NCEP Land Modeling Needs: Surface Type

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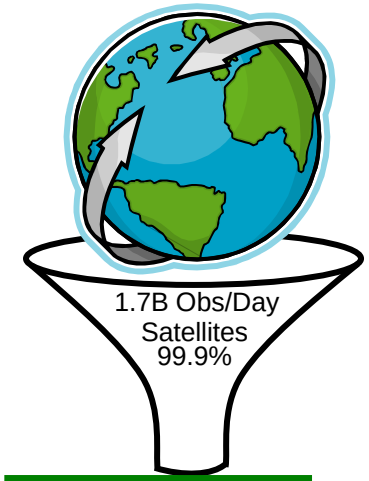
Environmental Modeling Center (EMC)

National Centers for Environmental Prediction (NCEP)
NOAA/NWS

SNPP EDR Validated 1 / Provisional review update
7 January 2014, NCWCP, Camp Springs, Maryland

Noah Land Model Connections in NOAA's NWS Model Production Suite



Global Data Assimilation

Regional Data Assimilation

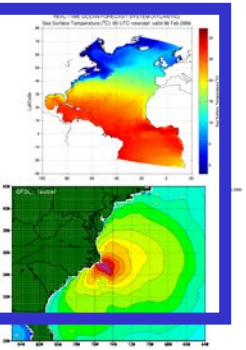
Global Forecast System

Climate CFS
MOM3

Hurricane
GFDL
HWRF

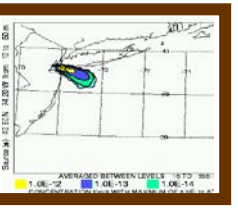
2-Way Coupled

Oceans
HYCOM
WaveWatch III

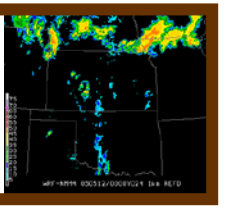


Regional NAM
WRF NMM
(including NARR)

Dispersion
ARL/HYSPLIT

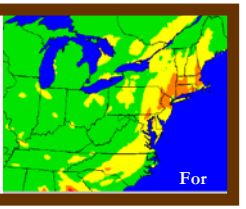


Severe Weather
WRF NMM/ARW
Workstation WRF



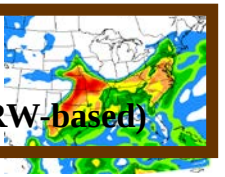
Short-Range Ensemble Forecast
WRF: ARW, NMM
ETA, RSM

Air Quality
NAM/CMAQ

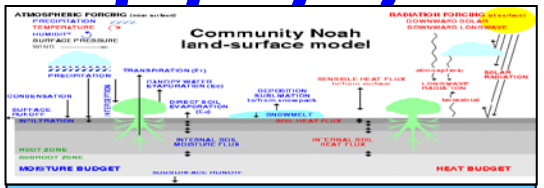


North American Ensemble Forecast System
GFS, Canadian Global Model

Rapid Update for Aviation (ARW-based)



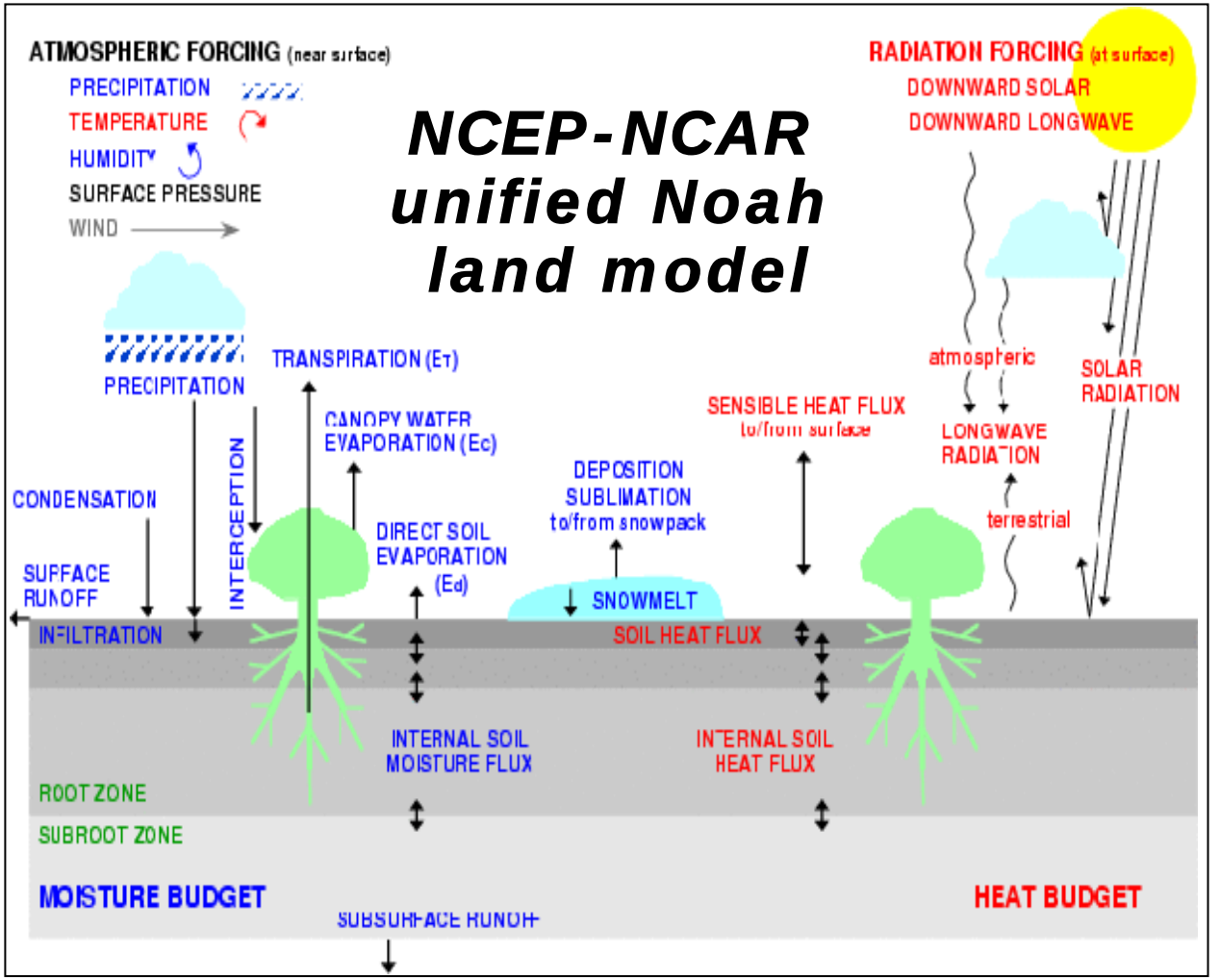
NCEP-NCAR unified



Uncoupled "GLDAS"

Role of Noah Land Model

- Close surface energy & water budgets,
- Determine **heat**, **moisture**, and **momentum** exchange between surface & atmosphere,



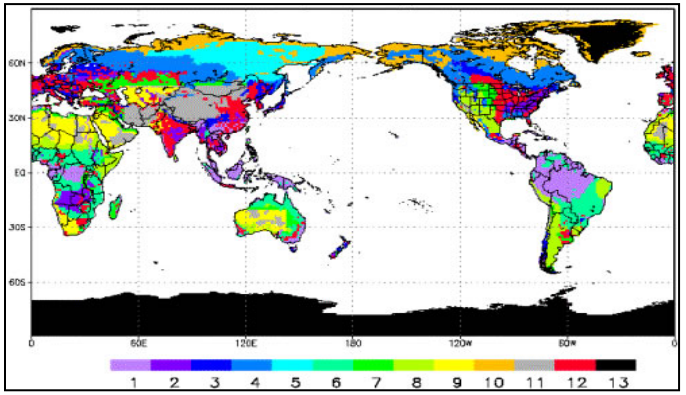
- Noah land model then provides surface boundary conditions to parent atmospheric model, e.g. NAM, GFS, CFS.

Land Model Requirements

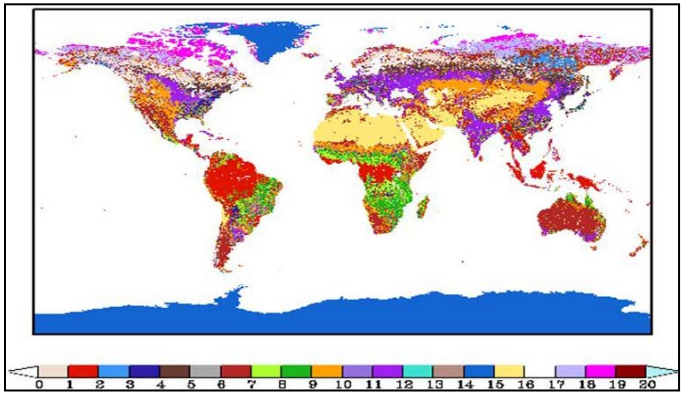
To provide these proper boundary conditions, land model must have:

- **Atmospheric forcing** to drive land model,
- Appropriate **physics** to represent land-surface processes,
- Proper **initial land states**, such as snow & soil moisture (analogous to initial atmospheric conditions, though land states may carry more "memory", especially deep soil moisture, similar to ocean SSTs),
- **Land data sets**, e.g. land use/land cover (vegetation type), soil type, surface albedo, and associated parameters, e.g. surface roughness, soil and vegetation properties.

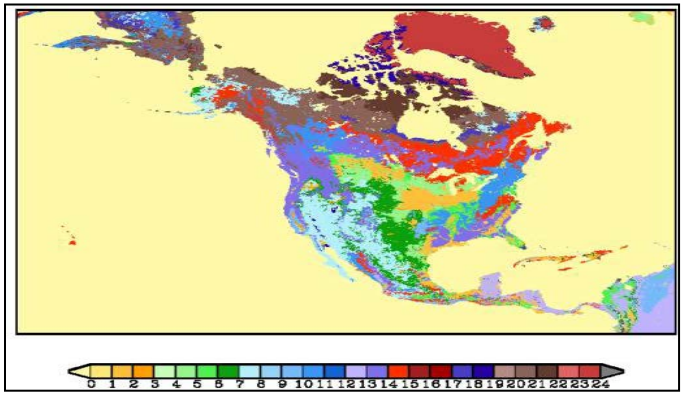
Land-Use (Vegetation Type) Data Sets



UMD *(1-deg): Global Forecast System (GFS), Climate Forecast System (CFS), Global Land Data Assimilation System (GLDAS).*



IGBP-MODIS *(1-km): North American Mesoscale (NAM) model.*

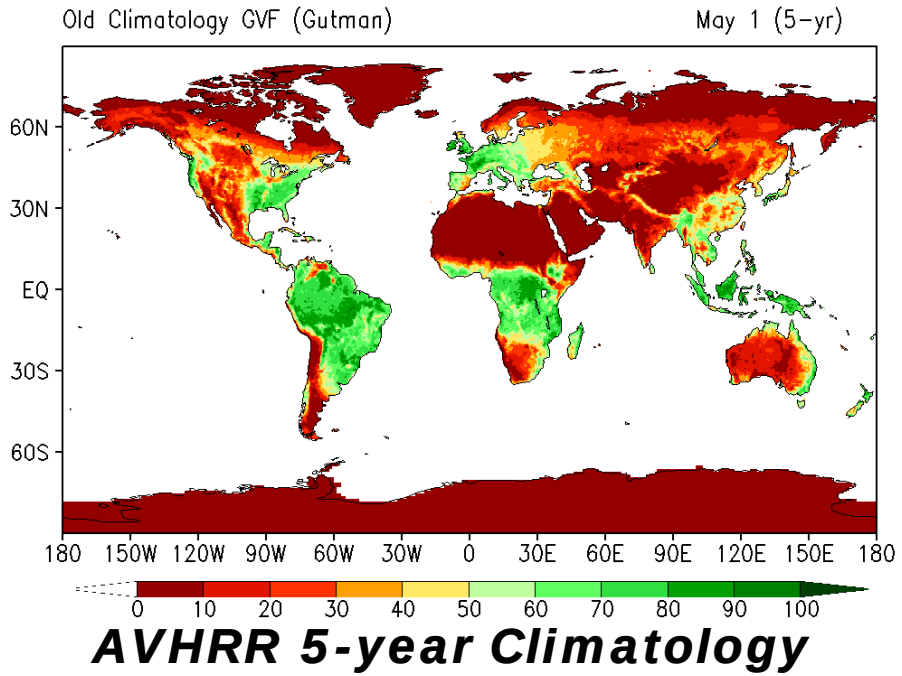


USGS *(1-km): Uncoupled Noah land model, North American Land Data Assimilation System (NLDAS) over CONUS.*

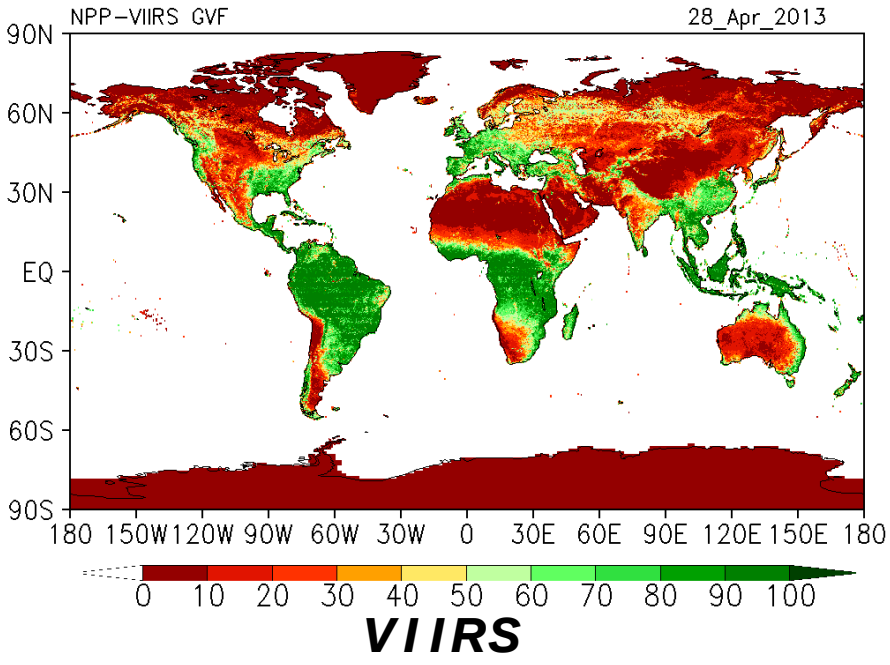
- Fixed fields, or updated monthly/seasonally/annually.
- Unify across NCEP modeling systems.

Green Vegetation Fraction

- **Climatology vs. near real-time GVF**
- **Ingested into NCEP models** where near real-time GVF leads to better partition between surface heating & evaporation --> impacts surface energy budget, PBL evolution, clouds & convection.

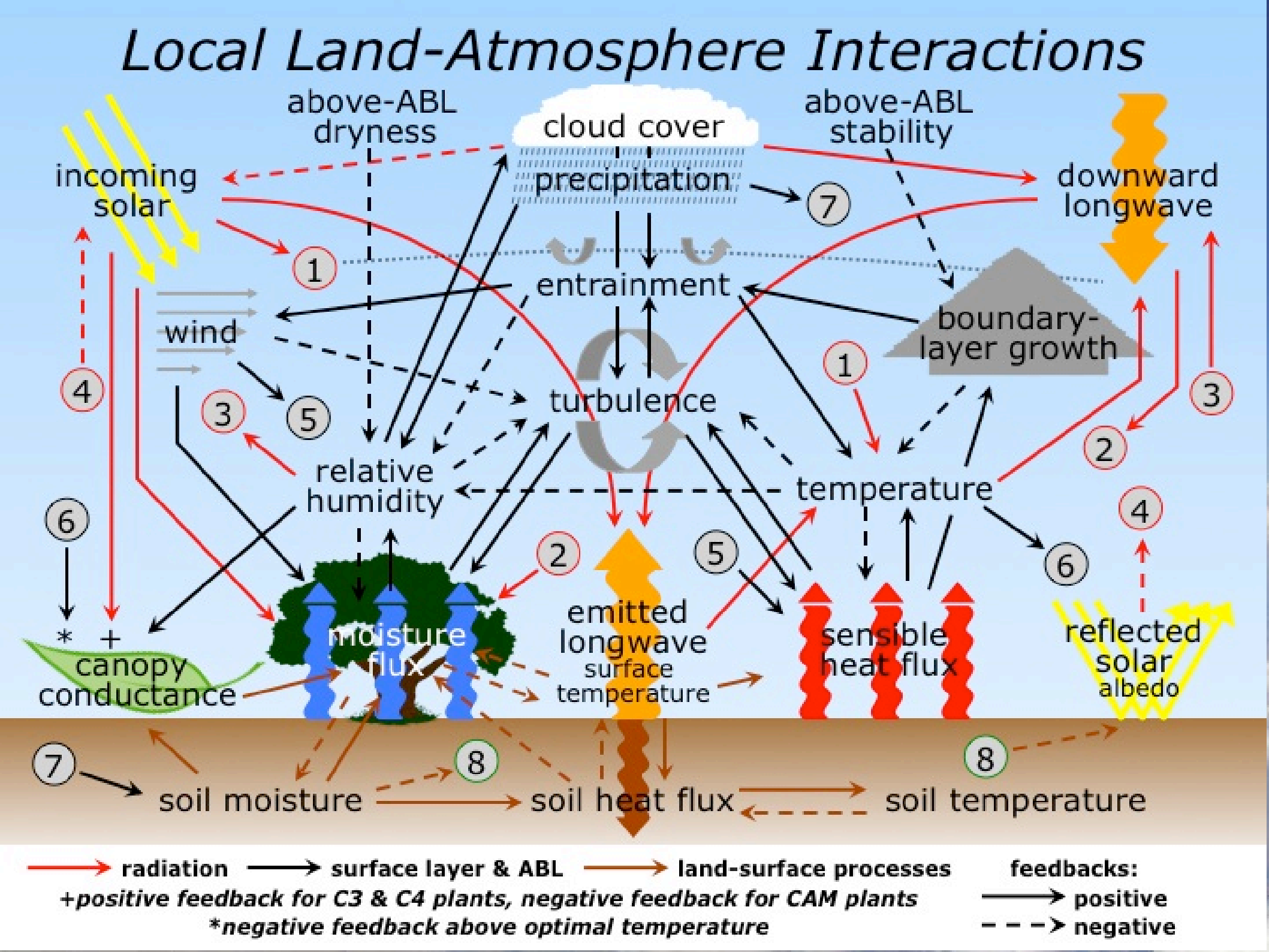


AVHRR 5-year Climatology



VIIRS

Note: *VIIRS GVF in Midwestern US much lower than AVHRR GVF Climatology.*


Local Land-Atmosphere Interactions
above-ABL dryness
cloud cover
precipitation
above-ABL stability
incoming solar
downward longwave
entrainment
wind
boundary-layer growth
turbulence
relative humidity
temperature
moisture flux
emitted longwave
surface temperature
sensible heat flux
reflected solar
albedo
canopy conductance
soil moisture
soil heat flux
soil temperature
radiation
surface layer & ABL
land-surface processes
feedbacks:
positive
negative
+positive feedback for C3 & C4 plants, negative feedback for CAM plants
*negative feedback above optimal temperature