Biogenic VOC Emissions in CESM

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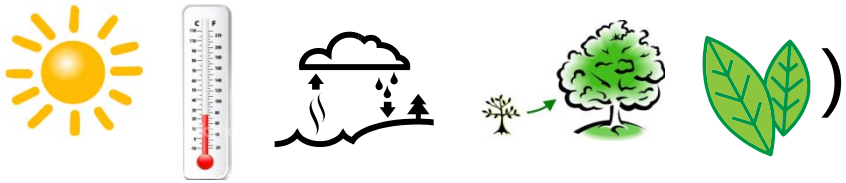
BIOGENIC VOC EMISSIONS: MEGAN v2

Update from Heald et al. [2008] and earlier from Levis et al. [2003]

$$F = \gamma\rho\sum_i \varepsilon_i \chi_i$$

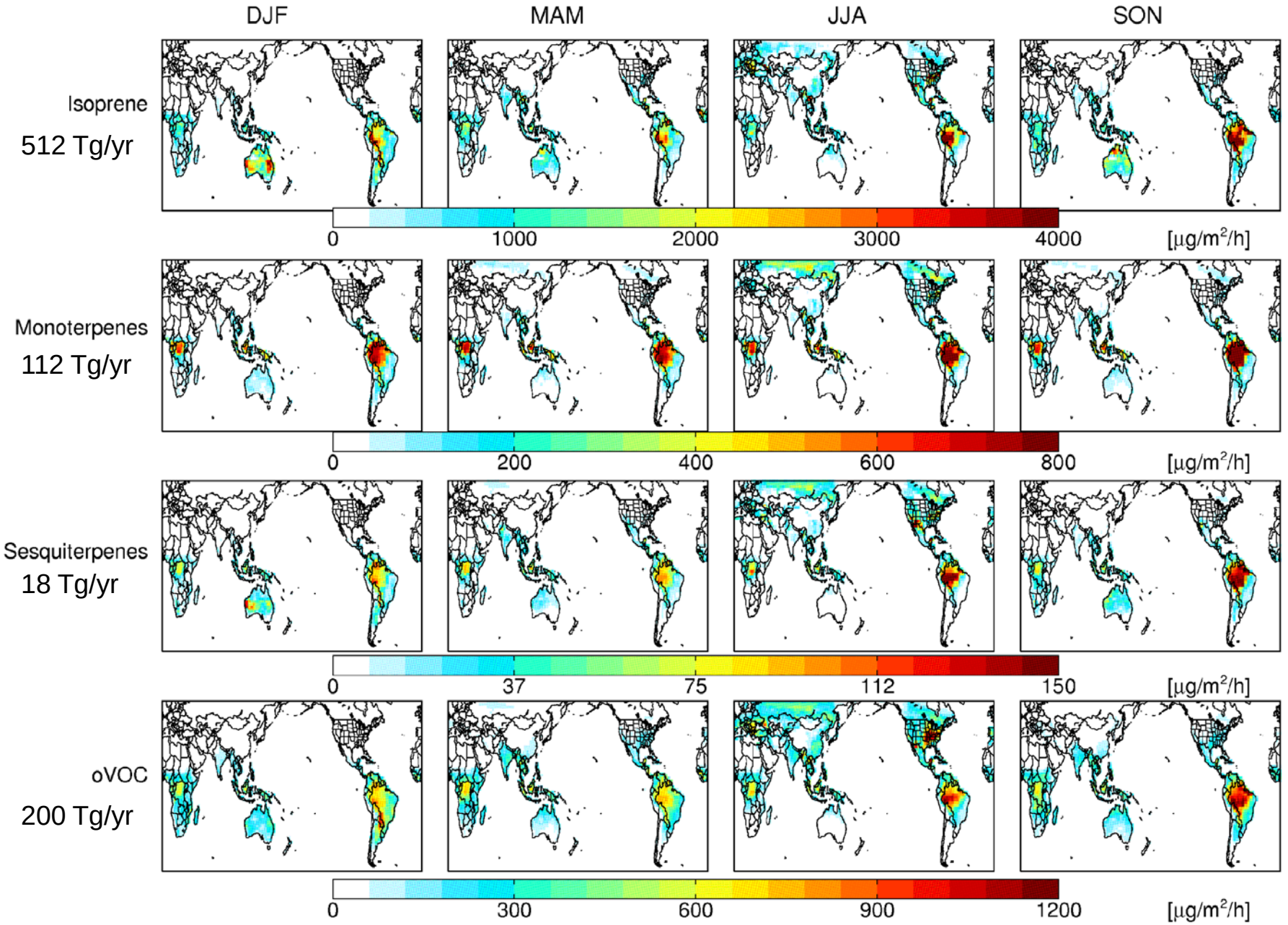
ε_i is the emission factor at standard conditions for vegetation type *i*
χ_i, fractional areal coverage
γ the emission activity factor
$\gamma\rho$ is the canopy loss and production factor

E=f()

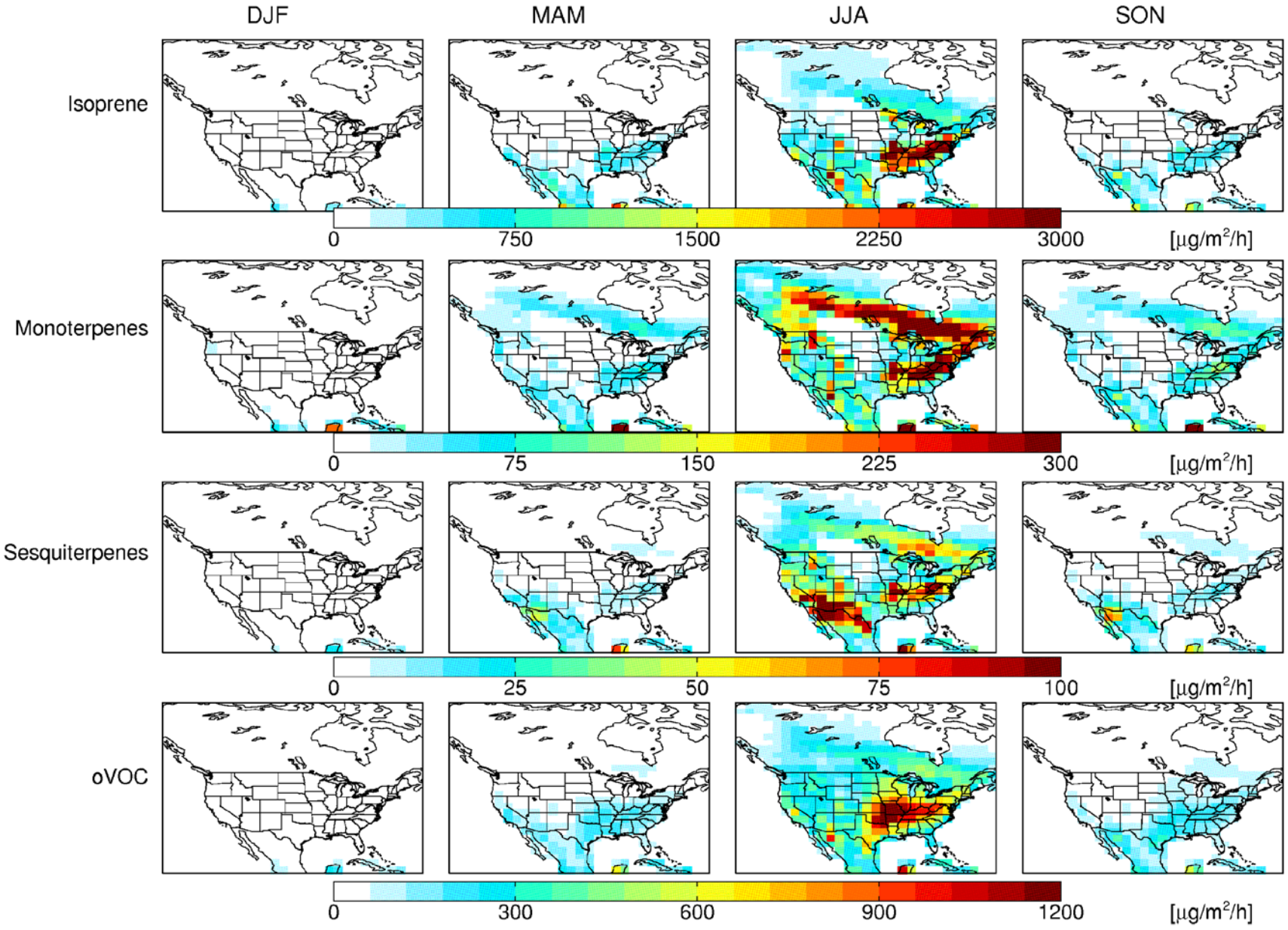
[Guenther et al., 2006]

Now simulate 20 compound classes in CLM. Using fixed EFs for PFT types for all (option for mapped EFs for isoprene)

BVOC EMISSIONS: MEGAN v2 in CLM



BVOC EMISSIONS OVER NORTH AMERICA



BVOC & OVOC SPECIES IN MEGAN v2 (in CLM)

SPECIES	GLOBAL EMISSIONS (Tg/yr)	
Isoprene	512	
Myrcene	5.0	112
Sabinene	5.7	
Limonene	8.3	
3-Carene	9.9	
Ocimene	5.5	
β-pinene	21.1	
α-pinene	40.7	
Other Monoterpenes	15.3	
Farnescene	2.8	18
β-caryophyllene	4.0	
Other Sesquiterpenes	11.5	
Methanol	91.7	200
Acetone	25.7	
Acetaldehyde, ethanol	30.8	
Formic acid, formaldehyde, acetic acid	30.4	
MBO	2.2	
oVOC	19.4	

IMPLEMENTATION PLAN

- ✓ MEGAN2 code updates in CLM
- ❑ Francis to add coupler code to transfer 20 compounds to CAM
  - ❑ available to community in code update?
- ❑ Alex Guenther to provide updates on EFs mapped to 15 CLM PFTs
- ❑ hard-wired parameters and EFs to be replaced with modifiable input file

Implications for CAM:

Now 20 compound classes can be sub-speciated into VOCs in CAM for application of choice / modified mechanism (eg. longifolene is part of oSQ)

CAUTION: CLM VOC emissions diagnostics need to be multiplied by gridbox landfrac (this is currently done in the coupler so correct emissions are sent to CAM, but for consistency with other diags land folks output emissions per unit land in CLM…)