State of the art modeling efforts in the NEESPI region

The group first identified known modeling efforts at regional scale relevant to NEESPI. These were defined as modeling either with a domain that spanned most or all of the NEESPI region, or smaller scale modeling efforts applied to enough sites so as to represent the region. Models were classified into off-line terrestrial ecosystem models, off-line land surface schemes (primarily limited to representation of the water and energy cycles), offline chemical transport models, and coupled regional and global climate models. Global coupled models were limited to those where there were known specific recent efforts to improve processes relevant to the NEESPI region (e.g., evaluation of the effects of vegetation change in the region on global climate, improvements of permafrost representation).

1. Models identified (including name of the model, contact, institution, and nature of the key variables or processes predicted, and/or the application:

Offline Terrestrial Ecosystem Models:
DAYCENT (Ojima, CSU: biogeochemical and ecosystem dynamics), DNDC (Li, UNH: boreal forest tower NEE fluxes),
TEM (McGuire, UAF: biogeochemical and ecosystem dynamics),
LPJ (Kaplan, Switzerland: tundra, tundra-forest boundary dynamics; Venevsky, Leeds: boreal fires),
FAREAST (Shugart, UV),
(Chen?, Toledo: NEE tower flux China, semi-arid)

Offline Land-surface models:
VIC (Lettenmaier/Wood, UW: surface water and energy balance, carbon emissions from lakes/wetlands),
SVAT-Regio, Mixfor-SVAT (Olchev, Moscow, IEEP: water-carbon cycles in wetlands and forest, agriculture),
COLM (Dai/Sokolik, BNU: aerosol/vegetation/photosynthesis),
multi-model ensemble (Serreze/Lettenmaier: water-energy cycles emphasis on snow, Noah, CLM, VIC, Sacramento, CHASM),
Romanovsky? (permafrost),
Shmakin? (Inst of Geography, Russia: energy and water fluxes in forest, etc), Gusev? (Inst of Water Problems, Russia),
CLM3.5 (Lawrence, NCAR: permafrost, snow),
Skadis (Sogachev, Helsinki Univ.: carbon fluxes, turbulent exchange)

Offline atmospheric chemical transport model:
SILAM (Sofiev, FMI: air pollution, biogenic aerosols, fires)

Regional coupled land-atmosphere models:
WRF/DUMO (Sokolik, WRF coupled with dust),
Arctic WRF (Sokolik, Curry, GIT: Arctic aerosol/hydrological cycle),

LM (German weather service: land-atmosphere interaction, synoptic),
ASM (Hinzman, IARC: Arctic regional reanalysis, coupled system feedbacks)

Global coupled land-atmosphere-ocean models:
CCSM (Lawrence, permafrost, DGVM shrubs, snow; CAM dust)
Kattsov? (multi-model)

2. What are the missing links and/or poorly represented processes?

Land surface models: See writeup on water and energy balance

Fully coupled models, global or regional:

- Lack of detail in aerosol feedbacks, e.g. fire emissions, VOCs, etc.
- Feedbacks of aerosols on surface radiation

Terrestrial ecosystem models:

- Near-coastal processes (not dealt with by ocean models either)
- lateral fluxes to surface water/river system (DOC),
- many things related to aerosols including deposition

3. What are the potential areas for collaboration in exchange of data sets that could be used for model evaluation, testing, etc?:

- pan-NEESPI gridded forcings (precipitation, downward solar and longwave radiation, surface wind, humidity, surface air temperature) needed for off-line simulations
- Seasonal and interannual variations in areal extent and other characteristics of lakes/wetland (McDonald, JERS/ALOS-based; Schmullius, ASAR ENVISAT)
- homogenized Russian soil temperature/met station data (at NSIDC)
- Permafrost data, e.g., active layer depth (some at NSIDC)

4. Recommendations:

1) NEESPI project office to assist in making above data sets more readily available to the NEESPI modeling community (could be as simple as assembling a catalog of data sets, characteristics, and accessibility)
2) Form a working group to evaluate alternative land cover-land use data (current conditions) for NEESPI region – candidates will include most global ~1 km data sets, but potentially others as well (Schmullius to coordinate)
3) Form a working group to determine feasibility of deriving multi-temporal land cover/use data for the NEESPI region for at least the last two decades, and to assure consistency of current conditions as per 2) above. Data set should reflect role of changing disturbance regimes (Dennis Ojima to coordinate)
4) Develop a recommended means for specifying land surface model parameters associated with current land cover classes from 2) Hank Shugart +David Lawrence + Alex Olchev+Robert Dickinson to coordinate

5) Determine how best to make flux tower data from known existing sites available to the NEESPI community, including addressing QC issues.
6) Review available soils data (soil types, characteristics, depth, and other variables) over the NEESPI region and recommend to the modeling community the best data set (or develop a plan for producing such data if existing data sets are deemed inadequate) (recommendation) + new towers