

Land Model Working Group CTSM-FATES integration

8:30 - 9:45	Technical features
9:45 - 10:00	Break
10:00 - 11:00	Benchmarking & evaluation
11:00 - 11:10	Break
11:10 - 12:00	Governance and coordination
	Wrap-up

*All times MDT



2020 CESM Workshop

Land Model Working Group, Community Terrestrial Systems Model & Functionally Assembled Terrestrial Ecosystem Simulator



Goal: To run CMIP-compatible, fully transient historical simulations of CTSM-FATES by summer 2021.

Discussion Aims: In this meeting we aim to prioritize needs, identify specific tasks & interested people to implement CTSM-FATESv1 integration.

1. Technical Features 8:30-10:00
2. Benchmarking & Evaluation 10:15-11:00
3. Governance & Coordination 11:10 - 12:00

Avoid a loss averse mindset

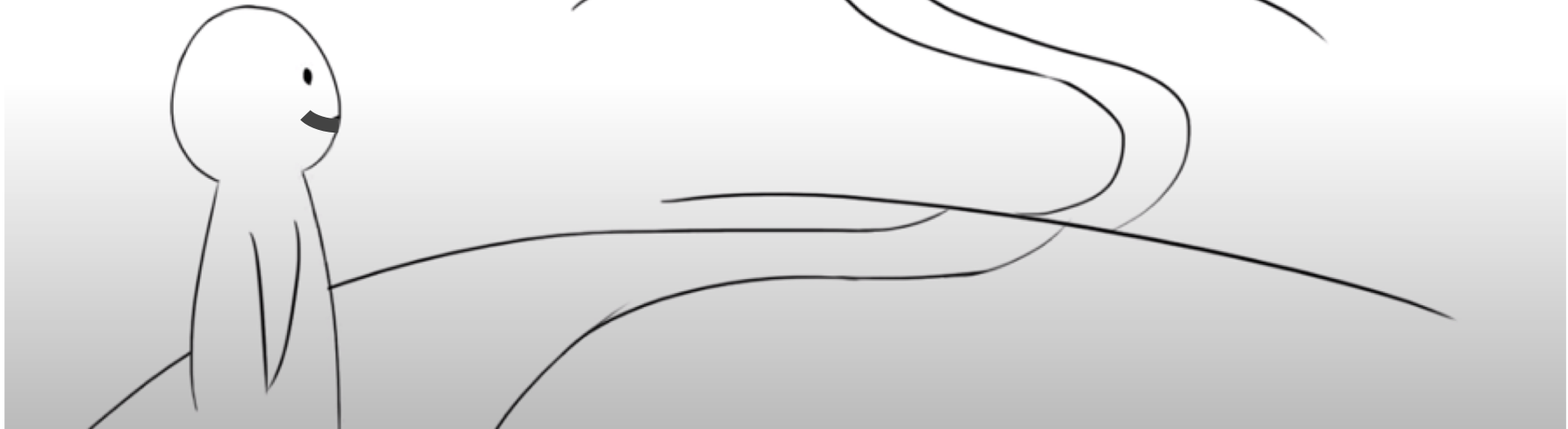


Short-term milestones vs. long-term vision

CTSM-FATESv1



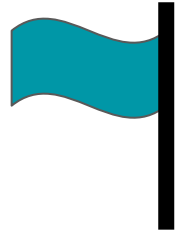
CTSM6-FATES
CESM3+



Goal: To run CMIP-compatible, fully transient historical simulations of CTSM-FATES.

CTSM-FATES v1 will:

- Include fully transient LULCC
- Be run offline and in AMIP configurations (I and F compsets) with:
 - Proscribed LAI (FATES-SP)
 - **Fixed biogeography***, similar to big-leaf CTSM **v1 default*
 - Fully prognostic FATES
- Use CLM5 crops
- Function in C only (no nutrients, for FATES columns)



Goal: To run CMIP-compatible, fully transient historical simulations of CTSM-FATES.

- **Compsets:** spin-up, historical, SSP's. With/without crops. FATES-SP, LULCC (**Erik**).
 - Crops running with FATES (**CTSM software, Danica**).
- **Reduced complexity modes:** FATES-SP, finalized nocomp mode. (**Rosie**)
 - Following SP implementation, assess skill of FATES vs relevant metrics (within low-res parameter ensemble).
- **LULCC:** Finalize & test v1 implementation (**Charlie/Alan, Peter**).
- **Fire & human-fire interactions for crop & LULCC (Jackie)**, should operate on columns?
- **PFT performance investigations.** n.b. that FATES makes this easier than big-leaf mode as you can run with only one-PFT, and
 - Drought deciduous phenology: This remains challenging, as per CLM5. Some clear structural errors need addressing as well as parametric issues.
 - C4 grass: Is also overproductive in CLM. Anthony Walker started looking at this in MAAT (**Jackie, Danica & Nick Smith**).
 - Shrub introduction: Allow shrubs to tolerate harsher growing conditions v.s allometric limits to height etc. Potential collaborations with EMERALD/NGEE-arctic/?
 - Mosses
 - Domain experts can potentially take charge of, e.g. of the testing of a new PFT type.
- **Develop workflow for testing and validation**
 - Including single point simulations?
 - Spinup? Soil C equilibrium?
- **Run test of coupled simulation (in Fixed Biogeog and/or SP mode) & evaluate fluxes:**
- **Calibrate dynamic vegetation model:** Ideally with a relatively simple PFT set.
- Isotopes (C = easy, H2O = straight forward w/o FATES-Hydro)?
- Costs (potentially change over time, address with smart load-balancing)?
- FATES-Hydro (maybe off for now)?

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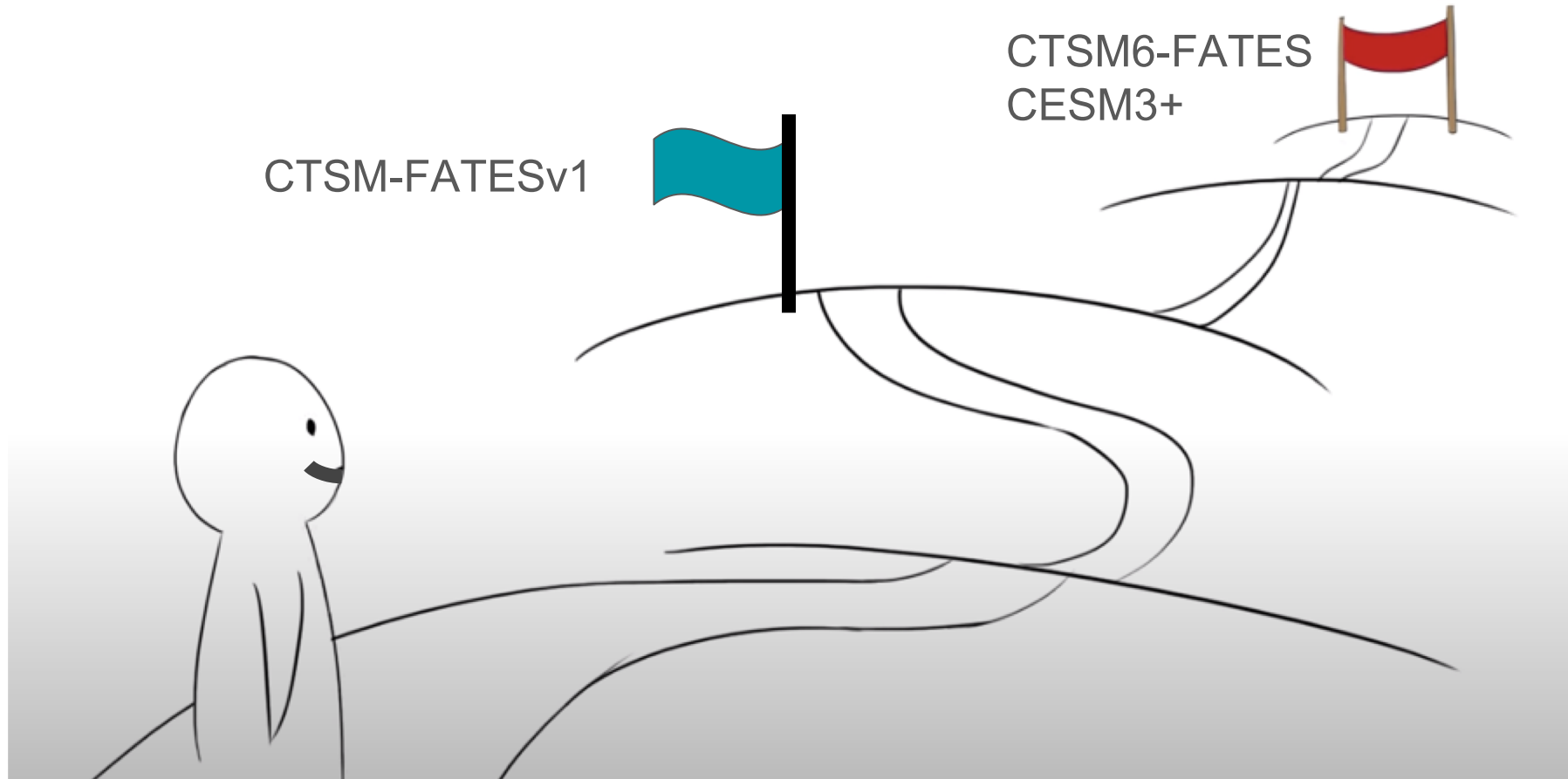


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Benchmarking & evaluation

ILAMB:

- Must still evaluate usual benchmarks: ET, GPP, etc. in at global scale, site-level & relationships

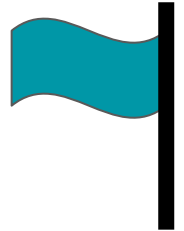
Additional FATES specific benchmarks:

- PFT distributions & other landscape metrics (kappa statistic, simulated vs. observed statistic (Monersud & Leemans 1992))
- Tree height data, tree density data (GEDI, MAP, others)
- Forest-inventory data (FIA, ForestGEO, others)
- Supersite (e.g. NEON? Or others w/ fluxes & structure + disturbance history)
- Allometry (BAAD, parameterization or evaluation?)
- Build on site/regional scale data (NEON)
- Greenness and Phenology (SIF, NDVI)
- ET (ECOSTRESS, GRACE)
- Spatial distribution of ioshydricity, globally, paper?
- Paleo

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Benchmarking of CTSM-FATES v1 will:

- Include 'standard' ILAMB and diagnostic package analysis
 - ET, GPP, etc. in at global scale, site-level & relationships
- Should also include...
 - Metrics for current pft distributions
 - How do we compare spatial and temporal scales of model and observations?
 - Nested from points, to regions & global



Do we agree, this is the target?

Goal: To run CMIP-compatible, fully transient historical simulations of CTSM-FATES.

Benchmarking of CTSM-FATES v1 will:

- PFT distributions & other landscape metrics (kappa statistic, ROC) [Peter, Polly, Shawn Serbin, Jackie]
- Stand structure, Lorey's height (GEDI, IceSat) [Charlie, Jackie, Adrianna]
- Use site-level data to evaluate stand structure & size distribution (at appropriate scales) [Will, Adrianna, Polly]
- Disturbance history (GFAD, from Ben Poulter, GFED4s -fire)
- All above work with Nate and Forrest, also DART?

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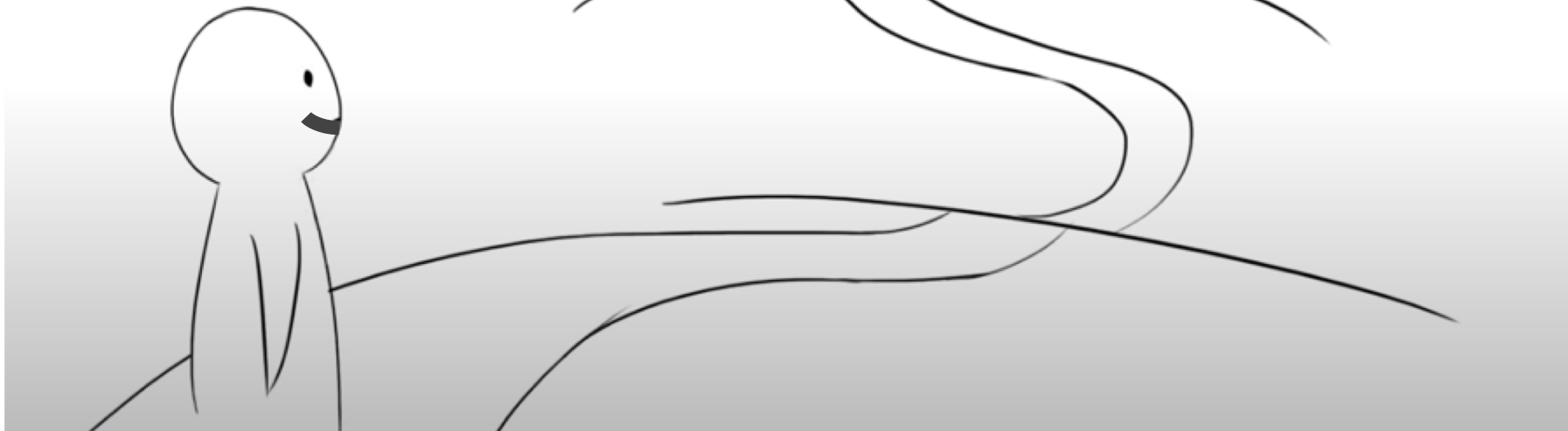
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Governance & Coordination

Support:

- Creating new or extending existing tools to deal with greater complexity
- Offline modelling capabilities? (docker, data atmosphere, single point?)
- Documentation
- Tutorials
- Formal user support for the integrated model will need to be on the CTSM side.

Coordination & Integration

- Using reduced complexity modes in FATES will allow us to evaluate duplicate aspects of CLM and FATES code
- Regular formal meetings between FATES and CTSM software engineers and key stakeholders for milestone setting, prioritization, reduction in overlapping efforts
- Are there key test cases for the CMIP simulations that can drive milestone targets?
- Can we use github project boards to coordinate tasks between organizations?
- Encourage members of both teams to sign up for mailing lists, slack workspaces, etc and participate

Goal: To run CMIP-compatible, fully transient historical simulations of CTSM-FATES.

Governance & Coordination of CTSM-FATES v1 will include:

- GitHub issues, projects, & milestones for CTSM-FATES integration [Erik, Will, Charlie, Dave]
 - Hosted on CTSM side, & linked appropriately w/ FATES
- GitHub issues and conversations for ILAMB benchmarks?
- Conversations on CTSM-FATES science (~monthly w/ CLM) & SE (more often)
- Formal user support for the integrated model will need to be on the CTSM side (Dave).
 - Tutorial (Summer / Fall 2021)

