Derive lake characteristics and initial fields for FLAKE in NWP and climate modeling for US CONUS from NARR

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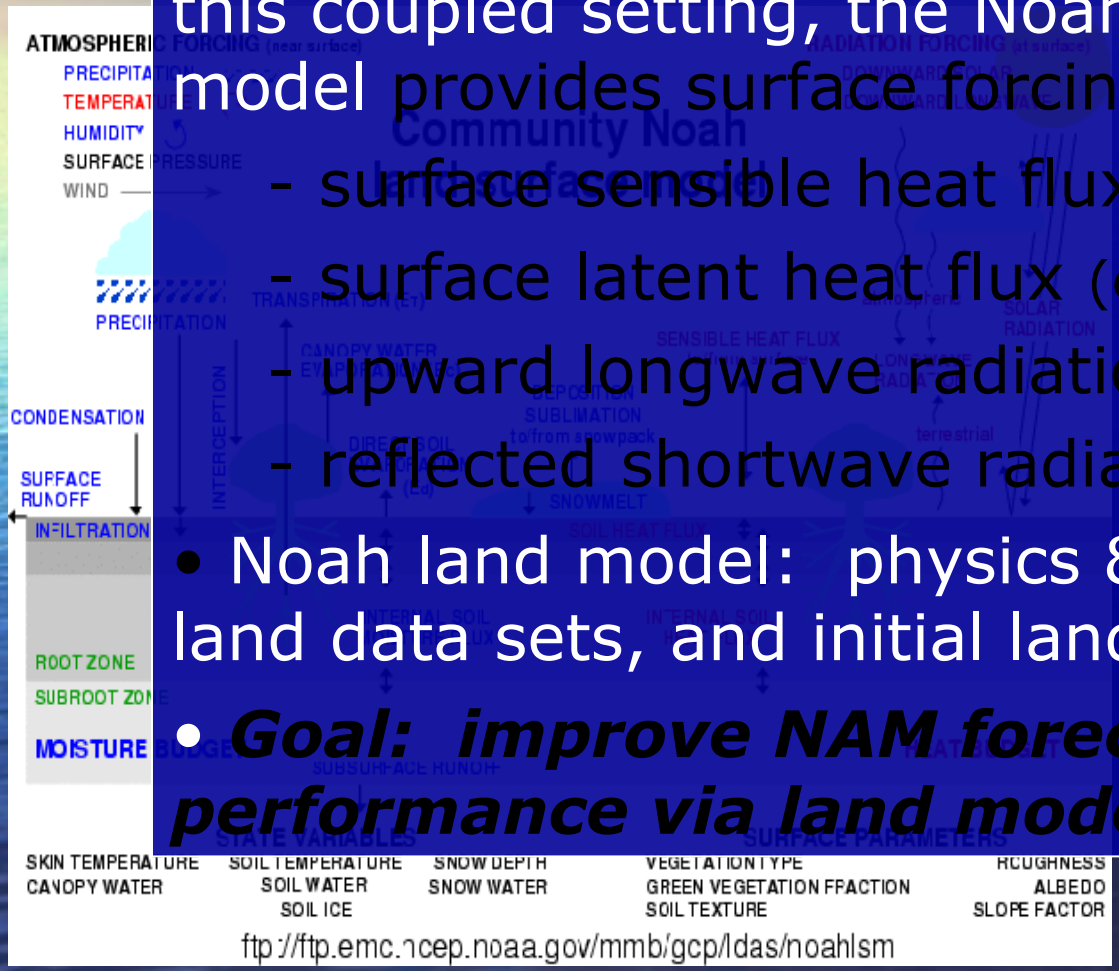
Camp Springs, Maryland

2nd Workshop on Parameterization
of lakes in NWP and climate modeling,

September 15-17, 2010,
Norrkoping, Sweden

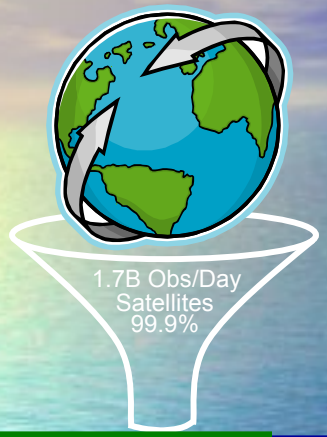
Noah land-surface model

- To represent the land-surface interactions with the atmosphere, as part of the NAM in this coupled setting, the Noah land-surface model provides surface forcing:
  - surface sensible heat flux
  - surface latent heat flux (evapotranspiration)
  - upward longwave radiation (Tskin, emiss.)
  - reflected shortwave radiation (albedo)
- Noah land model: physics & parameters, land data sets, and initial land states.
- ***Goal: improve NAM forecast model performance via land model improvement***



- Flexible soil layers: default is four soil layers (10, 30, 60, 100 cm thick), be can be specified (2 to N)
- Satellite-based annual cycle of vegetation greenness globally: 5-year monthly climatology (NESDIS AVHRR NDVI-based)

NOAA's NWS Model Production Suite

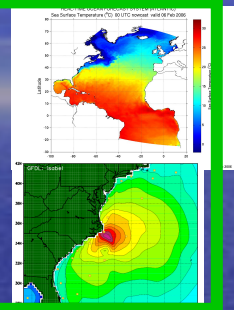


Climate
CFS
MOM3

Hurricane
GFDL
HWRF

2-Way Coupled

Oceans
HYCOM
WaveWatch III



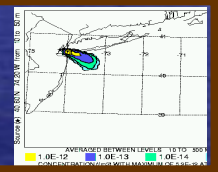
Global Data Assimilation

Global Forecast System

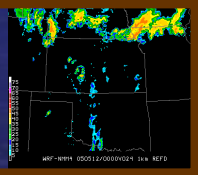
Regional Data Assimilation

Regional NAM
WRF NMM
(including NARR)

Dispersion
ARL/HYSPLIT



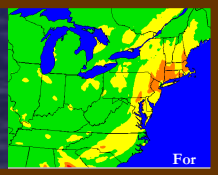
Severe Weather
WRF NMM/ARW
Workstation WRF



North American Ensemble Forecast System
GFS, Canadian Global Model

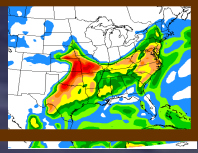
Short-Range Ensemble Forecast
WRF: ARW, NMM
ETA, RSM

Air Quality
NAM/CMAQ



NLDAS (uncoupled)

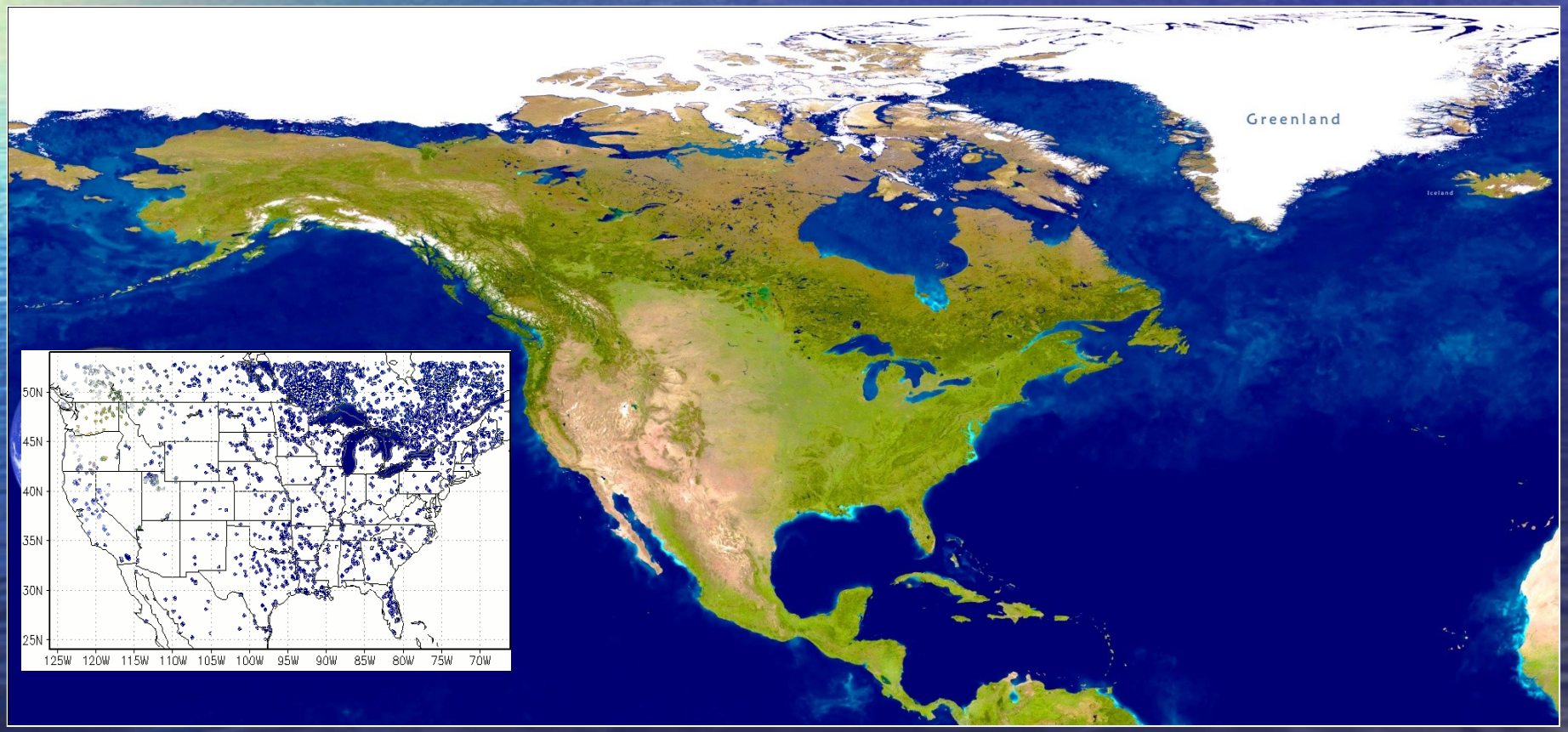
Rapid Update for Aviation



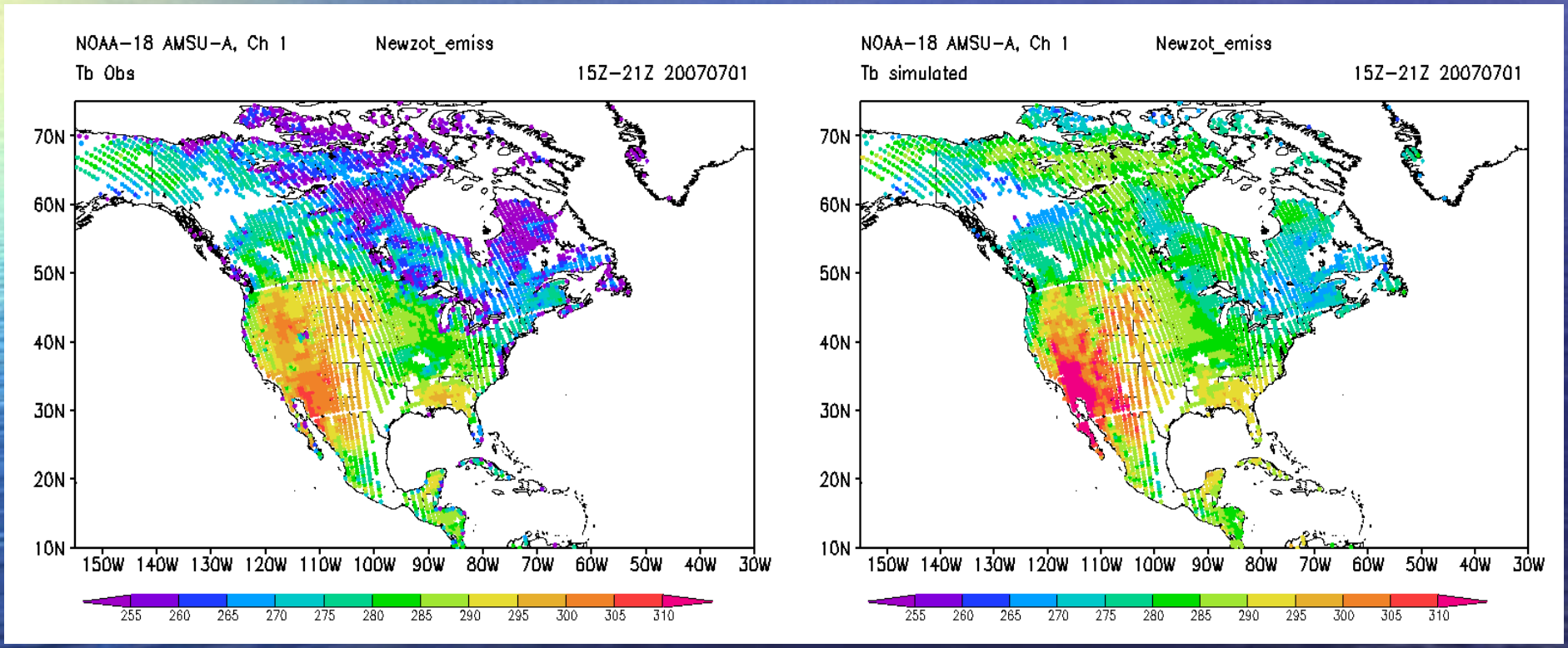
NOAH Land Surface Model

Lake modeling in NAM

- ***Thousands*** of lakes in N. America on the scale of 4km (NAM target), not resolved by SST analysis.
- Influence of previously unresolved lakes may be felt on this scale and can no longer just be "filled in".



Lake-Problems in NWP

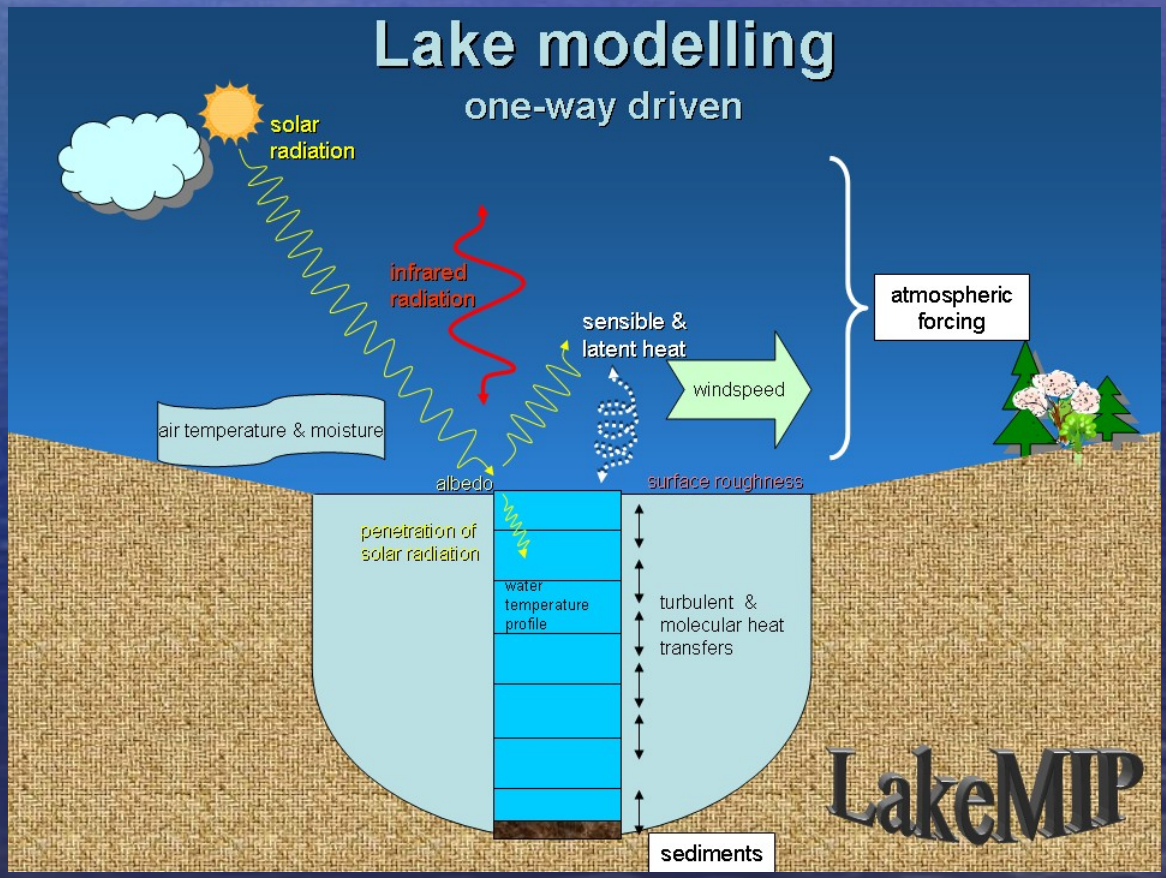


Weizhong Zheng and Michael Ek, *June 16, 2010*

Lake modeling in NAM

- Freshwater lake "***FLake***" model *(Dmitrii Mironov, DWD)*.
- In use in regional COSMO, HIRLAM (European models), UKMO, ECMWF (global).

  - two-layer
  - temperature & energy budget
  - mixed-layer & thermocline
  - snow-ice module
  - atmospheric forcing inputs
  - specified depth & turbidity



Short Term Objectives

- Run Flake off line with climatology
  - Get lake surface temperature
  - Derive lake characteristic parameters
- Coupling Flake with NAM

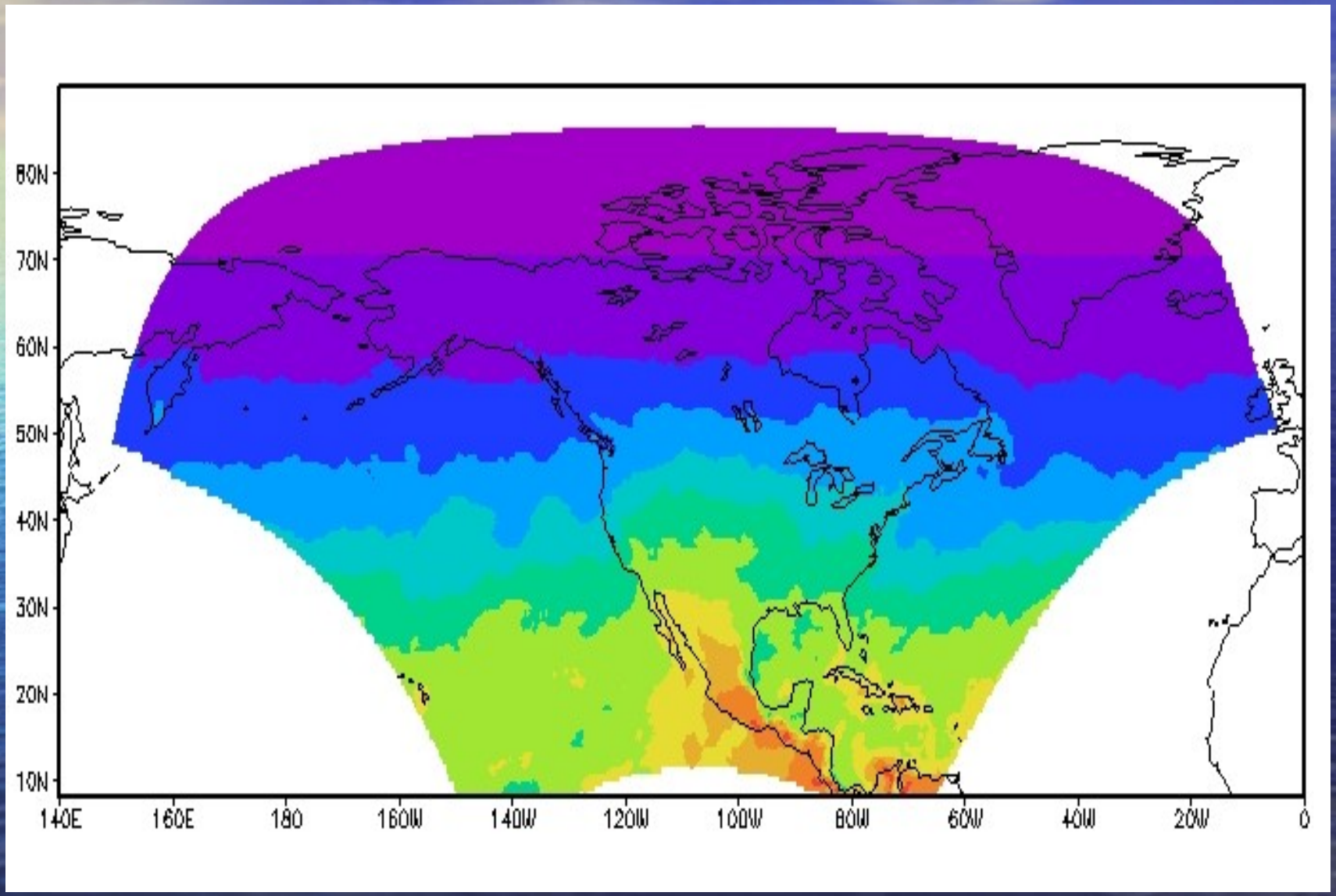
Lake Characteristic Parameters

- Lake depth (Ekaterina Kourzeneva)
- Shape factor (thermocline)
- Thickness of the mixed-layer
- Mixed-layer temperature
- Mean temperature of the water column
- Temperature at the water-bottom sediment interface
- Temperature at the bottom of the upper layer of the sediments
- Water turbidity or optical parameter
- Albedo of Water
- Depth of the thermally active layer of the bottom sediments
- Temperature at the outer edge of the thermally active layer of the bottom sediments
- Etc……

NCEP North American Regional Reanalysis: NARR

- Very High Resolution Reanalysis of the North American region including assimilated precipitation
- The native model grid is converted to a Northern Lambert Conformal Conic grid. Corners of this grid are 12.2N;133.5W, 54.5N; 152.9W, 57.3N; 49.4W , 14.3N;65.1W (essentially, North America). The grid resolution is 349x277 which is approximately 0.3 degrees (32km) resolution at the lowest latitude.
- 8-times, Daily and Monthly means for 1979/01/01 to 2009/07/31 .
- Long Term Daily, Monthly means for years 1979 - 2000.

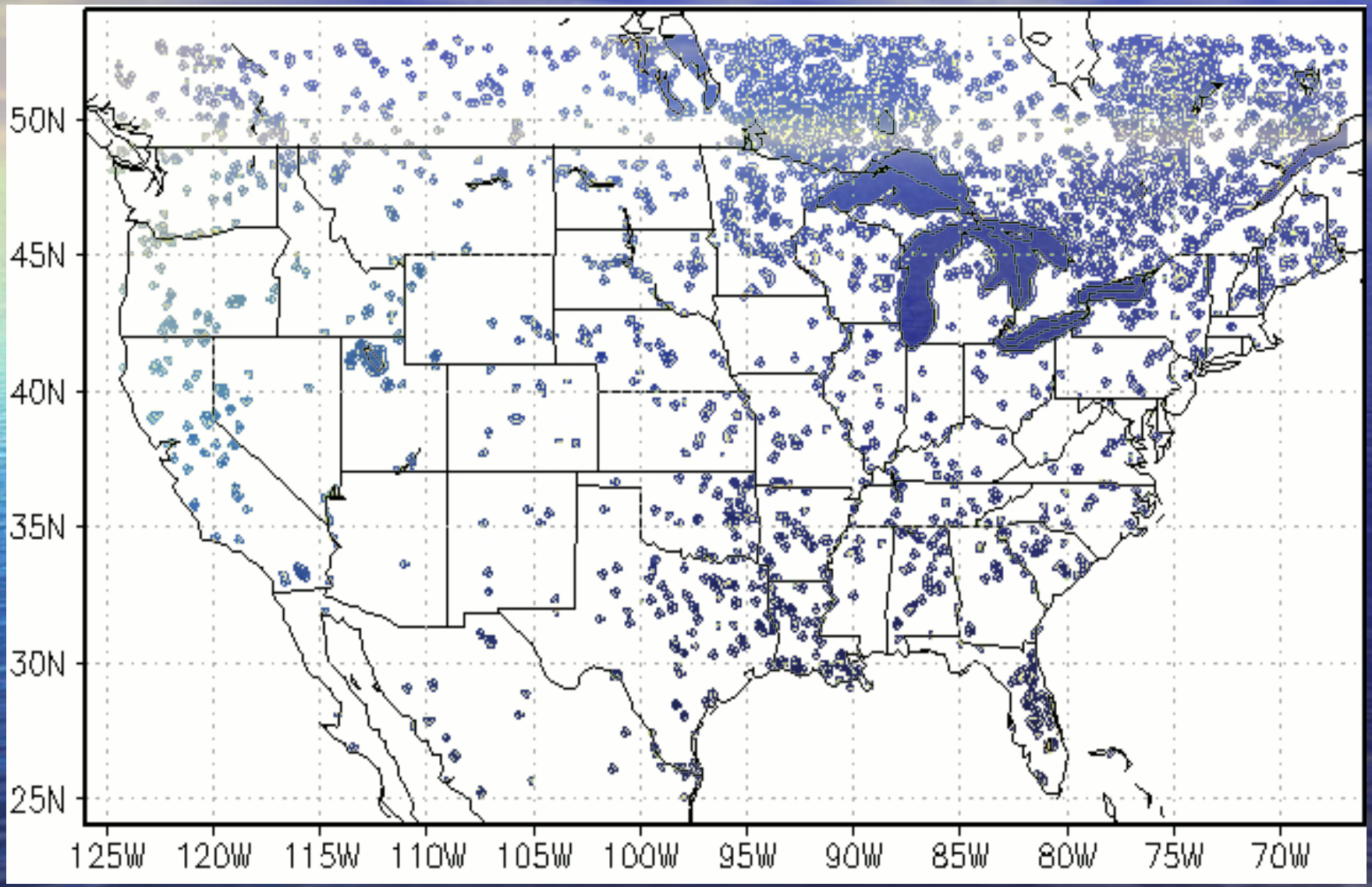
NARR DOMAIN


80N
70N
60N
50N
40N
30N
20N
10N
140E
160E
180
160W
140W
120W
100W
80W
60W
40W
20W
0

Other Data Sets

- 1 km topography (-9999 for Ocean)
- 1 km land use (14 types, 0 for water) (http://glcf.umiacs.umd.edu/data/landcover/)
- 1 km lake depth (Ekterina Kourzeneva)
- 1/12th degree SST and sea ice land mask
- .....

Experimental Domain & Lake Mask



- Two input sets (4km & 10 km) were prepared (Rs, Rl, Pa, U, Ta, Q, SMR, SD, Tsfc) from NARR
- A 2d driver was created (For each lake points, Flake is called by the driver)
- Some parameters were chosen

Summary

- Work in progress
- No results to show, but many questions, and appreciations.

Thanks for your attention!