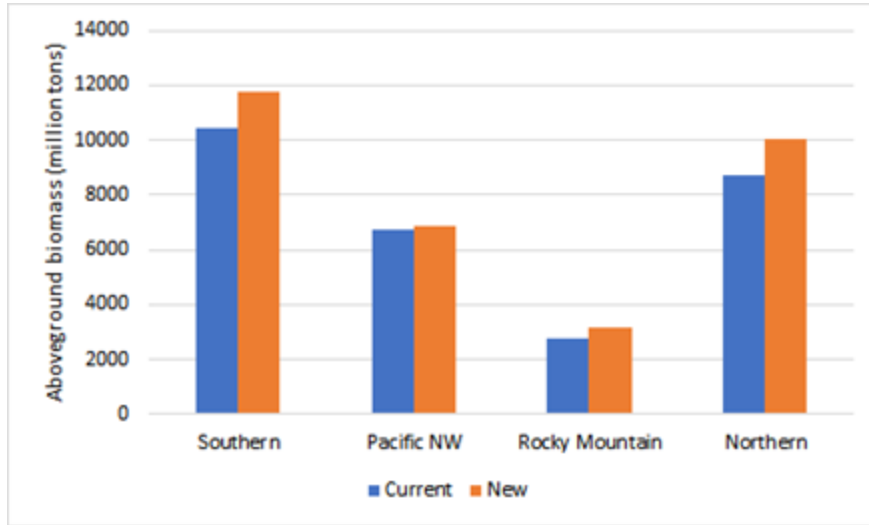


Jenkins biomass equations

“A call to improve methods for estimating tree biomass for regional and national assessments”

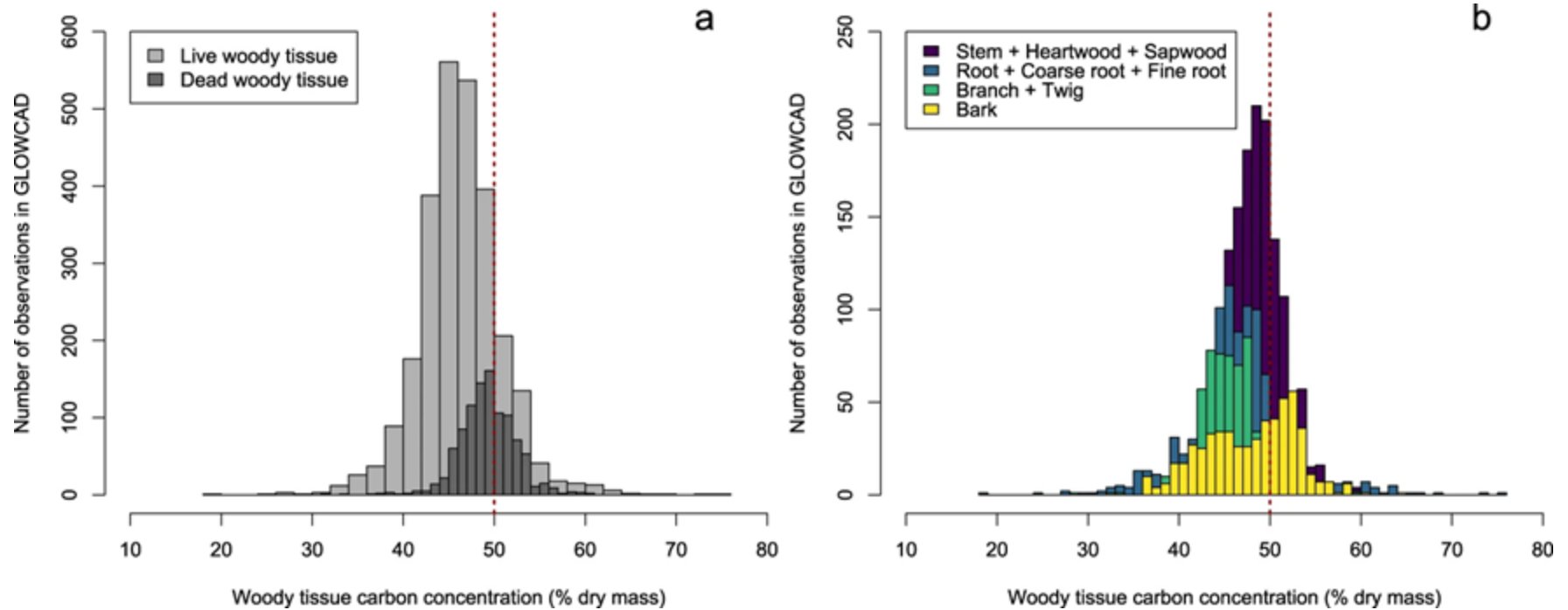


# New national scale volume and biomass estimators show an 11% increase in aboveground biomass.



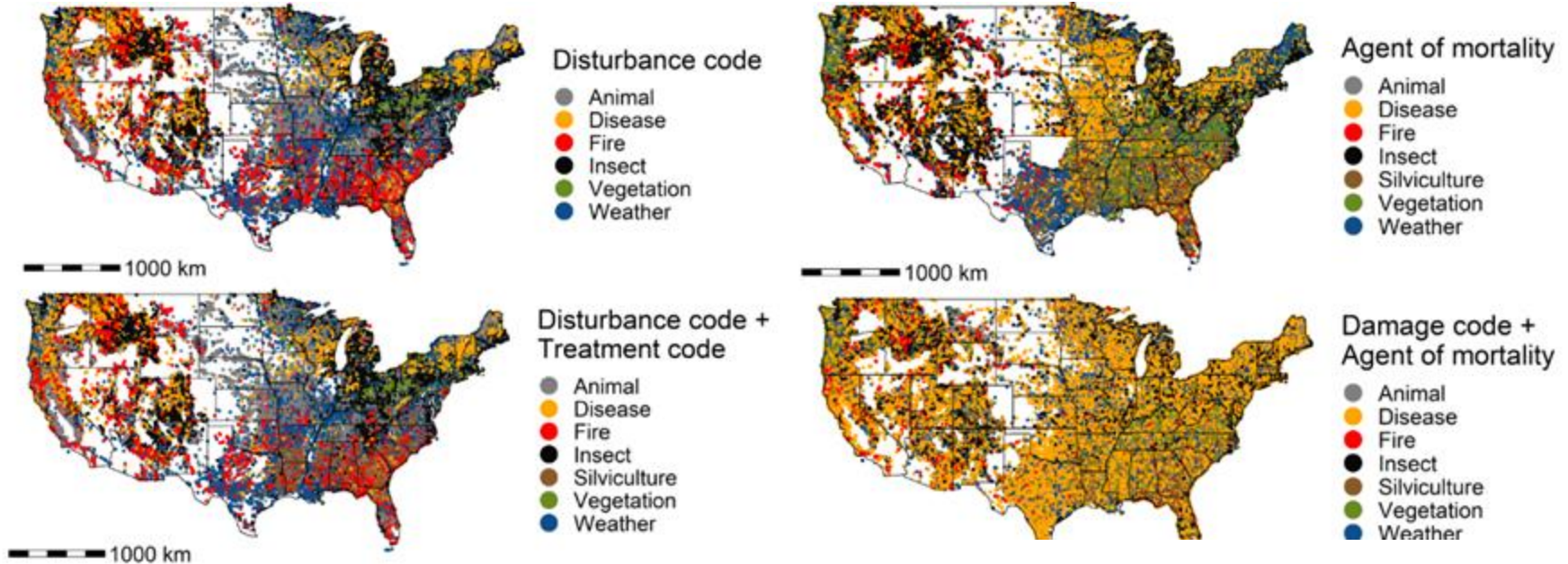
Source: USDA Forest Service, <https://www.fs.usda.gov/research/research/inventory/FIA/VBC> (July 2022)

# Beyond the 50% assumption: carbon fractions in wood.



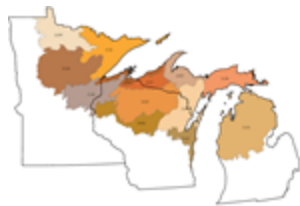
Source: Doraisami, M., R. Kish, N.J. Paroshy, G.M. Domke, S.C. Thomas, and A.R. Martin. 2022. [A global database of woody tissue carbon concentrations](#). *Scientific Data* 9(1):284.

# How we quantify forest disturbance matters.

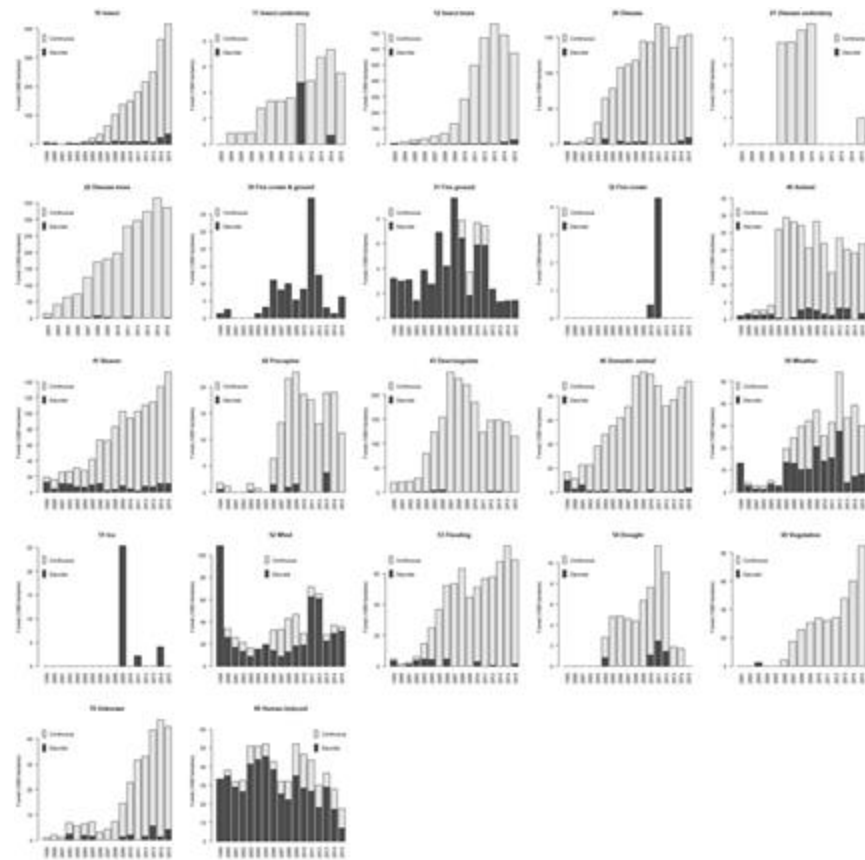


Source: Fitts, L.A., G.M. Domke, and M.B. Russell. 2022. [Comparing methods that quantify forest disturbances in the United States' national forest inventory](#). *Environ. Monit. Assess.* 194(4).

# More disturbances to forests. More detailed approaches to monitor disturbance.



Field guide	INVYR <sup>1</sup>	Total number of disturbance agents listed	Disturbance agents added	Disturbance years estimated
1.3	2000	16		1999–2015
1.4	2001	17	43	2000–2015
1.5	2002	18	60	2001–2015
2.0	2004	23	11,12,21,22,95	2003–2015
4.0	2008	28	90,91,92,93,94	2007–2015



<sup>1</sup>Inventory year that the field guide was first generally applied across the study area.

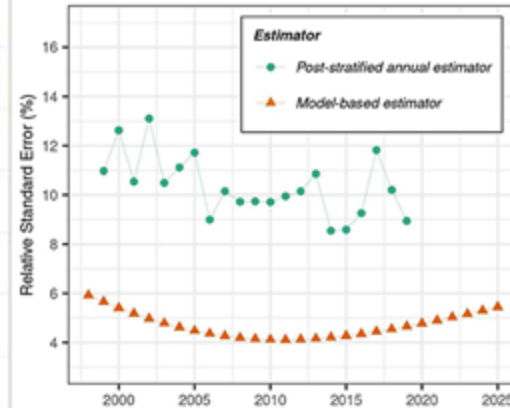
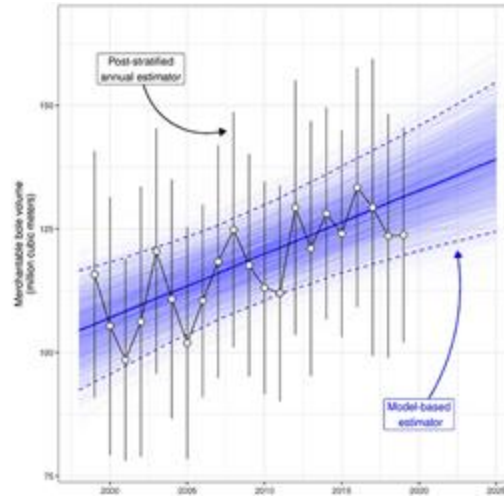
Source: Edgar, C.B., and J.A. Westfall. 2022. [Timing and extent of forest disturbance in the Laurentian Mixed Forest](#). *Frontiers in Forests and Global Change* 5.

# Small area estimation: forest inventory + other data

**SAE:** statistical approaches that improve the precision of forest inventory estimates for small geographic areas.

Incorporates additional data beyond the plot measurements (e.g., remote sensing data).

Results in more precise estimates.

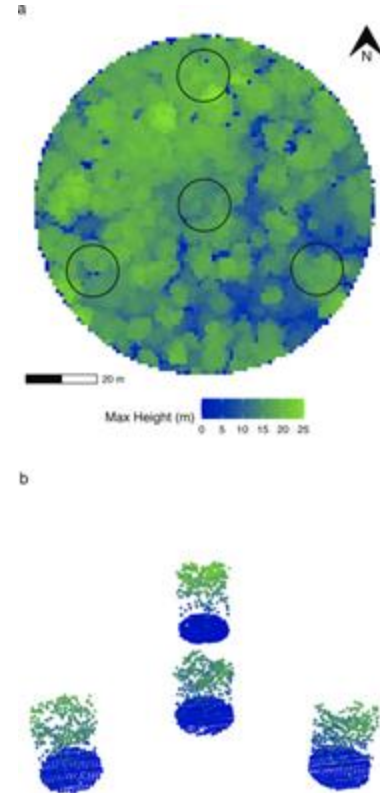
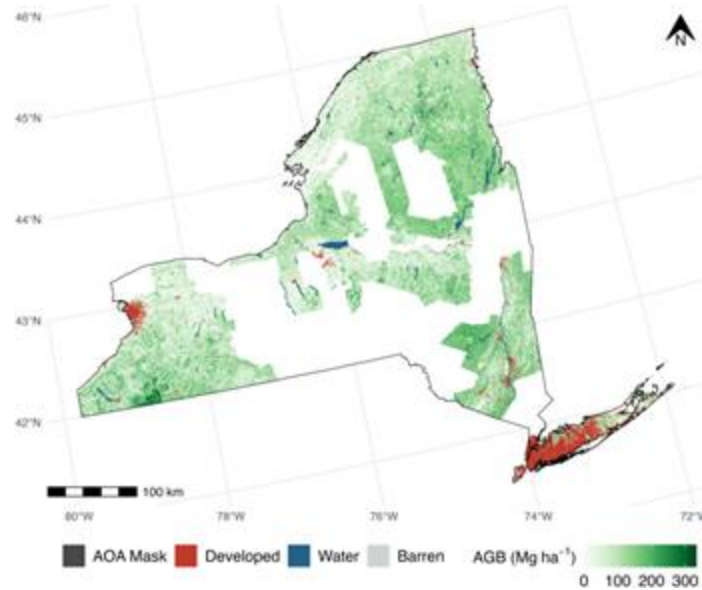


Washington County, Maine

Source: Stanke, H., A.O. Finley, and G.M. Domke. 2022. [Simplifying small area estimation with rFIA: a demonstration of tools and techniques](#). *Frontiers in Forests and Global Change* 5.

# Integrating inventory data with remote sensing.

- Trained models with FIA data, LiDAR, topographic, and climate variables.
- Explained up to 80% of variation of field observations.
- Produced 30 m AGB prediction surfaces.

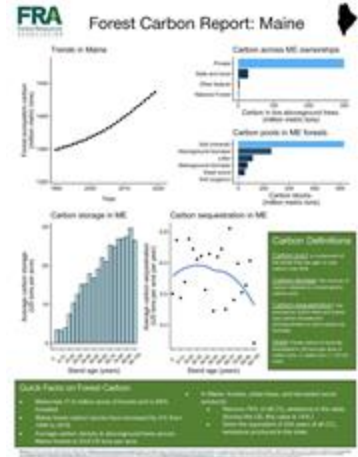


Source: Johnson, L.K., M.J. Mahoney, E. Bevilacqua, S.V. Stehman, G.M. Domke, and C.M. Beier. 2022. [Fine-resolution landscape-scale biomass mapping using a spatiotemporal patchwork of LiDAR coverages](#). *Int. J. Appl. Earth. Obs. Geoinf.* 114:103059.



# Improved tools to access forest carbon information

## FIA DataMart



### VALIDator 2.0.3

#### Select Parameters

Connected to FRS\_FIA2B  
Application revision date: September 12, 2022

[User Alerts](#)

#### Step 1 of 5 (choosing retrieval type and estimate type group)

##### Retrieval Type

The "State(s)" retrieval type is the default. You should only select the "Circle retrieval" type when the area of interest is a circular area around some point center in decimal degrees (the latitude and longitude of Duluth, for example, is latitude = 46.78 and longitude = -82.12) and enter the circle radius in [degrees \(in these units\)](#): 1. locate the point of interest using Google Maps, 2. right click on the location, 3. select "What's here?", 4. click on the green. Select state(s) or circle retrieval.

- State(s) retrieval
- Circle retrieval

If "Circle retrieval" is selected then specify latitude, longitude and radius of the circle.

Latitude (in decimal degrees)  
Longitude (in decimal degrees)  
Radius (in miles)

Please select the land basis from the drop-down list.

## FIA EVALIDator

**Title:** Greenhouse gas emissions and removals from forest land, woodlands, and urban trees in the United States, 1990-2010: Estimates and quantitative uncertainty for individual states

**Author(s):** [Walter Bryan F. Drake](#), [David M. Nowak](#), [David J. South](#), [James E. Cole](#), [Stephen M.](#)

# Forecasting forest carbon

- Approved growth and yield tools for carbon accounting.
- Developed have recently improved access
  - Improved user interface
  - Source code availability
- Research need: continue to develop/integrate new equations and validate/benchmark.



Thank you!



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