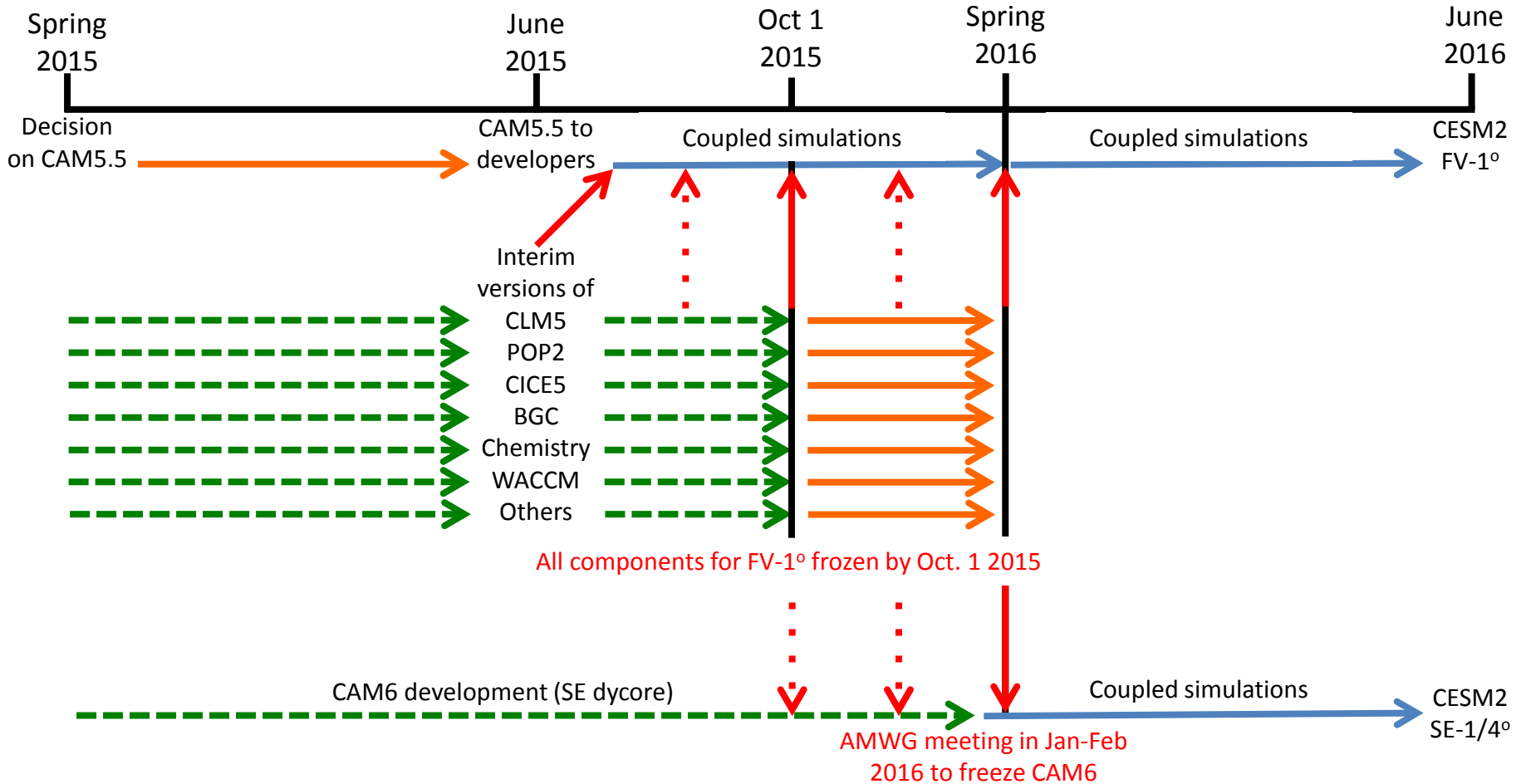


# Discussion of Development Plans

CESM Chemistry Climate Working Group

# Timeline for CESM2



→ Code delivery

...→ Potential code delivery

- - - → Potential code development

→ Assembling and optimizing coupled model

# Chemistry-Climate WG development for CESM2

(based on CSL proposal – Jan 2015)

- Improve chemistry representation:
  - Implementation of FAST-J photolysis scheme, with CLOUD-J, accounting for impact of aerosols on photolysis
  - Evaluation of simple chemistry used in CAM5-MAM
  - Improvements to secondary organic aerosol (SOA) formation
  - Addition of nitrate aerosol (and MOSAIC)
- Test CSLAM in Spectral Element dynamical core with chemistry
- Test couplings of land, biogeochemistry and atmospheric chemistry
  - Including methane, biogenic VOCs, fire emissions
- Test chemical representation in CAM5.5 at 1-degree

# Current Development & Evaluation Activities

- Evaluation of CCMI
- CAM5 – 0.25 and 0.5 degree tests
- Expanded chemistry (aromatics, terpenes) – evaluation with SOAS, SEAC4RS campaigns
- SOA formation intercomparisons on-going

# Diagnostics

- Chemistry diagnostics package – comparison to variety of observations, can compare 2 runs instructions available from Simone
- We can provide a standard run (release with bug fixes) to be compared to user runs in the diagnostics package

- Get fire model on trunk
- Get fast-j on trunk (waiting for cloud-j)
- Sea salt organic emissions improvements?
- CSLAM-MOAB (not this year...)

*from CESM Breckenridge Workshop June 2014*

## **Development for CESM2 from joint BGC-Land-Chemistry session**

- Closing the global CH<sub>4</sub> cycle (ocean–LANL has version; wetlands-tuning needed)
- Improving the nitrogen (& C) cycle (ammonia from manure, riverine (inorganic N))
- Trace gas and aerosol emissions from fires (M. Val Martin)
- Improve biogenic VOCs
  - Reduce differences in MEGAN emissions between active vs prescribed LAI (perhaps tune CN LAI) **{not a big issue in CLM4.5}**
  - Other biogenic emissions algorithms – Tim Butler, Forrest Hoffman, Jeff Chambers should confirm not duplicating efforts
- Ozone feedback on vegetation health
- Coupling DMS, HCs, OCs, primary & secondary aerosols from ocean to atm
- CICE5 – coupled into CESM with BGC

## *from CESM Breckenridge Workshop June 2014* - **Diagnostics**

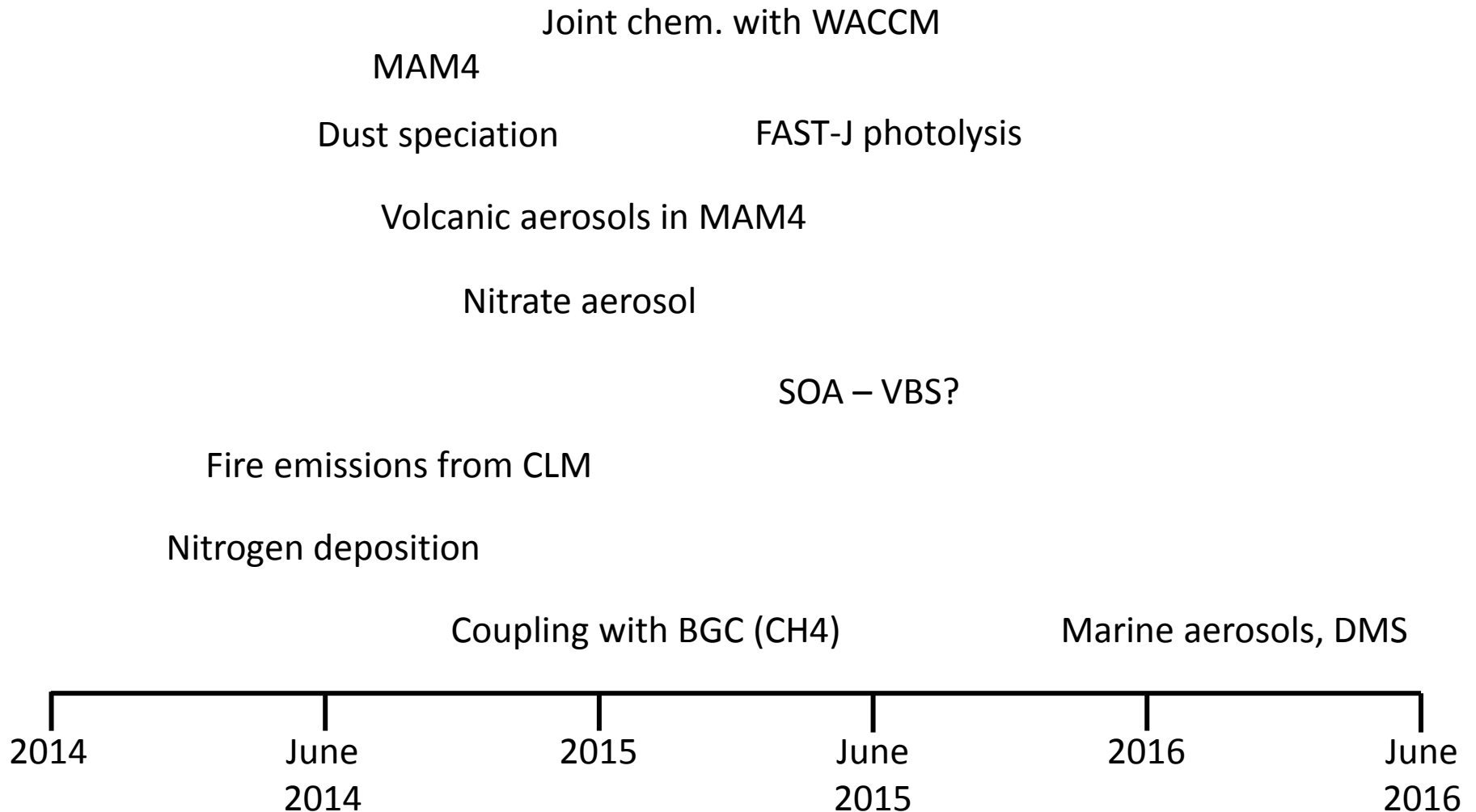
- Box model – based on KPP, wrapper written by C. Knote – available from him now (to be posted somewhere soon)
- Tools for model result differencing
- Aerosol diagnostic package (PNNL)
- Benchmark numbers: methyl chloroform lifetime, ozone budget terms, methane lifetime, mass-weighted tropospheric OH, lightning NO<sub>x</sub>, sf(co/nox/isoprene))
- Requested at Feb 2014 meeting:
  - Burdens & budgets as line plots (vs time or lat)
  - PDFs of global distribution from monthly means
  - Notes page for comments/caveats about observations
  - Surface ozone – afternoon or 8-hr max
  - Variables for Fast-J evaluation: cloud fraction, optical depth, J<sub>s</sub>
  - Metrics: surface O<sub>3</sub> (N.America & Europe), ozonesondes (500mb), CO (surface, NH vs SH), MOPITT CO, AOD (Aeronet, MODIS – lat. gradient), Angstrom coeff (AERONET), OMI Trop O<sub>3</sub>



More slides from last year's meetings

*from CESM Breckenridge Workshop June 2014*

# CESM2 CCWG development



# Discussion: Plans for Compsets for CESM 1.3

## Currently available:

Only 1.9x2.5 compset,

CAM4 (MEGAN no CN coupling) and CAM5 (no MEGAN) B2000 and F2000, 1 transient GEOS5

## CESM 1.3:

### CAM4:

- Maintain existing compsets
- RCP compsets (CCMI)
- No additions in resolution

### CAM5:

- Update to coupling of CN and MEGAN
- Keep both trop and trop/strat mechanism?
- MAM3/MAM4/MAM7?
- 1deg res. ?
- 1850 control?
- RCP compsets ?

# Development

Included in CESM1.2

- MEGAN-v2.1
- Chemistry coupled with MAM and CAM5 physics
- ...?

To be in CESM1.3

- Val Martin dry deposition scheme
- Prescribed aerosol option
- Diagnostic radiation for any MAM species
- MAM4
- Dust speciation

Future versions

- Superfast chemistry in CAM5 (LLNL)
- FAST-J photolysis (DOE funded: M.Prather/P. Cameron-Smith)
- SE/FV dynamical core comparison: on-going tracer tests based on SD configuration
- Specified dynamics in FV and SE (pressure fixer)
- Fire emissions of trace gases (M. Val Martin)

# Other developments in progress

- ▶ Coupling MOSAIC to nitrate
- ▶ Coupling to wildfire model
- ▶ Coupled DMS emissions
- ▶ Aiken mode dust
- ▶ Dust speciation
- ▶ Aerosol scavenging
- ▶ Stratospheric aerosol
- ▶ Organic intercomparison
- ▶ Nucleation
- ▶ Coupling to SNICAR
- ▶ Marine organic

# Development – Medium Priority

- Update SOA mechanism, including VBS (MIT, NCAR, PNNL, LLNL, UM, PSU, NCSU) intercomparison
- More general aerosol thermodynamics (PNNL, NCSU)
- Ammonium & nitrate (NCAR, LLNL)
- Speciation of POM: hygroscopicity (PNNL)
- Ion-induced nucleation (SUNY-Albany, PNNL, NCSU)
- Marine organic sources (NCSU, Harvard, LANL, Scripps, PNNL)
- Coupled DMS emissions (LANL, ORNL, LLNL, PNNL)
- Coupling MAM to SNICAR (Flanner & PNNL)
- MAM volcanic aerosol (NCAR, PNNL)
- Geoengineering stratosphere, CCN (NCAR, PNNL)
- Frost flower sources (Scripps, LANL)
- Conversion of preprocessor to KPP?
- Vertical resolution
- WACCM lite?