

# Land surface: Merging efforts on surface processes, remote sensing, modeling and data base, on focusing on African Land Data Assimilation (ALDAS)

(wp 4.1, 4.3, 4.4)

Tools & methods relevant for integrated Wps:

- Wp 1.2 (water cycle),
- Wp 1.3 (land-atmosphere feedbacks),
- Wp 2.3 (land surface processes).



Biarritz-Seignosse meeting  
Land surface models session  
Wednesday Sep 21 2005  
14:00-18:30



# Introduction: Land Surface Modellers

(EU: WP 4.1.1, API WP4.1.2)

14 Laboratories in France, Spain and UK:

CEH, CESBIO, CETP, Cirad, CNRM, CRC, ECMWF, ENS,  
HSM, ISE, LMD, LTHE, UCLM, UCPT.

AMMA-API and AMMA-EU coordinated together to address  
some of scientific questions of Wps 1.2, 1.3, 2.3

Coordinated use of models, fields observations, satellite and data  
base



# “Land Surface Modelling” ?

Predict water, energy, vegetation and biogeochemical processes.

Different approaches, concepts and parameterizations depending on considered studied processes, spatial and temporal scales and corresponding forcing tools:

‣ **SVAT**: vertical transfert of water and energy between surface and atmosphere) ~ time step: minute to hour

‣ **Integrated LSM**: second generation of SVAT, for GCM coupling, (including lateral transfers, CO<sub>2</sub> cycle, phenology, vegetation dynamic - ~ time step: minute to hour

‣ **Hydrological models**: at basin scale, spatially distributed, ground water - Representative Elementary Watershed – rainfall event or hourly to daily time step.

‣ **Vegetation models**: at daily time step, for vegetation phenology

‣ **Crop model**: agricultural systems



# Land Surface Models

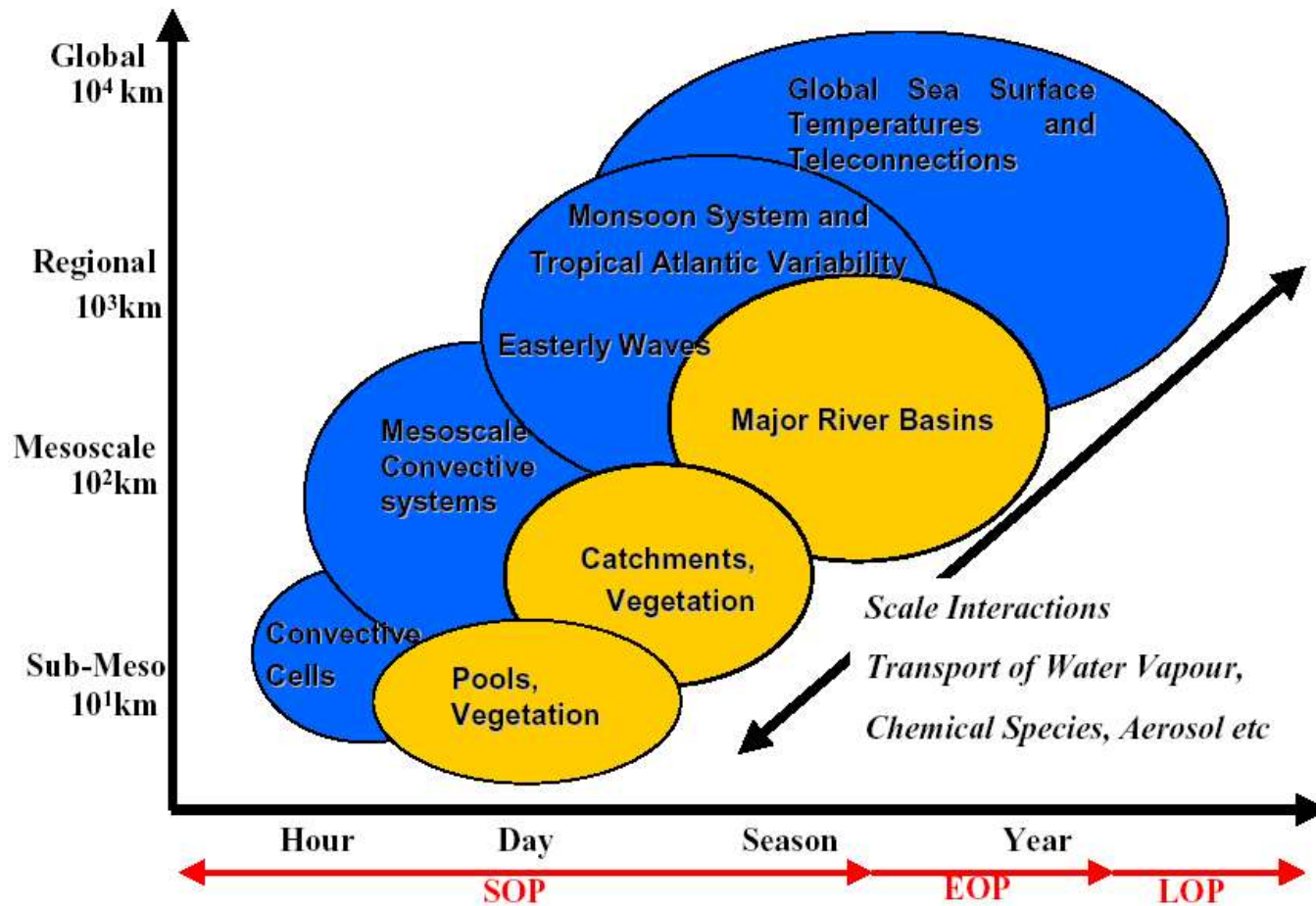
- 5 integrated land surface models (LSM): ISBA, JULES, ORCHIDEE, TESSEL IBIS
- 1 SVAT model: SETHYS
- 3 vegetation models: STEP, TGPIX, TREEGRASS
- 4 hydrological models: GR4j, Power, Rew\_v4.0, ABC-rwf
- 1 crop model: SARRAH

A lot of Models are used. They focus on different processes, work at different temporal and spatial scales, on different domains and sites.

HOW modelling activities are organized to address scientific questions (WP 1.x & 2.3) pointed out in AMMA ?



# Space and time scales

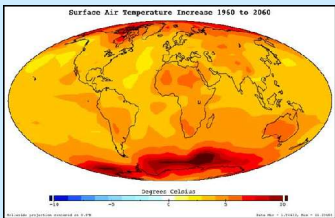


## Scale interactions control

- Processes (WP2.3)
- Water budget (WP 1.2)
- Land-atmosphere feedbacks (WP 1.3)



# Domain of applicability and coupling



GCMs  
 ARPEGE  
 LMDZ  
 ECMWF  
 Met Off  
 CCM3  
 MM5  
 RCM  
 MAR

ISBA  
 ORCHIDEE  
 TESSEL  
 JULES  
 IBIS  
 SETHYS  
 Noah LSM ?

VIS, PIR, MW

VIS, TIR

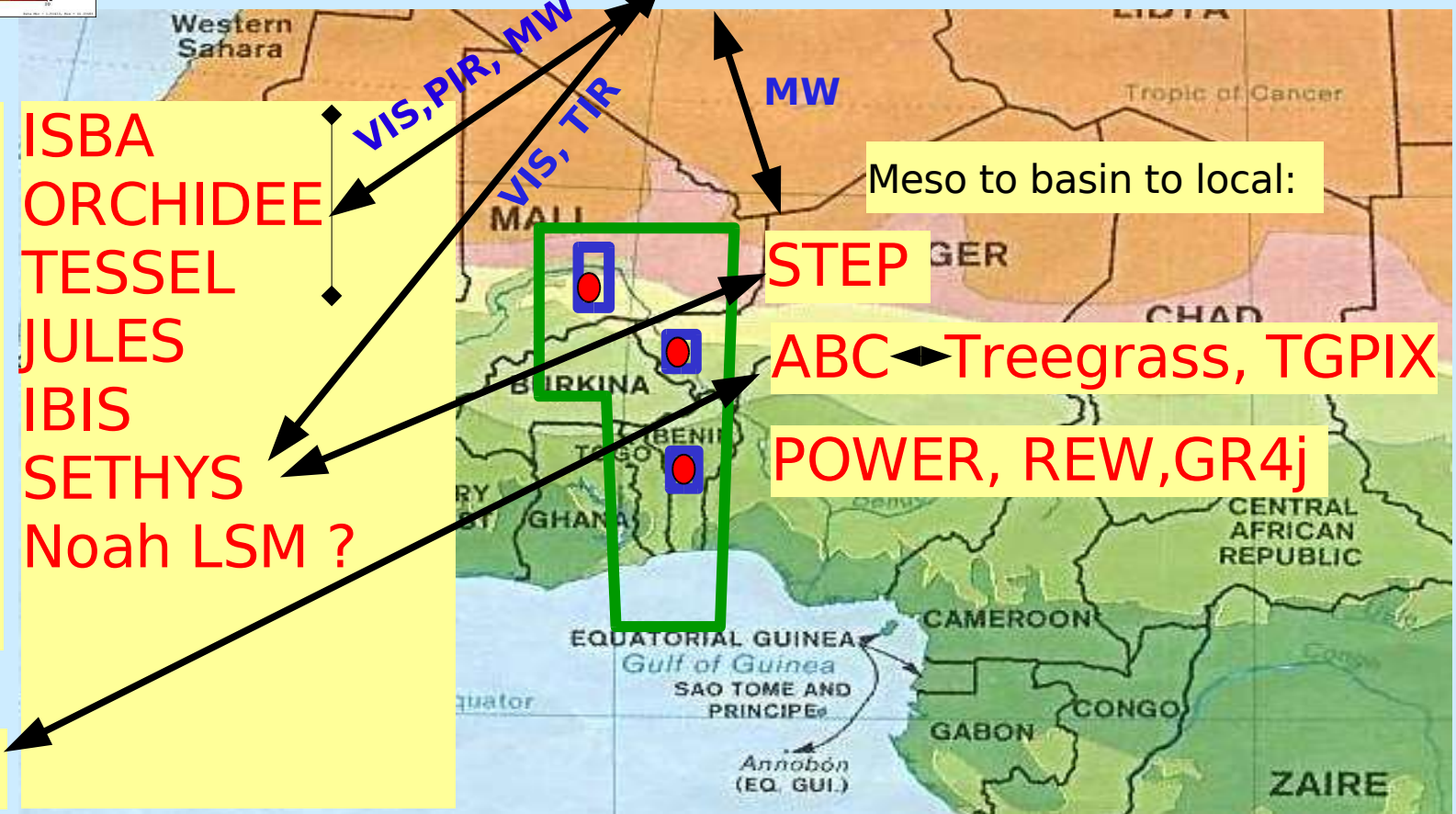
MW

Meso to basin to local:

STEP

ABC Treegrass, TGPIX

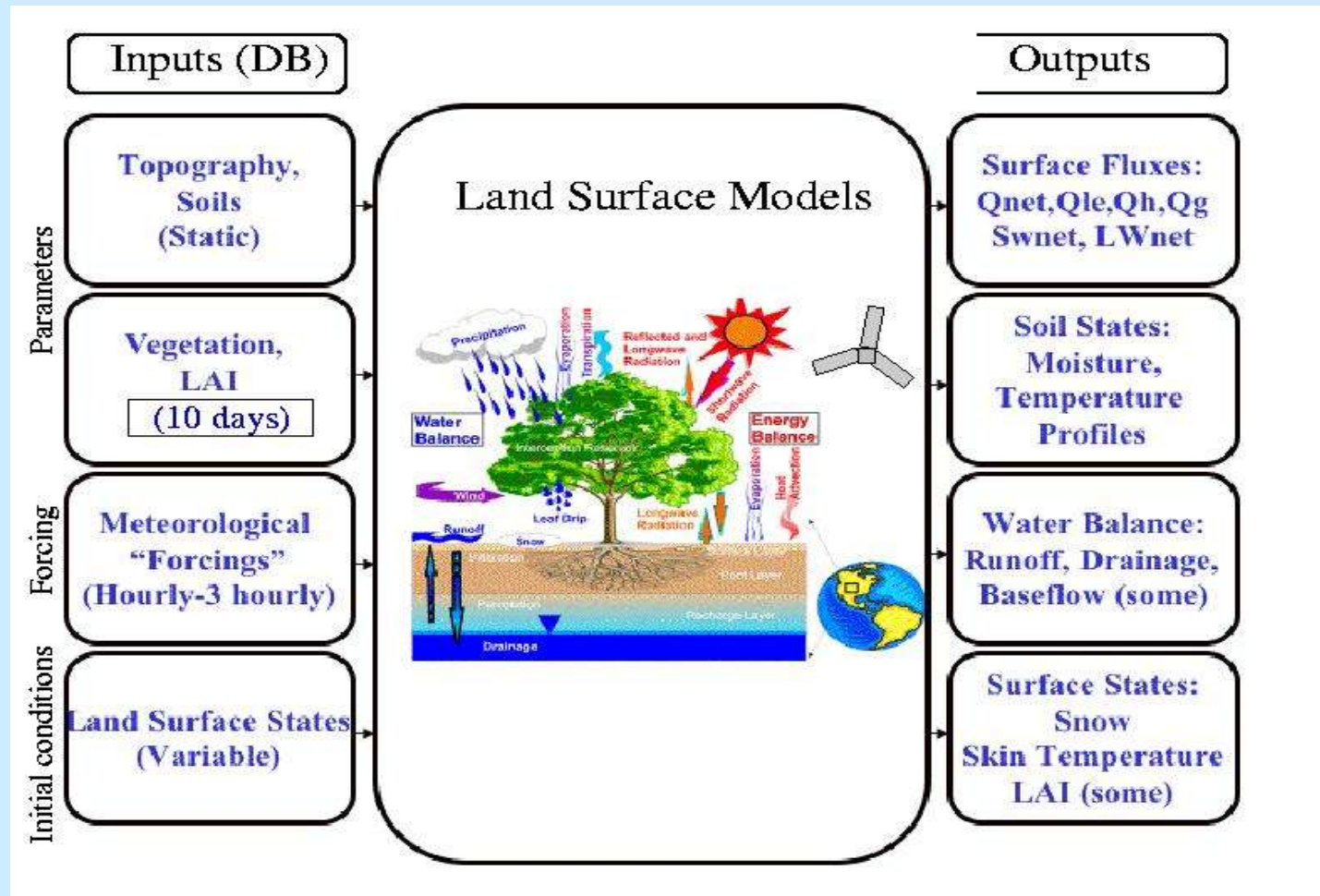
POWER, REW, GR4j



Global, Regional to meso and local



# Forcing Data base for Modelling activities



Analysis of the output: surface fluxes, soil states, water balance, surface state on the studied domain (temporal and spatial).



# Modeling Strategy

- Difficulty: extreme diversity of spatial scales involved in land surface processes.
- Interaction between processes at different scales critical to modeling activities

Strategy is to use the diversity of models to coordinate efforts through:

- Multiscale forcing data base (A. Boone, CNRM)  
link with wps 4.3, 4.4
- ALMIP: AMMA LSM Intercomparison Project (CNRM),  
link with GSFC's LIS (land Information System)  
and GLDAS
- ALDAS system (ECMWF)



# Proposed agenda

**14:00-14:10 Introduction to LSM activities in AMMA (P. de Rosnay)**

**14:10-16:00 Land surface modelling activities**

- STEP: Sahelian vegetation modeling and assimilation (F. Baup)
- Models for land processes in the Niger meso site (B. Cappelaere)
- GR4j (S. Galle)
- SETHYS model and calibration methodology using TIR data (C. Otlé)
- Jules model (C. Taylor)
- ISBA (A. Boone)
- ORCHIDEE: parameterization and sensitivity to forcing data base (J. Polcher)

**16:20-17:45 Merging efforts to build a multiscale land surface forcing DB**

- PRECIP-AMMA (F. Chopin)
- SAFLAND (R. Lacaze, J.L. Roujean)
- Multiscale forcing DB (A. Boone)
- ALDAS (P. Bechtold)
- Discussion

**17:45-18:30 ALMIP (AMMA LSM Intercomparison Project)**

- Presentation of the project (A. Boone and P. de Rosnay)
- Discussion (what model, link with upscaling issues...)



# Questions

- Link with mesoscale data base
- Specific field measurements of models parameters with a coherent inter-site approach
- Upscaling methods
- Participants to ALMIP



# Intercomparison Project

ALMIP-1:

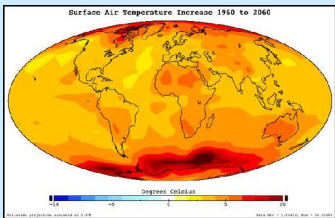
- Based on experience/knowledge acquired with previous experiments (PILPS, Rhône AGG...)
- Use of Integrated LSM and SVAT models
- Focus on ability to represent spatial/temporal vegetation phenology
- Local to meso to regional scale fluxes
- Period: 2003 (spin-up), 2004

Participants to ALMIP-1: LSM (ORCHIDEE, ISBA, TESSEL, JULES, IBIS, Noah, SETHYS)



**ALMIP** AMMA Land Surface Model  
Intercomparison Project

# Domain of applicability and coupling



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LMDZ

ECMWF

Met Off

CCM3

MM5

ISBA

ORCHIDEE

TESSEL

JULES

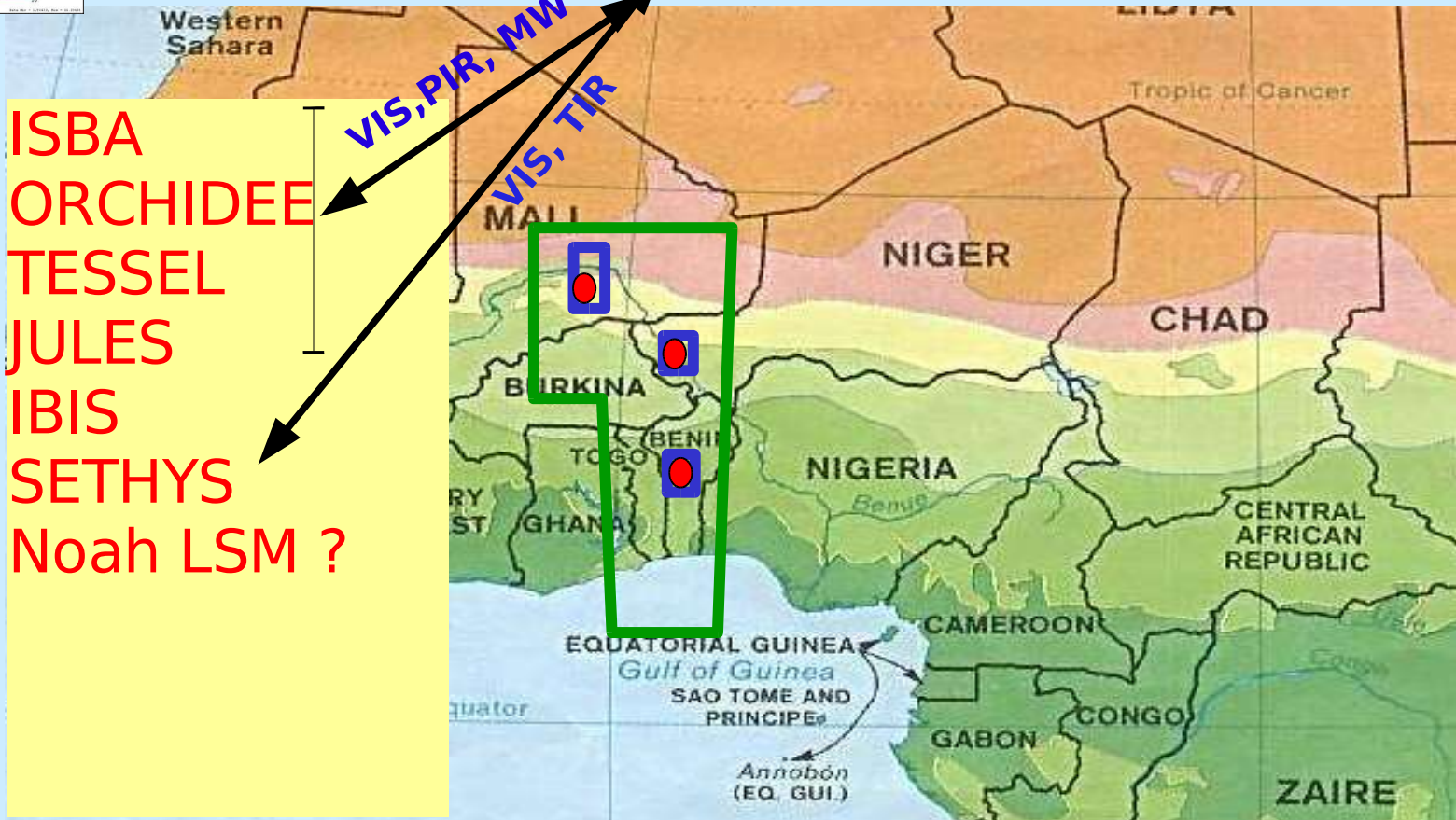
IBIS

SETHYS

Noah LSM ?

VIS, PIR, MW

VIS, TIR

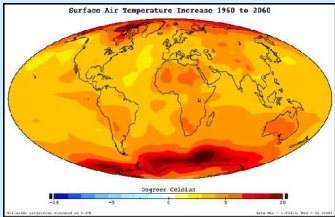


Global, Regional to meso and local



**ALMIP** AMMA Land Surface Model Intercomparison Project

# Domain of applicability and coupling



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VIS, PIR, MW  
 VIS, TIR

MW

Meso to basin to local:

STEP

ABC Treegrass, TGPIX

POWER, REW, GR4j



Global, Regional to meso and local



**ALMIP** AMMA Land Surface Model Intercomparison Project



# ALMIP 2006-2007

## Outcomes of wp2.3 (land processes):

How take advantage of the large range of models involved in processes studies to address scientific objectives of wp 1.2, 1.3, 2.3 ?

How to organize an inter-comparison project with such a large range of processes represented by different models types, at various scales (temporal, spatial) ?

Requirement in coherent specific parameters measurements on the different sites to allow models comparison (link wp4.2.3).

Reflexion concerning an innovative inter-comparison approach: an ALMIP-2 experiment (2007?) in which different approaches of surface modelling are involved (hydrological, vegetation, LSM, svat...).



# ALMIP-2

**Proposition of crossed comparison of models/sites from local to meso scale, focusing on different processes:**

Mali : **STEP**, **ABC**, **Mike She**, **TREEGRASS**, **TGPIX**,  
ISBA, ORCHIDEE, TESSEL, JULES, IBIS, SETHYS, Noah

Niger: **ABC**, **Mike She**, **TREEGRASS**, **TGPIX**,  
ISBA, ORCHIDEE, TESSEL, JULES, IBIS, SETHYS, Noah

Benin: **Power**, **GR4j**, **Rew**, ISBA, ORCHIDEE,  
TESSEL, JULES, IBIS, SETHYS, Noah

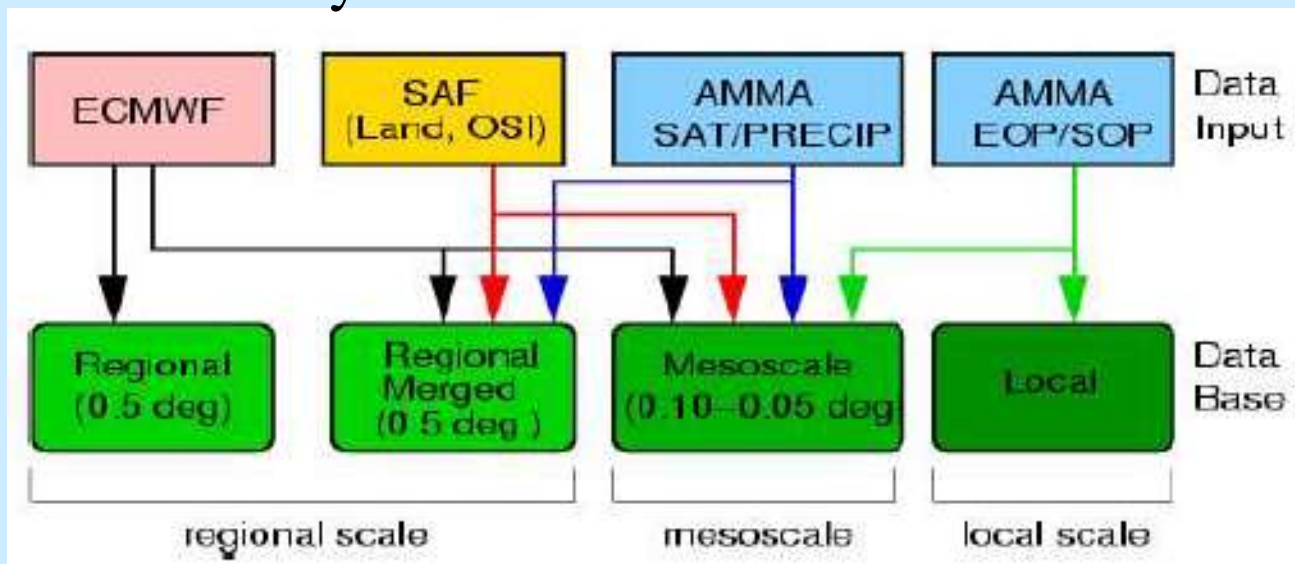
Senegal site ? **ABC**, **Mike She**, **STEP**, **TREEGRASS**, **TGPIX**,  
ISBA, ORCHIDEE, TESSEL, JULES, IBIS, SETHYS, Noah



# Multiscales Land Surface Forcing Data base (A. Boone)

Appropriate input data to run LSM. Two types of input:

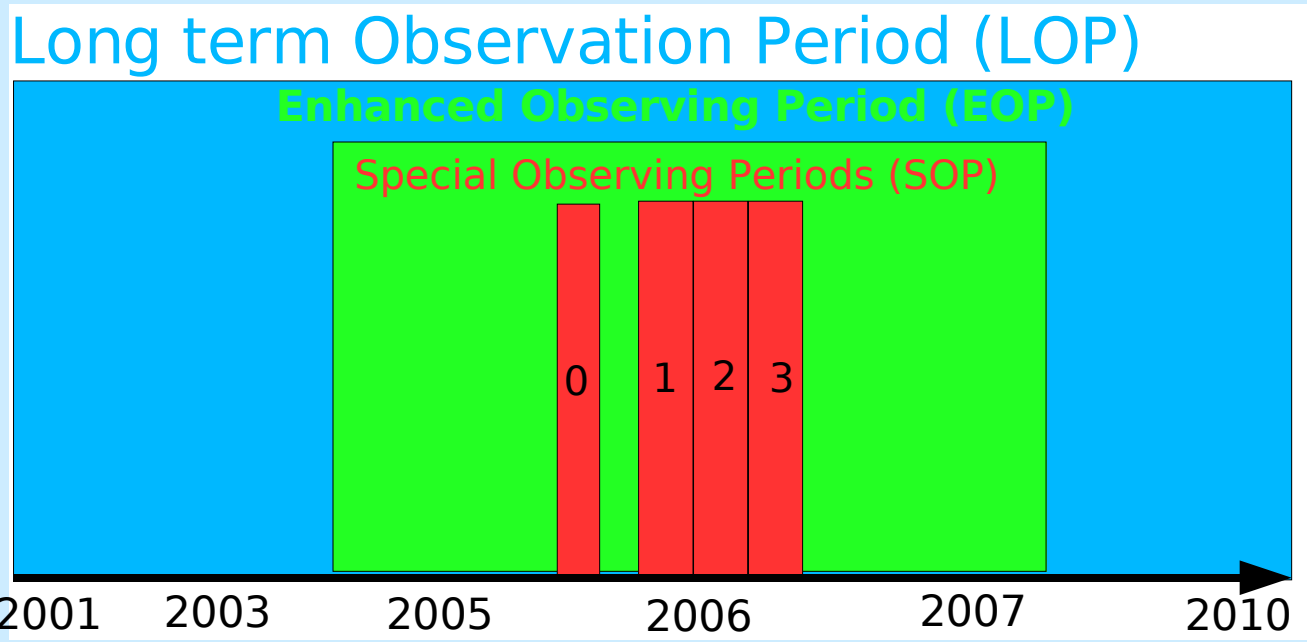
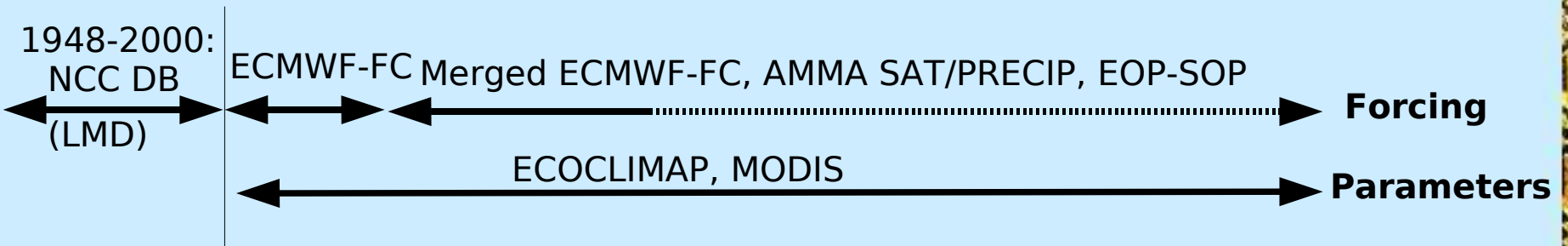
- **Parameter data:** Properties of the land surface that change on timesteps of a day or longer, e.g., soil, land cover, topography
- **Forcing data:** Atmospheric inputs to the land surface models, including precipitation, radiation, and surface winds, temperature, pressure and humidity.



Various sources for each of the spatial scale of the database



# Multiscales Land Surface Forcing Data base (A. Boone)

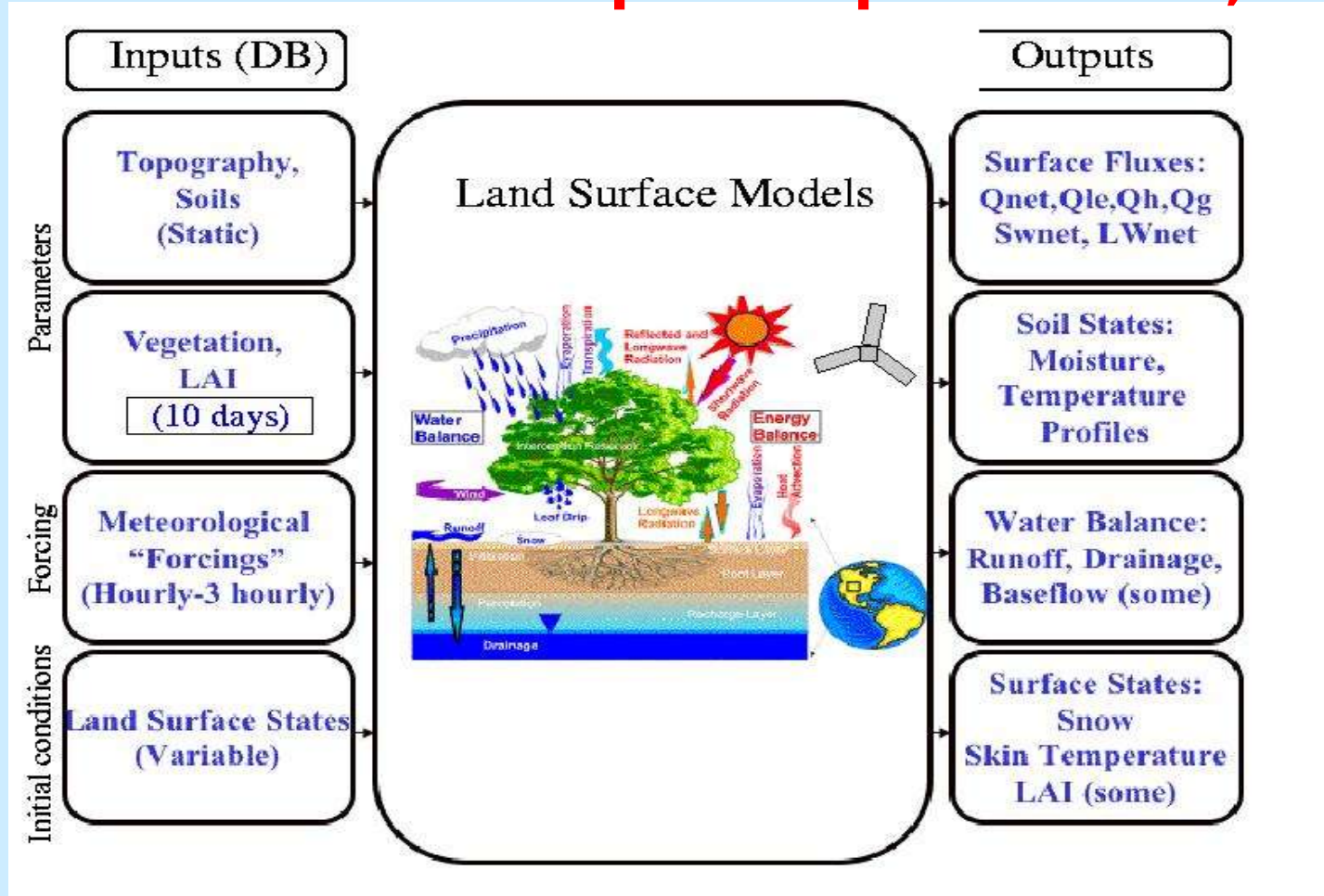


- On going:**
- AMMA LSM DB for 2001-2004--- (CNRM)
  - Analysis of the models sensitivity to the forcing DB (LMD)



# ALMIP

## Link between models input-outputs-scales, domain



Analysis of the output: surface fluxes, soil states, water balance, surface state on the studied domain (temporal and spatial).

