Updates to model algorithms and inputs for the Biogenic Emissions Inventory System (BEIS) model

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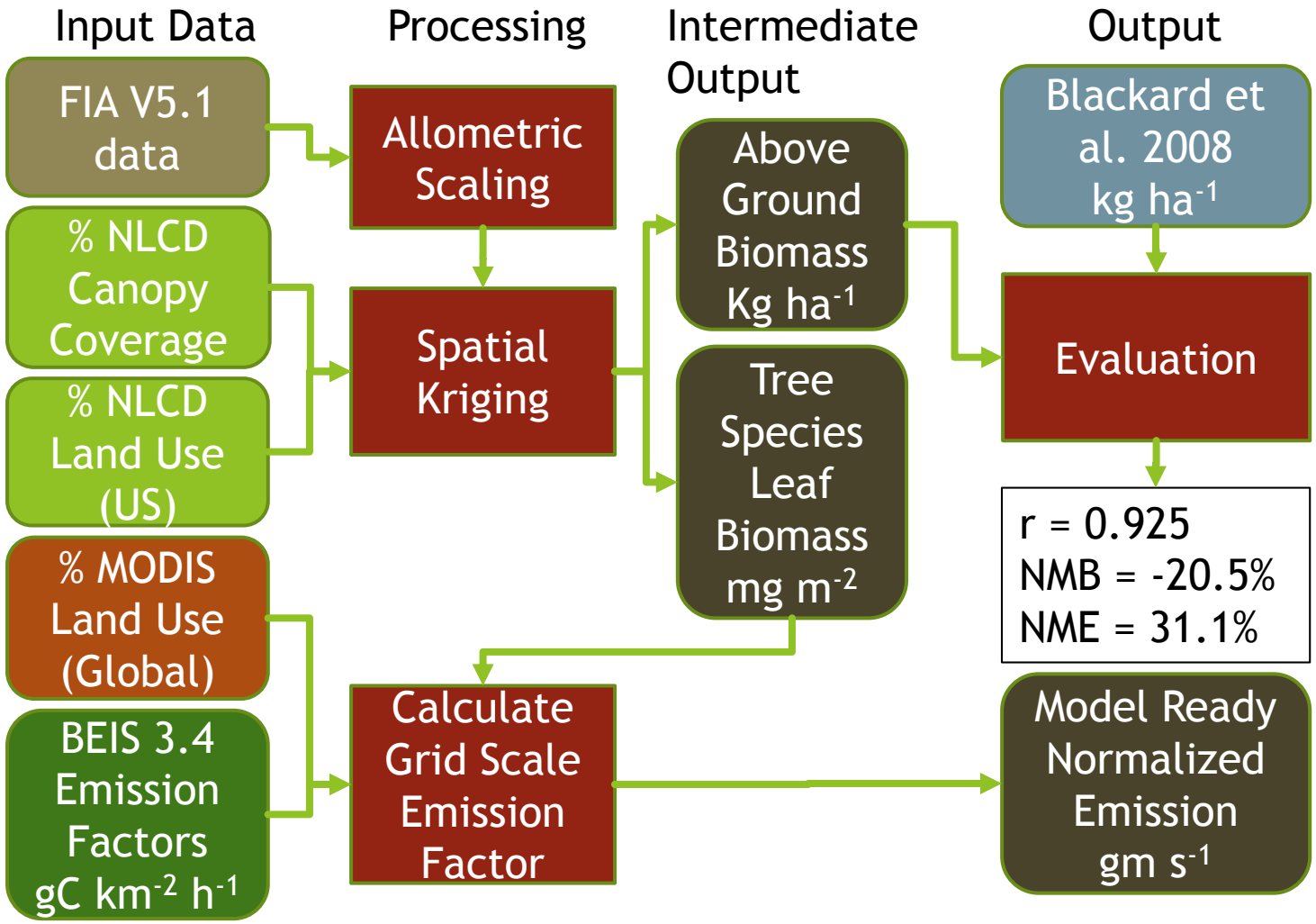
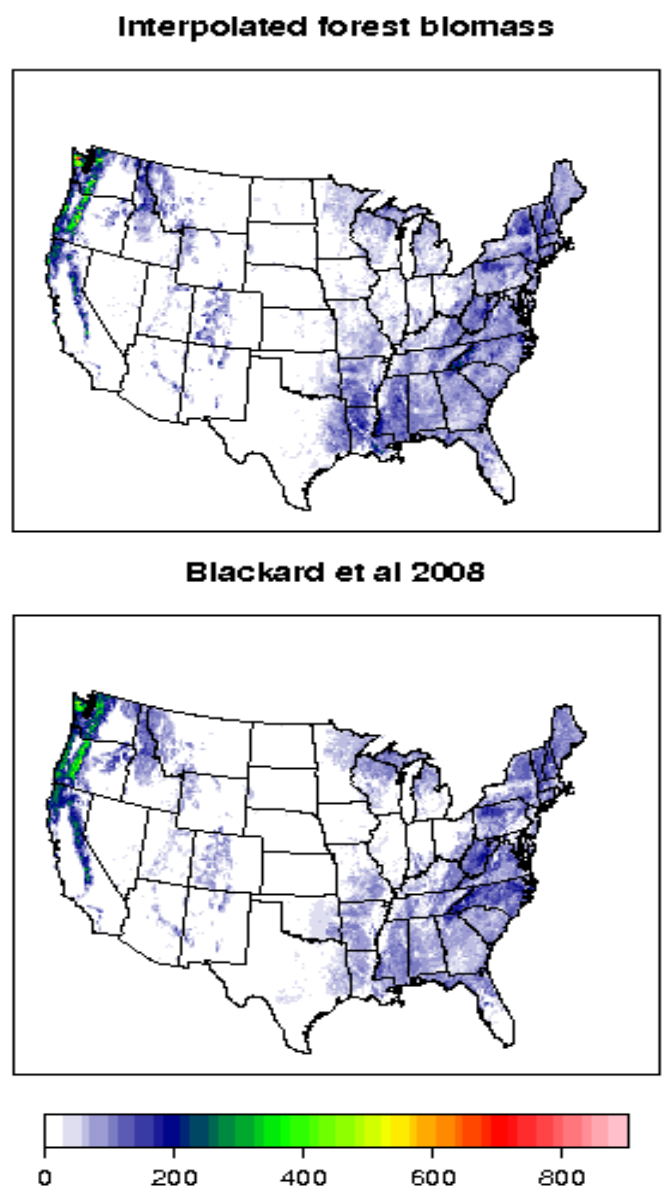
Overview of presentation

- BEIS overview
  - BVOC emissions model with 193 plant species groups and support for NLCD and MODIS plant functional types
  - Can be run coupled to CMAQ or offline using modeled meteorology
- BEIS updates
  - Updated land use
  - Two major updates to canopy model
    - Implemented a leaf temperature algorithm
    - Dynamic two layer canopy algorithm
  - Better integration with CMAQ-WRF system
    - Uses WRF land surface physics and CMAQ air-surface exchange algorithms
- Model simulations coupled to CMAQ with WRF meteorology
  - 2009 4km California domain compared to BEARPEX observations
  - 2011 12km continental US domain compared to monitoring network observations

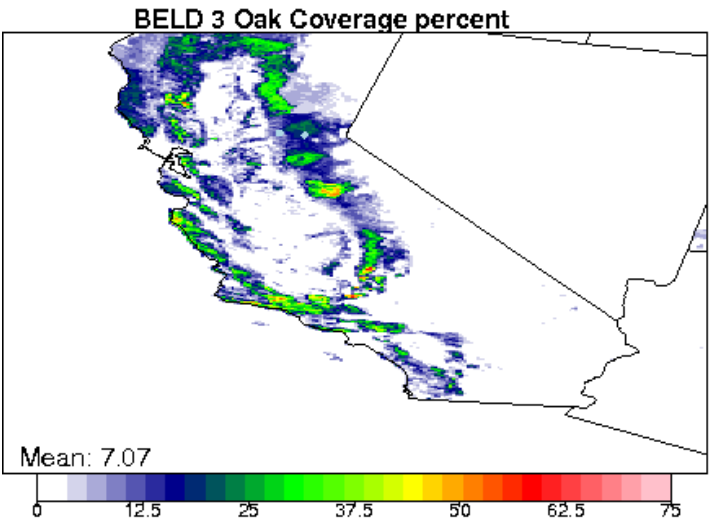
Biogenic Emissions Landuse Data (BELD) Processing

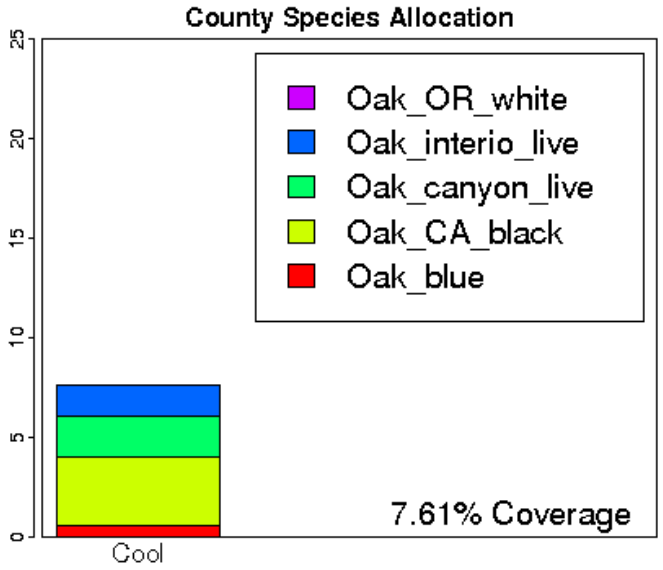


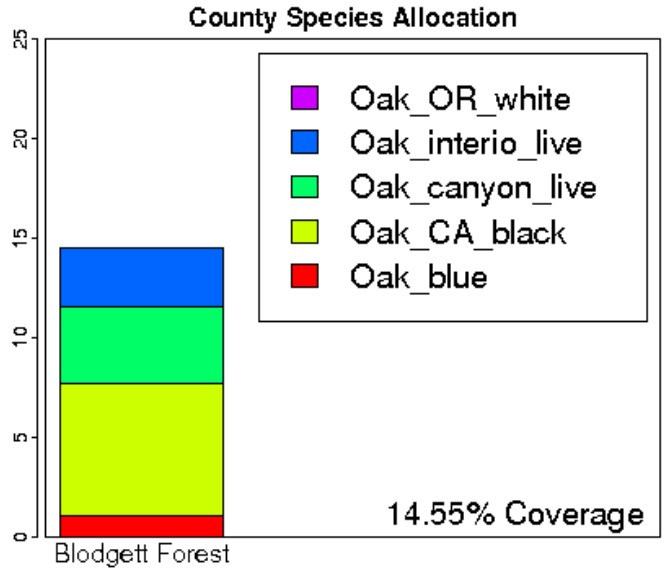


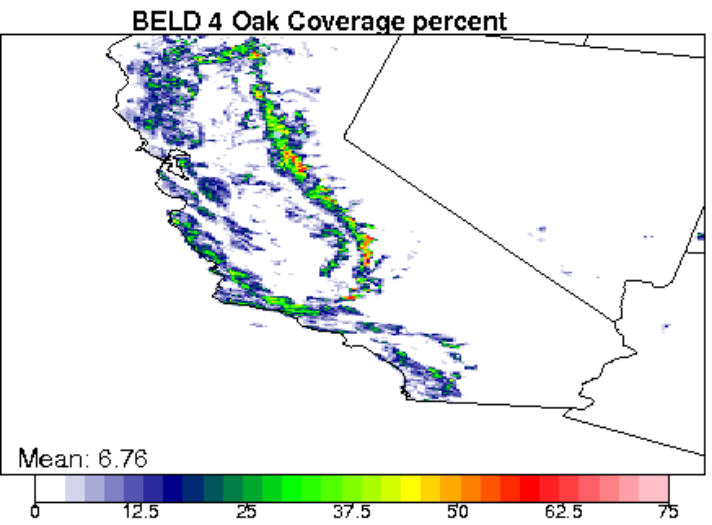
Blackard et al. (2008) Mapping U.S. forest biomass using nationwide forest inventory data and moderate resolution information, *Remote Sensing of the Environment*, 112:1658-1677

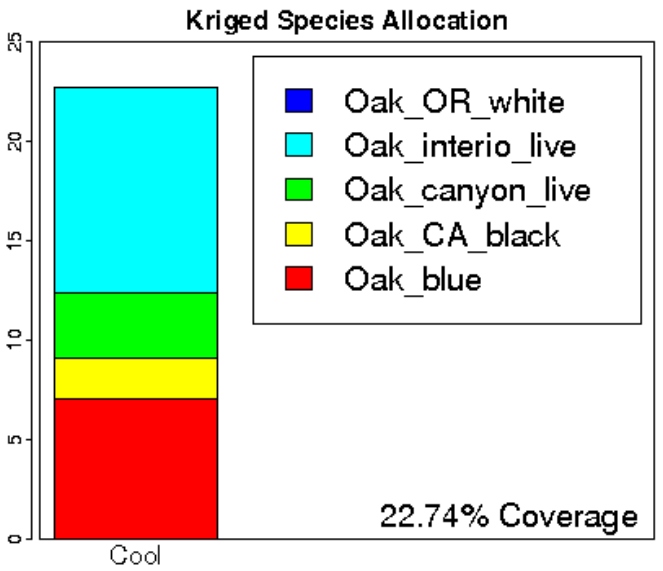
FIA Interpolated data

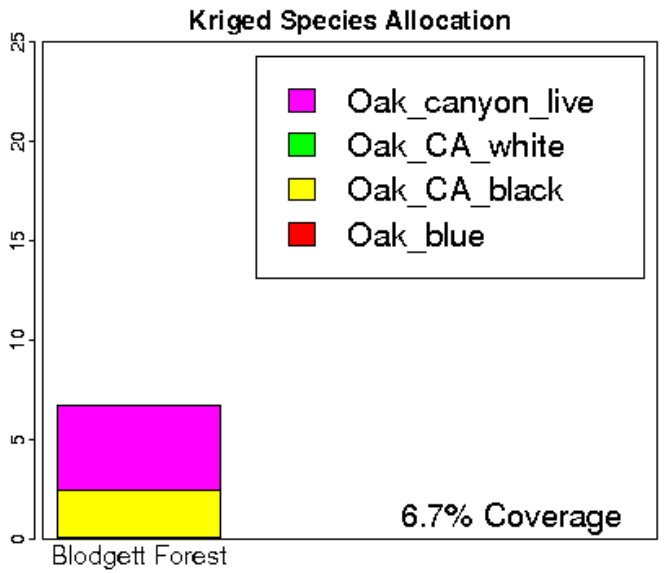








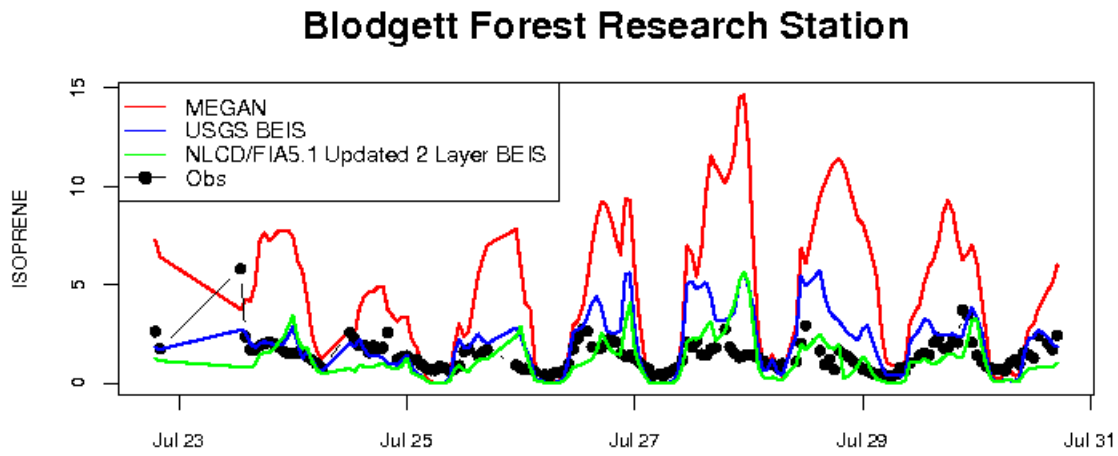


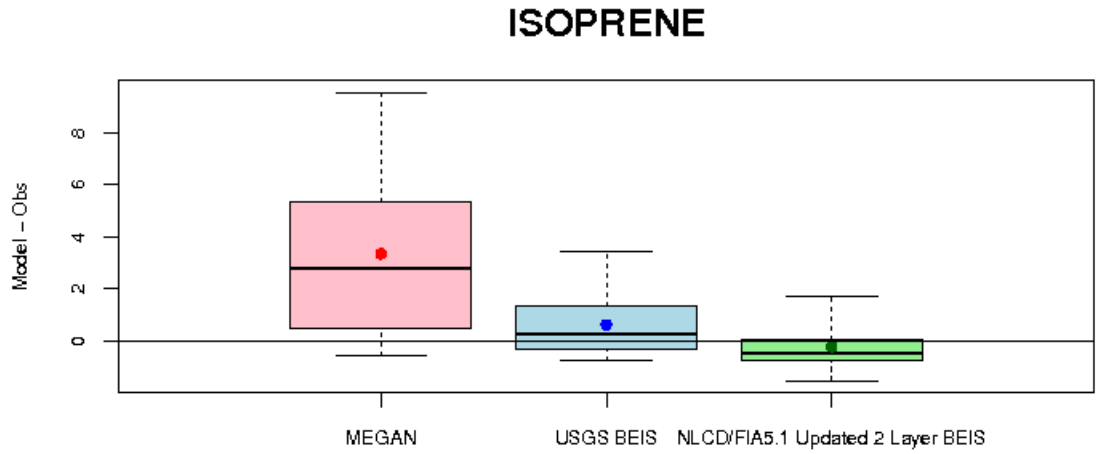


Isoprene BFRS

Isoprene estimates are improved with the interpolated FIA BELD data and updated BEIS canopy model

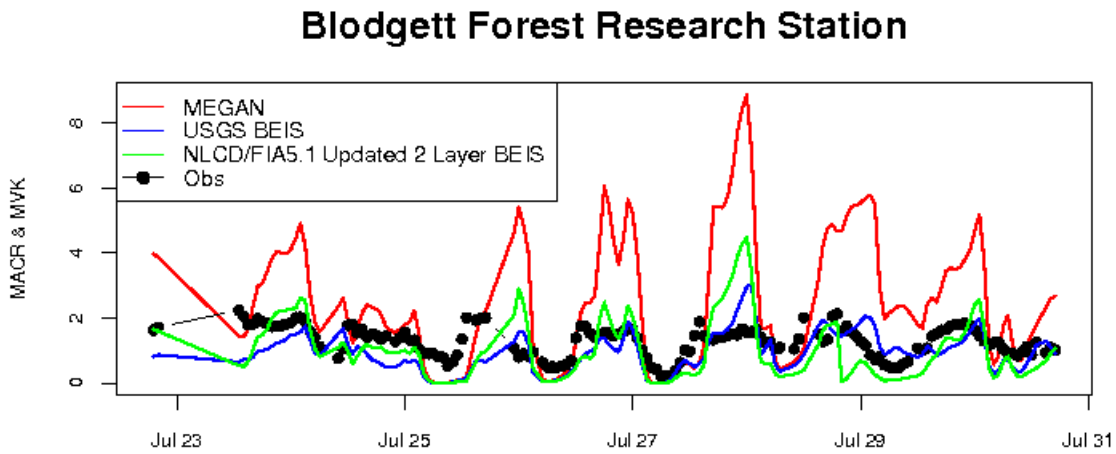
	NMB	NME	RMSE	Spearman ρ
MEGAN	238%	251%	4.70 ppb	0.57
BEIS	44%	72%	1.44 ppb	0.60
Updated BEIS	-16%	59%	1.12 ppb	0.58



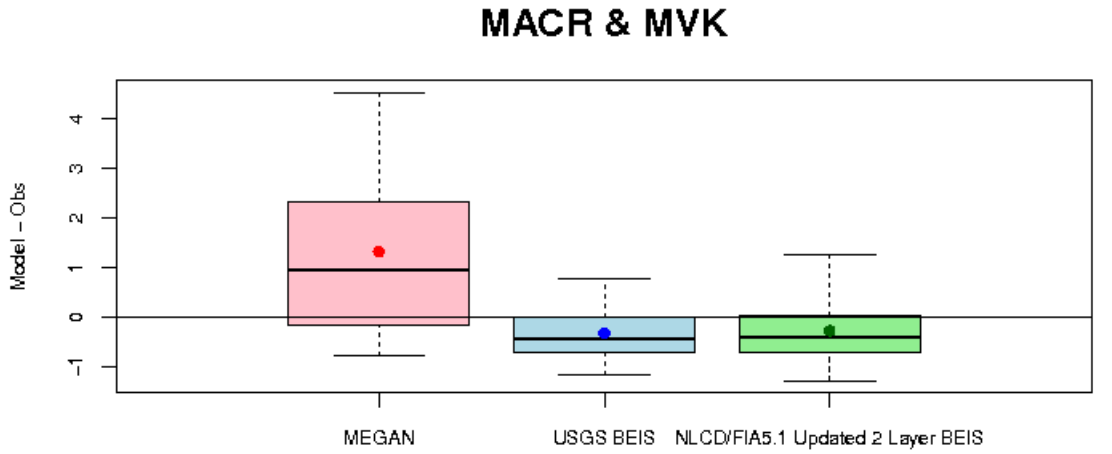


MVK + MACR BFRS

- Simulations with MEGAN emissions overestimate MVK MACR
  - May be capturing high SOA for the wrong reason
- Simulations with updated BEIS better captures these products



	NMB	NME	RMSE	r
MEGAN	102%	126%	2.21 ppb	0.49
BEIS	-25%	44%	0.66 ppb	0.45
Updated BEIS	-21%	53%	0.77 ppb	0.62



CONUS evaluation results and conclusions

- BEIS and BELD have been updated
- Evaluate well against BEARPEX BVOC and network observations
- Better captures Isoprene and terpene gradients from Sacramento to BFRS
- Future work
  - Evaluate against other field campaigns
    - SOAS/SENEX, DISCOVER AQ 2011, CALNEX/CARES, CABERNET
  - Evaluate and update BEIS emission factors
    - Urban forestry surveys (particularly important in Southwest)

Species	Network	Base BEIS			Updated BEIS		
		NMB	NME	r	NMB	NME	r
O_3	AQS	3%	37%	0.567	8%	30%	0.721
Isoprene	AQS	19%	103%	0.468	20%	87%	0.549
NO_X	AQS	40%	96%	0.437	46%	94%	0.475
TNO_3	CASTNet	-30%	36%	0.788	-23%	32%	0.799
TNO_3	NADP	-30%	51%	0.642	-28%	51%	0.638

Thanks and Questions

Please email bash.jesse@epa.gov for collaboration and beta versions of BELD data and BEIS code