



Multiscale Land Surface Model Database and Intercomparison within AMMA

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Outline:

1) Multi-scale land surface model **Database**

a) Science Objectives

b) Components

c) Applications

2) AMMA Land surface Model Intercomparison Project (**ALMIP**)

a) Scientific Questions

b) Experiments

3) Perspectives



1) Data Base

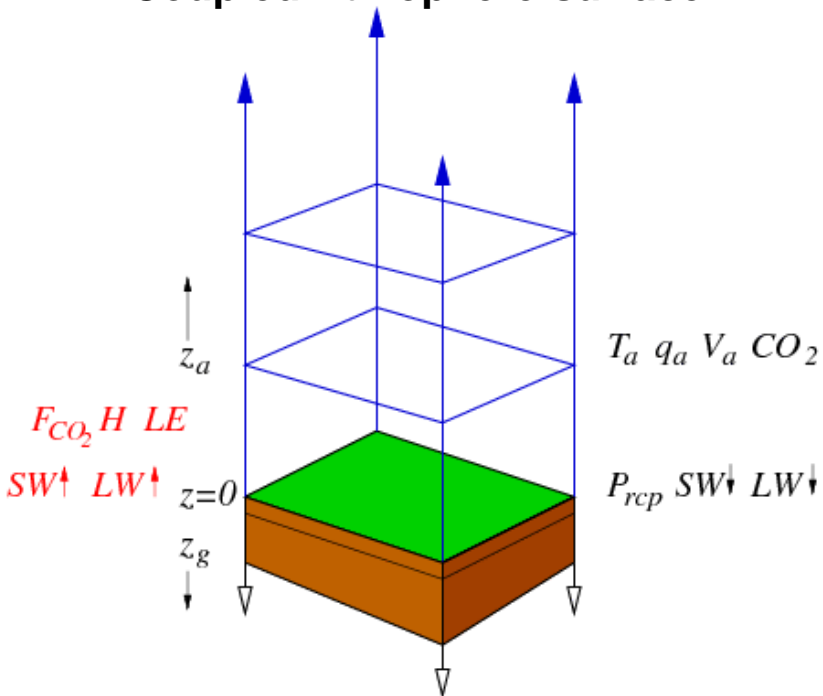
a) Objectives / Applications

Break various components of complex coupled system into manageable portions which can then provide insight into various processes: 1st step → *Offline mode*

Coupled Atmosphere-surface

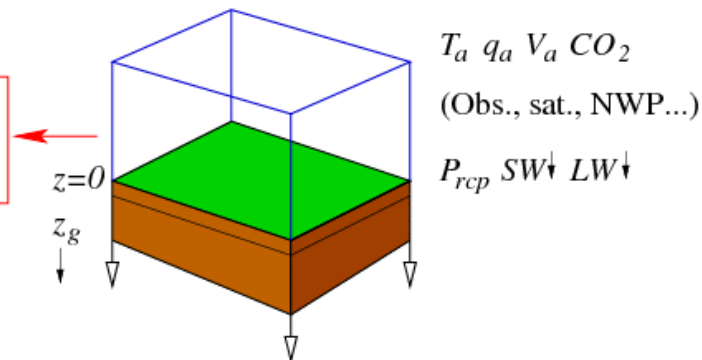


De-coupled (*Offline mode*)



Diagnostics

F_{CO_2} H LE
 SW^{\uparrow} LW^{\uparrow}





1) Data Base

a) Objectives / Applications

Break various components of complex coupled system into manageable portions which can then provide insight into various processes: 1st step → *Offline* mode

- Influence of **soil moisture « memory »** on the atmosphere
- Improve **regional scale hydrological processes**
(sub-grid parameterizations, infiltration, flood planes)
- Determine key processes → **vegetation functioning** (African ecosystems)
- **Extend** vegetation processes to the regional scale
- Use a **multi-scale** approach
- Develop a surface flux and soil moisture « **climatology** » → used to study coupling with atmosphere, improve assimilation systems...
- Intercomparison Project (**ALMIP**) over region (CESBIO and CNRM)



1) Data Base

b) Components

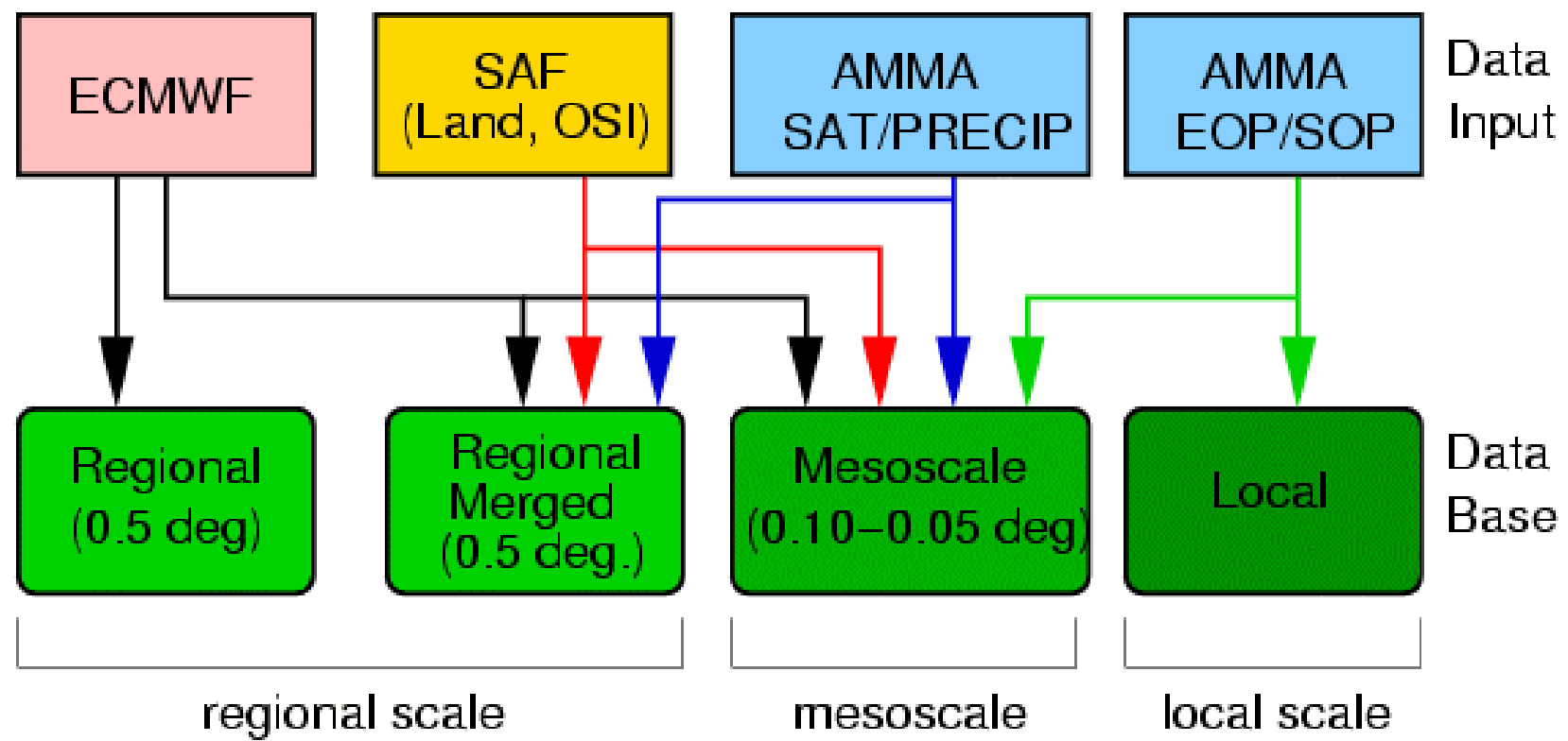
- Surface parameters → ECOCLIMAP (default)
 - Land use / cover
 - Soils and vegetation
 - 1km (upscaled to larger resolutions)
 - Tile approach for PFTs
 - Single « representative » annual cycle
- Atmospheric Forcing
 - Tair, Qair, PSurf, Wind_E, Wind_N,
SWdown, LWdown, Rainf
 - Based on NWP + satellite based data
 - 0.5 deg to 0.05 deg, 3h to 15min

* Multi-Scale: local, mesoscale, regional scale



1) Data Base

b) Components





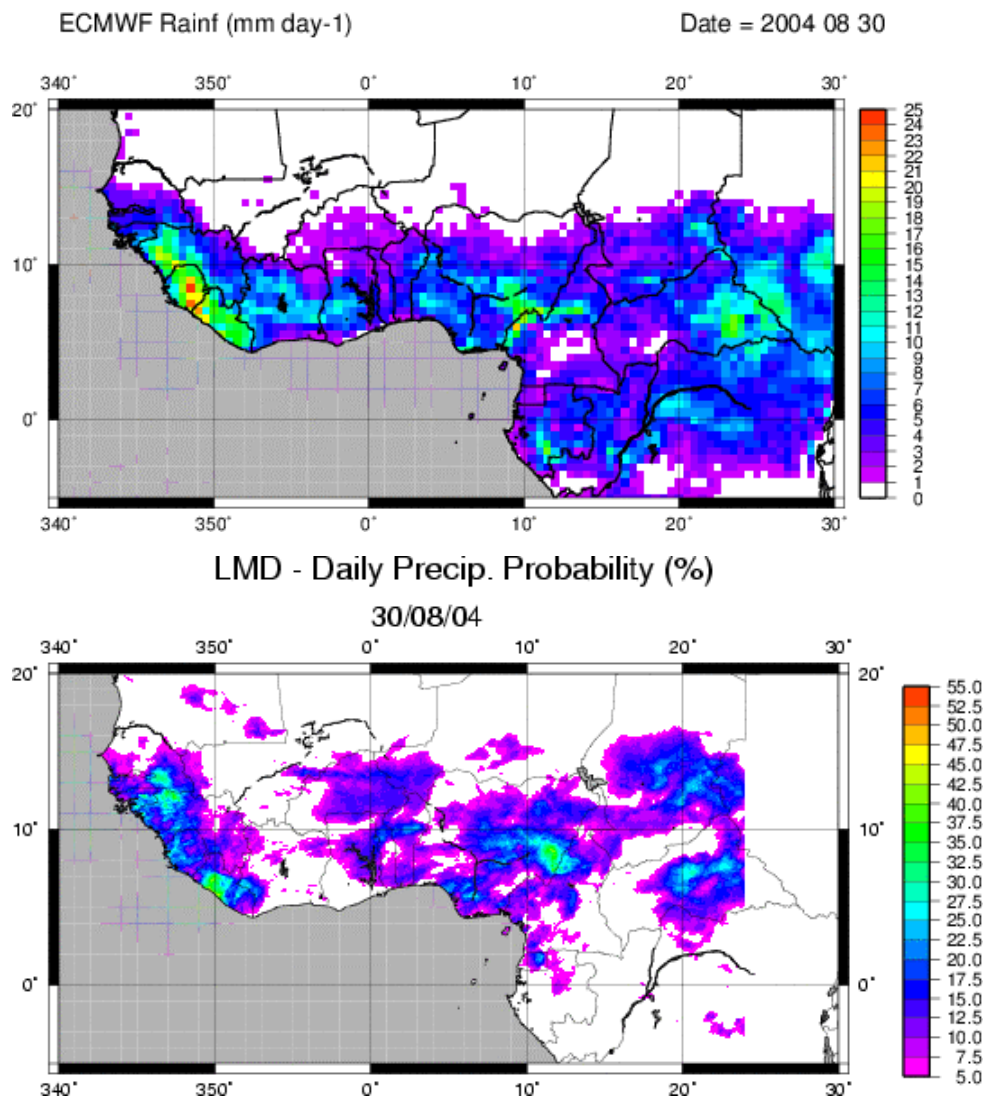
1) Data Base

b) Components

Current work: merging of satellite based data and NWP output

- ECMWF – FC precipitation
- 0.5 deg, 3h
- Forecast 36h - 12h → 24 hour

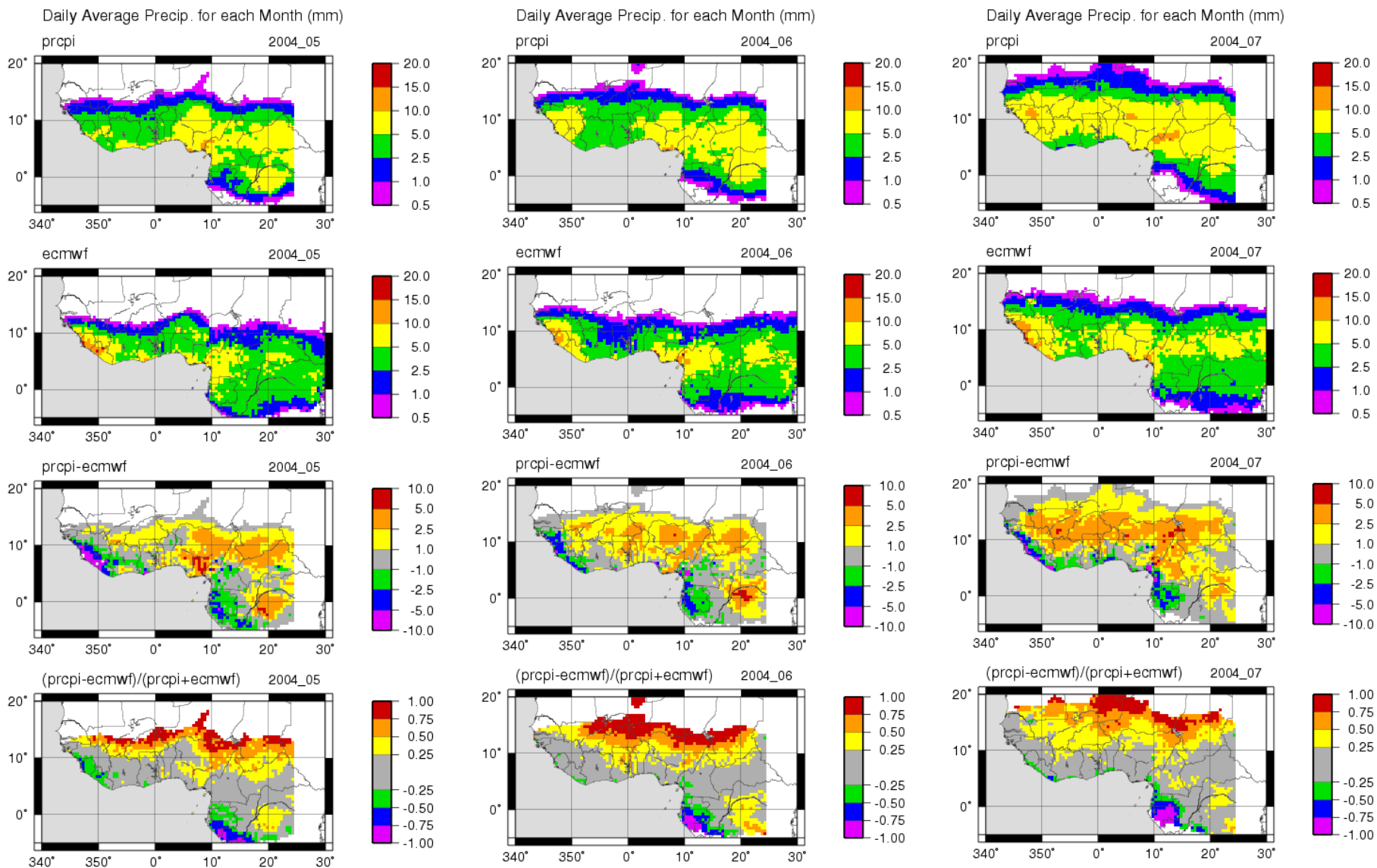
- AMMA-SAT: MSG (LMD: F. Chopin)
- 3 km → 0.05 deg, 15min
- Monsoon period (June-Sept.)
- 2004 +





1) Data Base

ECMWF FC versus AMMA-SAT product: May-Jul, 2004



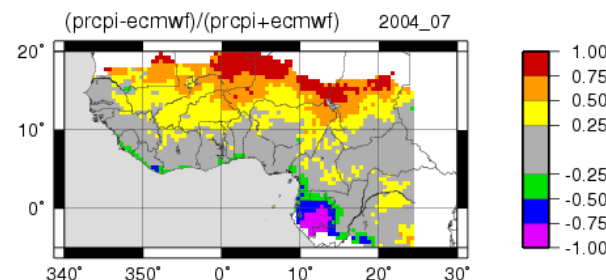
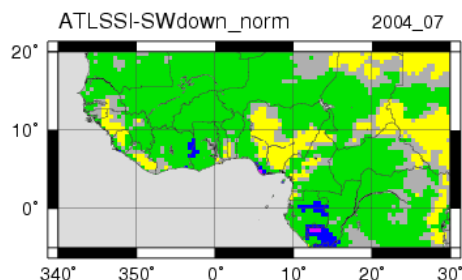
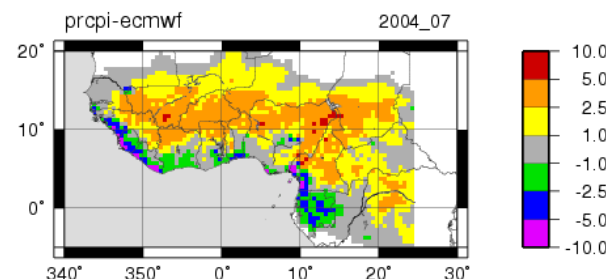
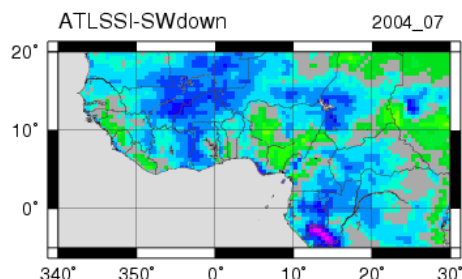
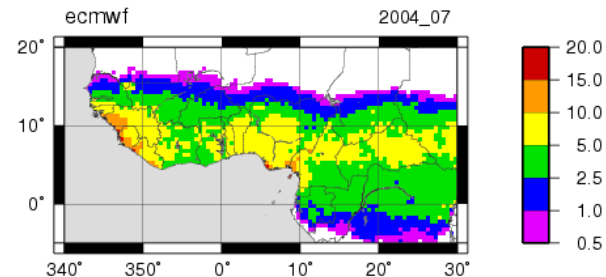
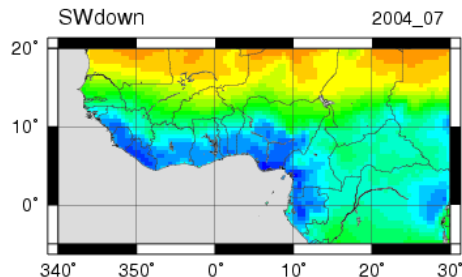
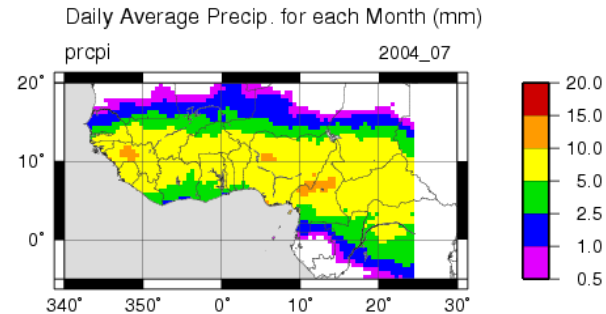
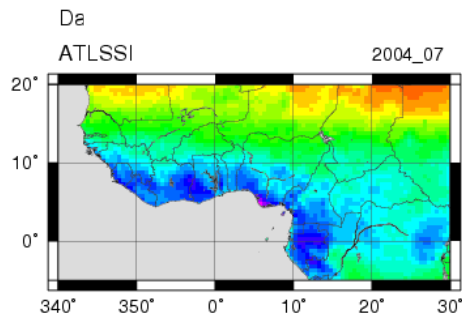


1) Data Base

OSI-SAF

(Ocean and Sea Ice)

- SWdown, LWdown radiative fluxes
- MSG (coherent with AMMA-SAT precip.)
- July+, 2004 (June 2004 ready in 2006)
- 0.10 degree, 3h
- Comparison with ECMWF FC →





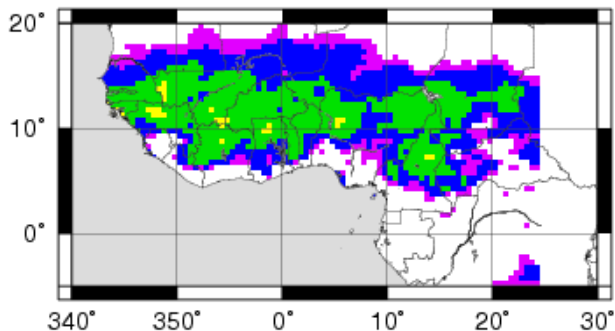
1) Data Base

Vadidation/Evaluation of atmospheric forcing?

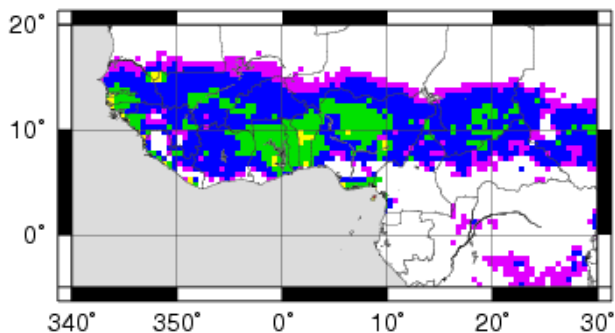
Difference: July-June

Daily Average Precip. for each Month (mm)

prcpi 2004_07



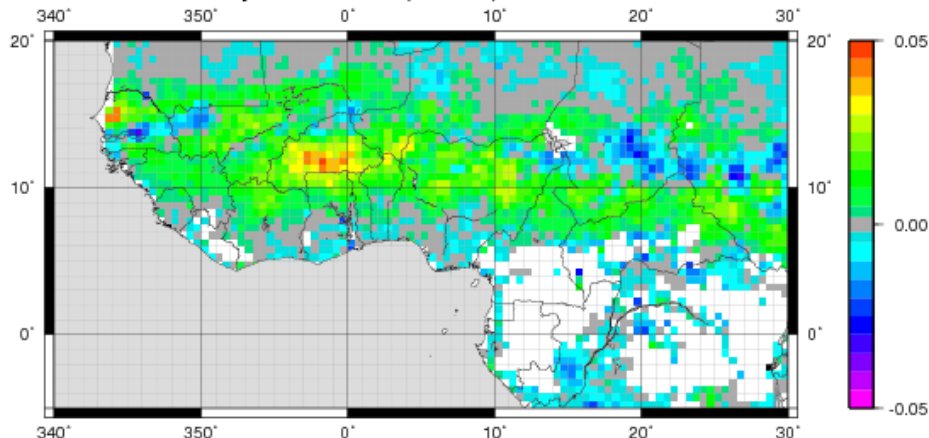
ecmwf 2004_07



AMSR-E

- Microwave sensor
- « *Surface* » soil moisture
- 50 km, 2 passes daily
- Flagged data below 5-10 N
- Difference: July – June (averages)

Daily Soil Moisture (m3 m-3) 2004_07





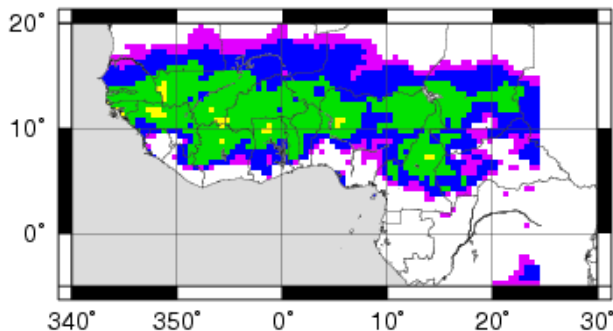
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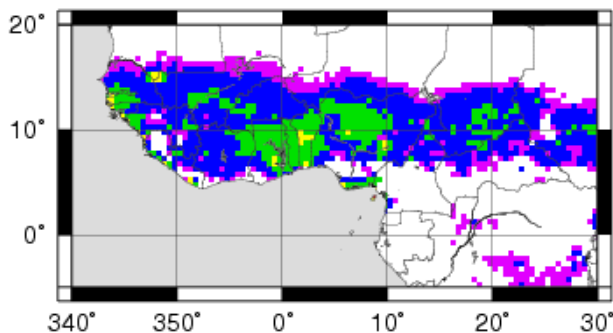
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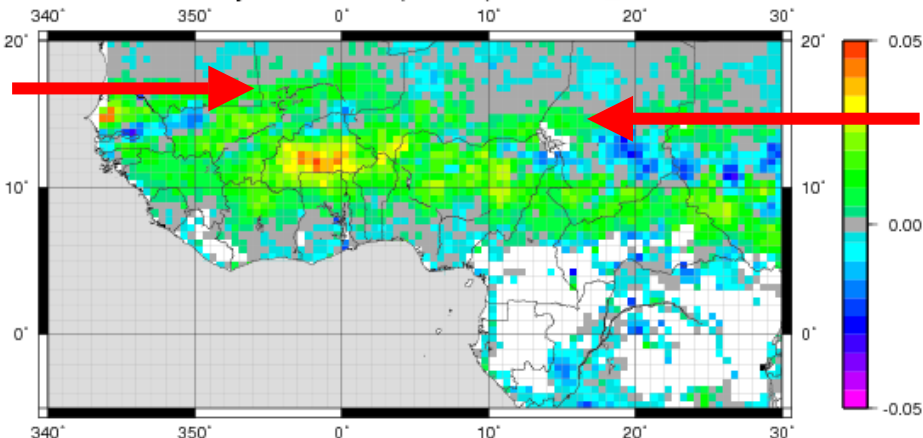
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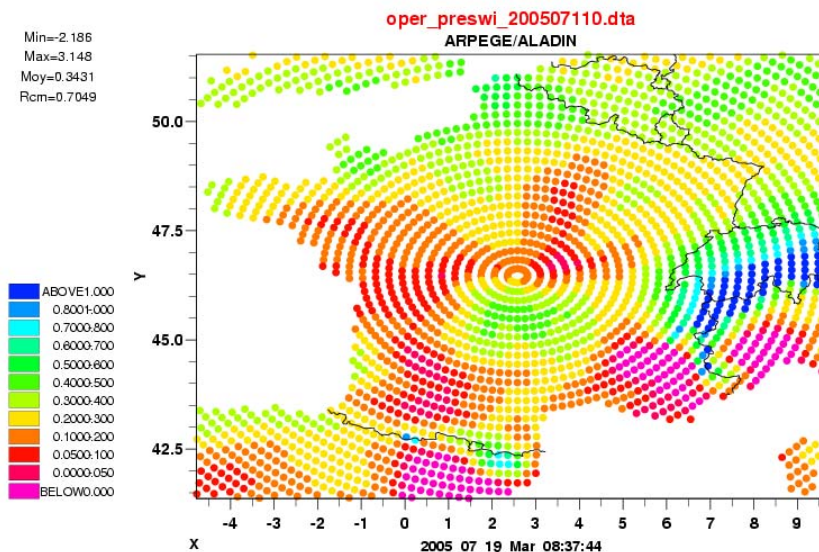
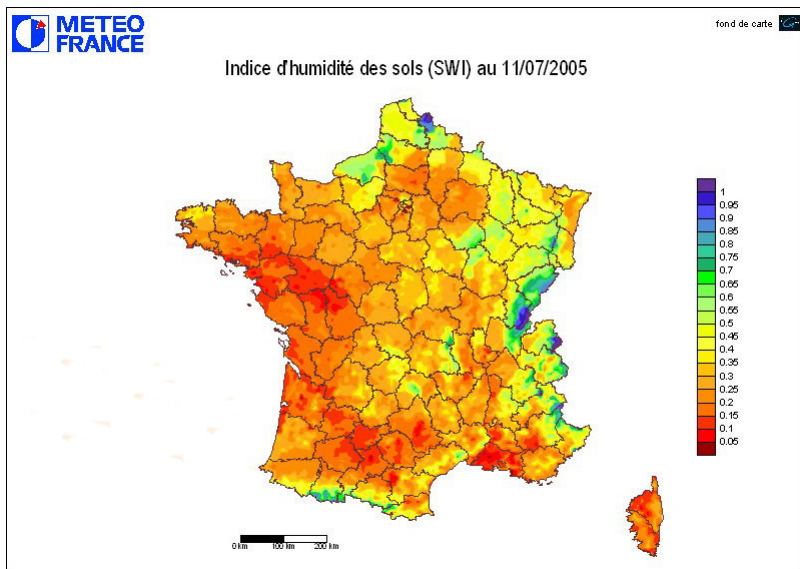




1) Data Base

c) Applications

- Mesoscale – convection (MOANA/CNRM: N. Acensio)
- Offline fluxes, LSS model intercomparison
- Assimilation (ALDAS)





ALMIP

AMMA Land Surface Model
Intercomparison Project

WP 4.1

Aaron Boone, Patricia de Rosnay and ALMIP group

a) Context

Question: What have we learned from SVAT / LSS/ LSM intercomparison projects?

- Determination of baseline or « minimum » physics (eg. Stomatal resistance)
- Importance of sub-grid hydrology
- Importance of soil moisture (on surface energy balance: HAPEX MOBILHY)
- Better numerical schemes
- Chance for extensive validation
- Ability of schemes to simulate carbon cycle
- Innovations in Sub-grid cold-season processes
- Impact of changing scale
- Ability of such models to simulate regional / large scale hydrology



SnowMIP

Rhone-AGG



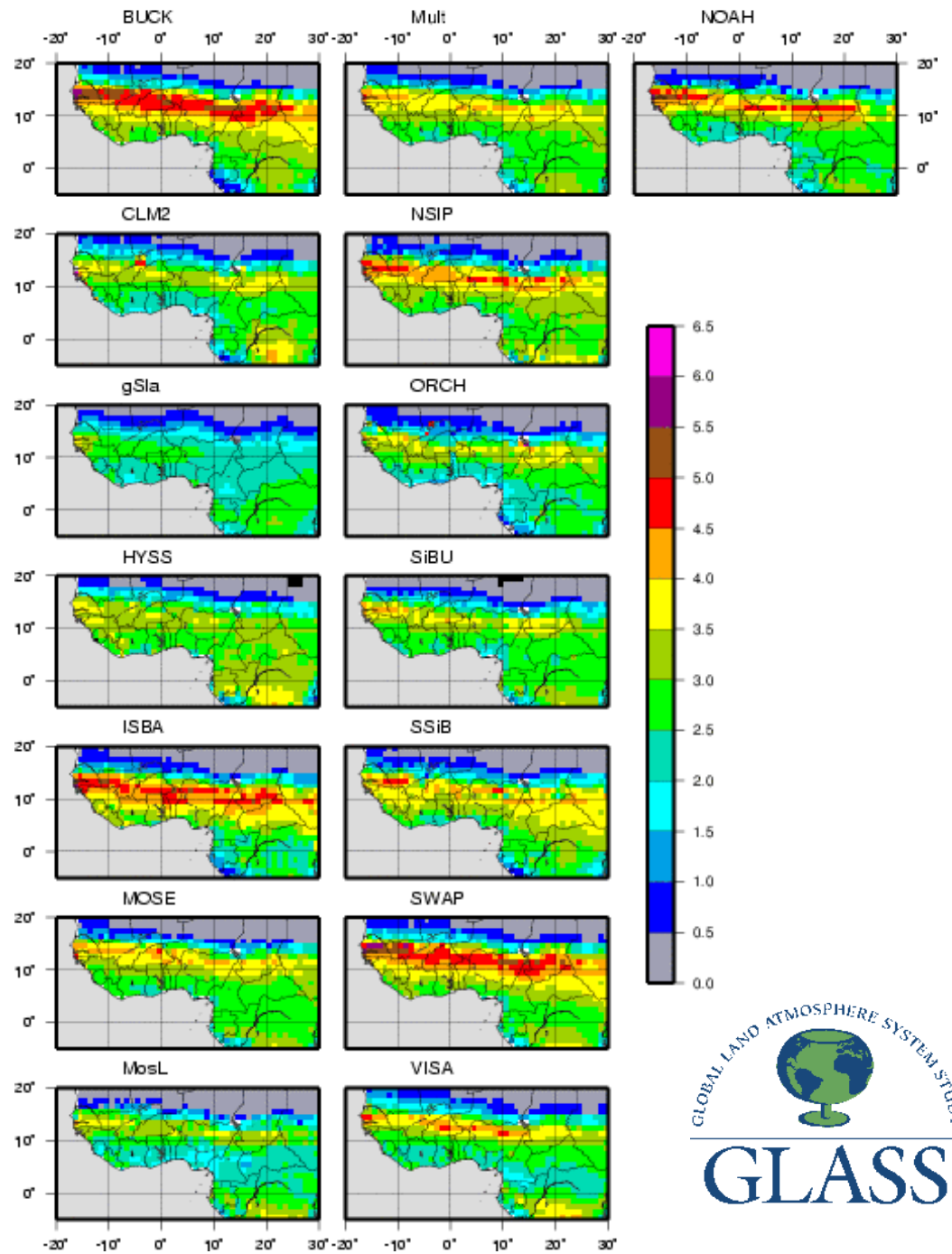


Global Soil Wetness Project 2

International Land Surface Model Intercomparison Project – Dirmeyer et al.

- 15 LSMs (NWP, GCM, Hydrology...)
- Control Exp. Forcing:
 - ISLSCP parameters
 - NCEP – hybridized, gauge-corrections
- Global scale, 1 deg resolution
- Forcing: 3h, 1982-1995
- Evapotranspiration (monthly: mm day-1)
- 10-year average: 1986-1995
- Significant differences!!! →

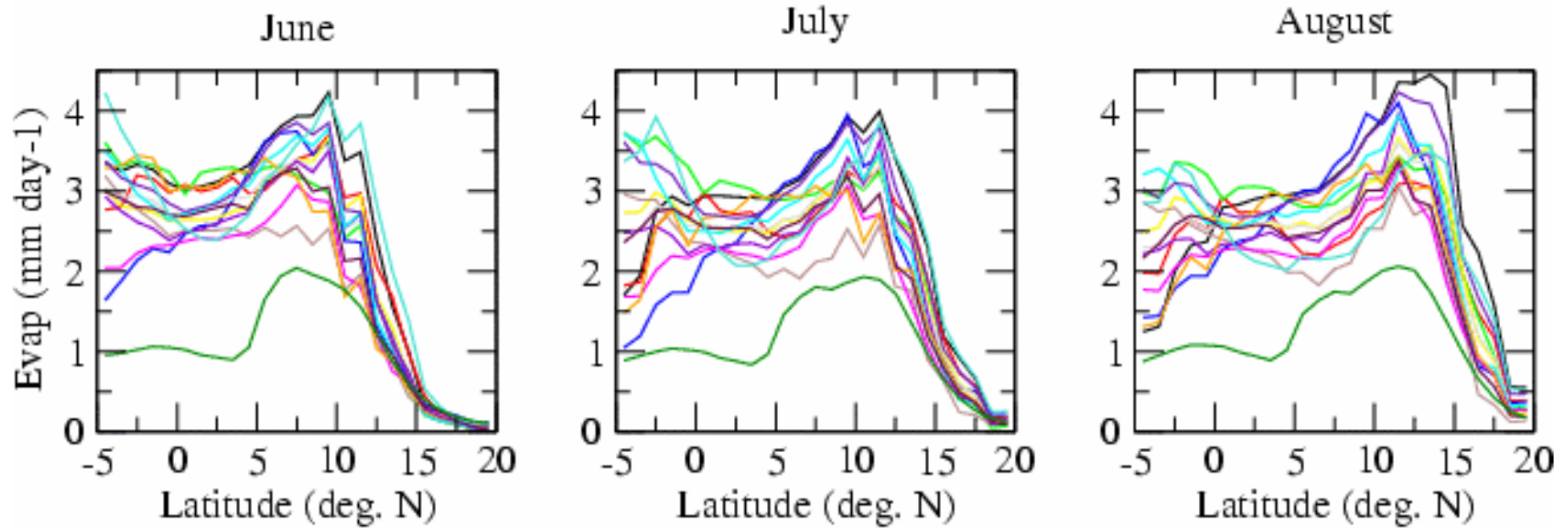
GSWP2 10 year Sep AVG Evap





- 15 LSSs, 1 deg. res.
- Evap (average → 10 years, -20E to 30 E longitude)
- Inter-LSS Meridional gradient highly variable

GSWP2 Average 1986-1995



15 LSSs: Average over -20 to 30 deg. E



2 Science Objectives

- No one scheme perfect: examine ensemble of models

WP4.1

- Response of different schemes to scale change

WP2.3, 1.2

- Develop a mult-model climatology of « realistic » high resolution soil moisture, surface fluxes, water and energy budget

WP1.3, 4.4, 3.x

- See what improvements needed in SVATs to simulate processes particular to African climate and surface

WP2.3

- See how simple SVATs can simulate spatial distribution and inter-annual variability of vegetation

WP2.3,1.3



ALMIP AMMA Land Surface Model Intercomparison Project

Curent
sources:

| | | | |
|-----------------|--|--------------------------|---------------------------------------|
| AMMA-SAT/PRECIP | Precip Probability | 3km → 0.05 deg, 15min | 2004+ |
| OSI-SAF | SWdown, LWdown | 0.10 deg., 3h | 2004 |
| LAND-SAF | SWdown, LWdown, Tsurf | 0.05 deg., 30 min | 2005+ |
| ECMWF | Tair, Qair, Wind, PSurf, Rainf, LWdown, SWdown | 0.50 deg., 3h | 2003+ (2001+?) |
| AMMA EOP/SOP | Fluxes, soil moisture, vegetation (biomass, LAI...) | local | 2004 Mali, Dahra, Niger (2005+) |
| AMSR | Soil moisture (surface) | 25 km | 2004... |
| AMMA-SAT | MODIS LAI | 0.01 deg, monthly | 2003+ |

Evaluation
Data:



ALMIP

AMMA Land Surface Model
Intercomparison Project

Models:

| Model acronym | Institute | Contact |
|----------------------|---|------------------------------|
| ORCHIDEE | LMD, Paris, France | J. Polcher |
| ISBA | CNRM / Météo France Toulouse | A. Boone |
| TESSEL | ECMWF, Reading, UK | A. Beljaars |
| JULES | CEH, Wallingford, UK | C. Taylor |
| SETHYS | CETP, France | C. Ottlé |
| IBIS* | ISE, Montpellier, France | C. Delire |
| NOAH* | (NCEP, USA) CETP, France | C. Ottlé/ B. Decharme |

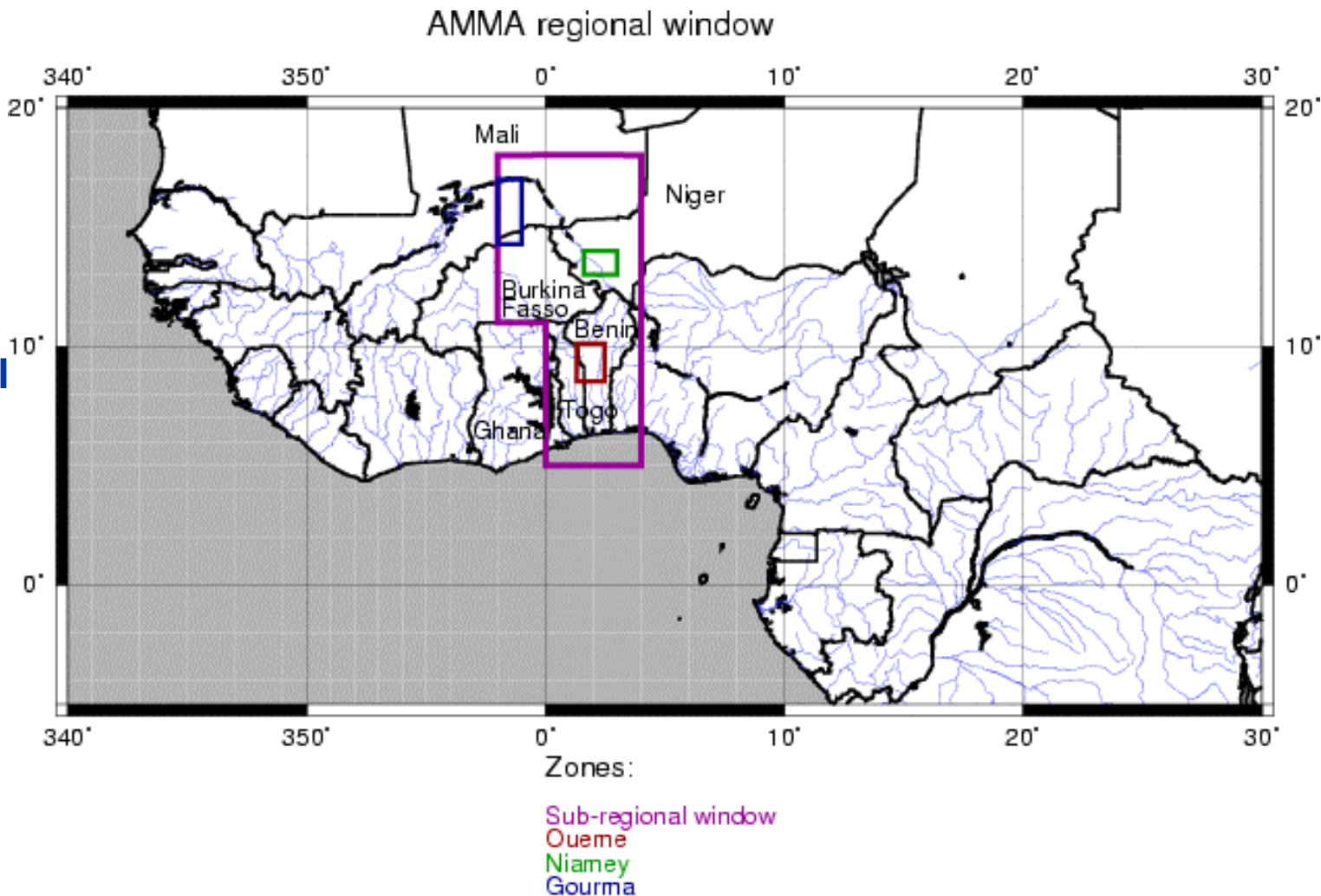
MIKE-SHE (Sandholt and Norgaard), SSib (Poccard-Leclercq and Xue)



ALMIP AMMA Land Surface Model Intercomparison Project

Study Zone:

- regional
- sub-regional
- mesoscale
- local





5 Experiment

Diagnostics:

Emphasis on soil moisture, surface fluxes, vegetation response to forcing (along meridional gradient)

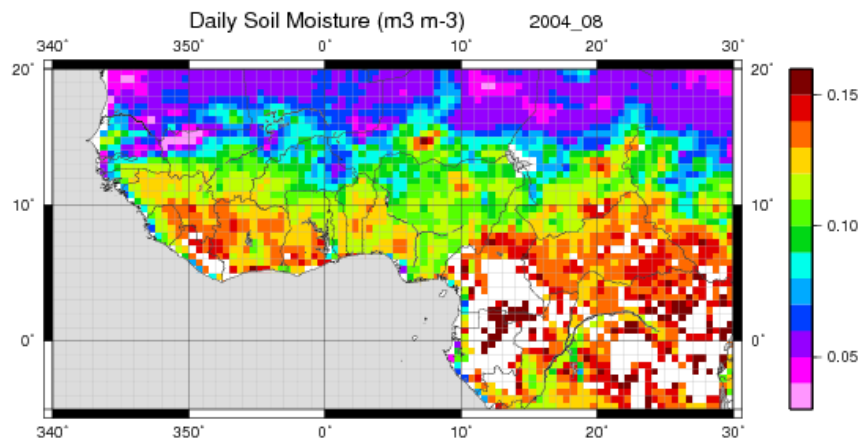
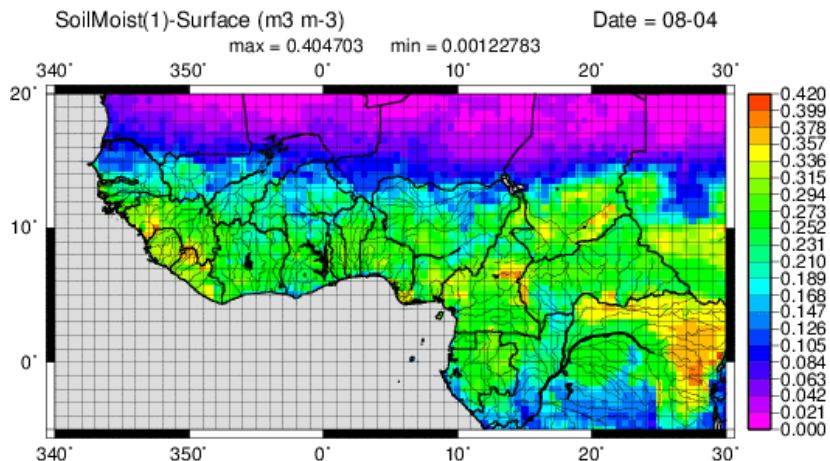
- Turbulent fluxes (Sensible and latent heat...)
- **Net radiation** fluxes (short and longwave...)
- **Surface temperature**
- Soil moisture (all layers → **surface/superficial**, root zone)
- Evapotranspiration
- Runoff components
- **LAI** (biomass)
- Diurnal cycle, decadal-monthly, inter-annual
- Different spatial scales



ALMIP AMMA Land Surface Model Intercomparison Project

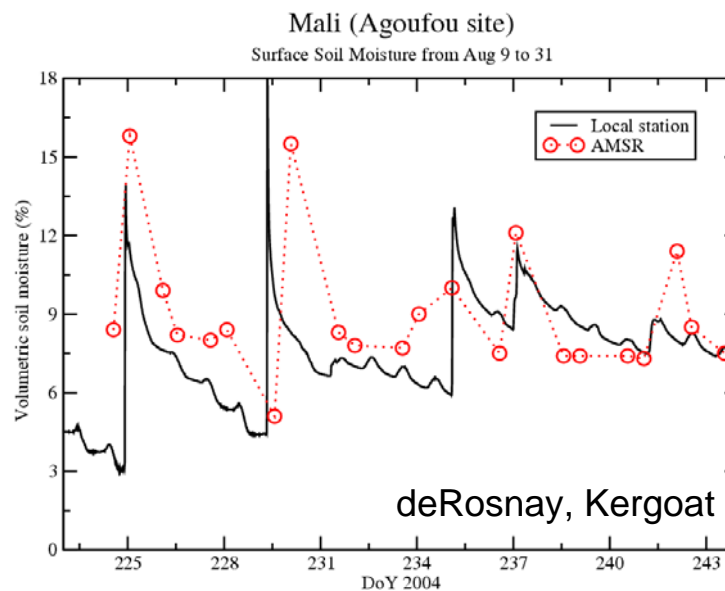
Simulated by ISBA (CNRM/Météo-France)

AMSR-E



Model evaluation:

e.g. Regional and local scale soil moisture





3 Perspectives

- Simulate land surface fluxes, soil moisture, vegetation at various scales
- Compare simulated soil moisture to ARPEGE/assimilation
- NWP/Mesoscale model initialization
- Finalize science plan for ALMIP
- Complete regional merged and mesoscale atmospheric forcing data (2004): extend through 2005
- Search for more evaluation data (forcing and for simulations)
- Data distribution to participants
- Begin simulations
- Interactions with GCM WP4 Intercomparison
- 1st step towards ALDAS
- Collaboration with GLDAS-LIS (USA)



Contributors (data):

AMMA-SAT (F. Chopin, LMD)

OSI-SAF (2004), LAND-SAF (2005+)

MEDIAS (R. Lacaze)

ECMWF (A. Beljaars)

Dahra (I. Sandholt)

Niger (B. Cappelaere, L. Descroix)

Mali (E. Mougin, L. Kergoat)

et al !!!