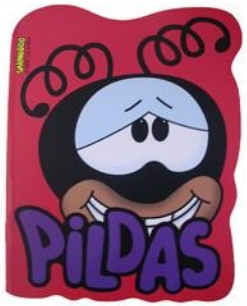
GEWEX/GLASS Panel Meeting, Seattle, 24 August 2010

Project for the Intercomparison of Land Data Assimilation Systems (PILDAS)



PILDAS-1 Experiment Plan

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PILDAS objectives

- Enable better **communication** among developers of land data assimilation systems (LDAS).
- Develop and test a **framework for LDAS comparison** and evaluation.
- Compare land assimilation **methods**.
- Conduct sensitivity studies of **assimilation input parameters** (such as model and observation errors).
- Provide **guidance and priorities for future** land assimilation research and applications.
- Ultimately, produce **enhanced global data sets** of land surface fields.

PILDAS-1 overview

The **first experiment (PILDAS-1)** will focus on
- systems targeted for weather and seasonal forecasting at operational centers and research institutions,
- soil moisture assimilation, and
- development of a framework for LDAS comparison.

PILDAS-1 will use
- various assimilation approaches (EnKF, EKF, …),
- “off-line” land model (not coupled to atmosphere), and
- synthetic observations.

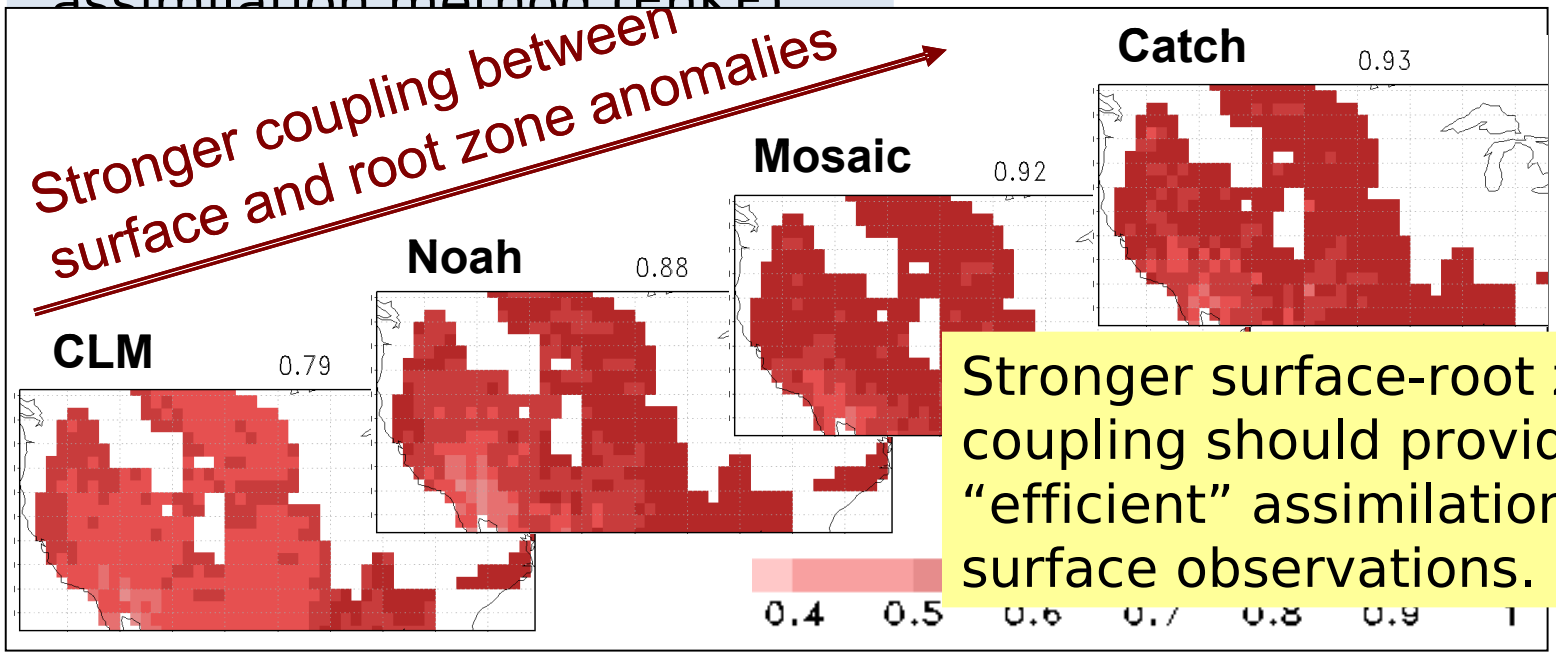
PILDAS-1 provides a first assessment of the capability of different assimilation systems to

Heritage pilot study (Kumar et al. 2009)

- How does land model formulation impact assimilation estimates of root zone soil moisture?
- Synthetic soil moisture assimlation with multiple land models but only one assimilation method (EnKF)

		Synthetic observations from			
		Catch	Mos	Noa	CLM
Model	Catch	0.71	0.54	0.36	0.38
	Mos	0.55	0.69	0.31	0.33
	Noa	0.43	0.43	0.36	0.26
	CLM	0.11	0.21	0.10	0.45

Avg

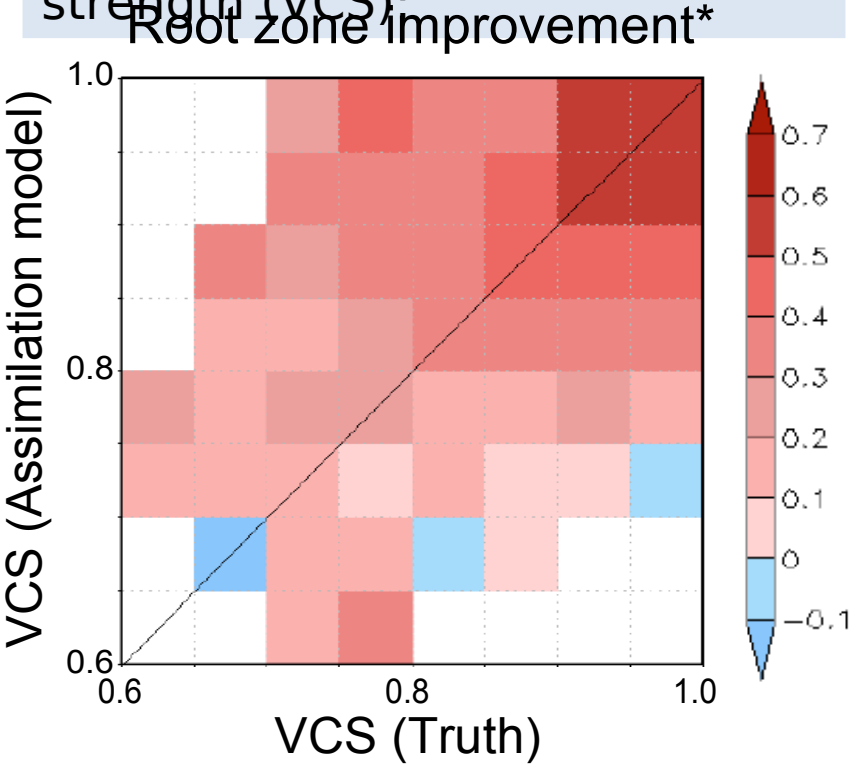


Stronger surface-root zone coupling should provide more "efficient" assimilation of surface observations.

Kumar et al. (2009) Water Resour. Res.,

Heritage pilot study (Kumar et al. 2009)

Bin spatially distributed results of all fraternal twin experiments according to vertical coupling strength (VCS):

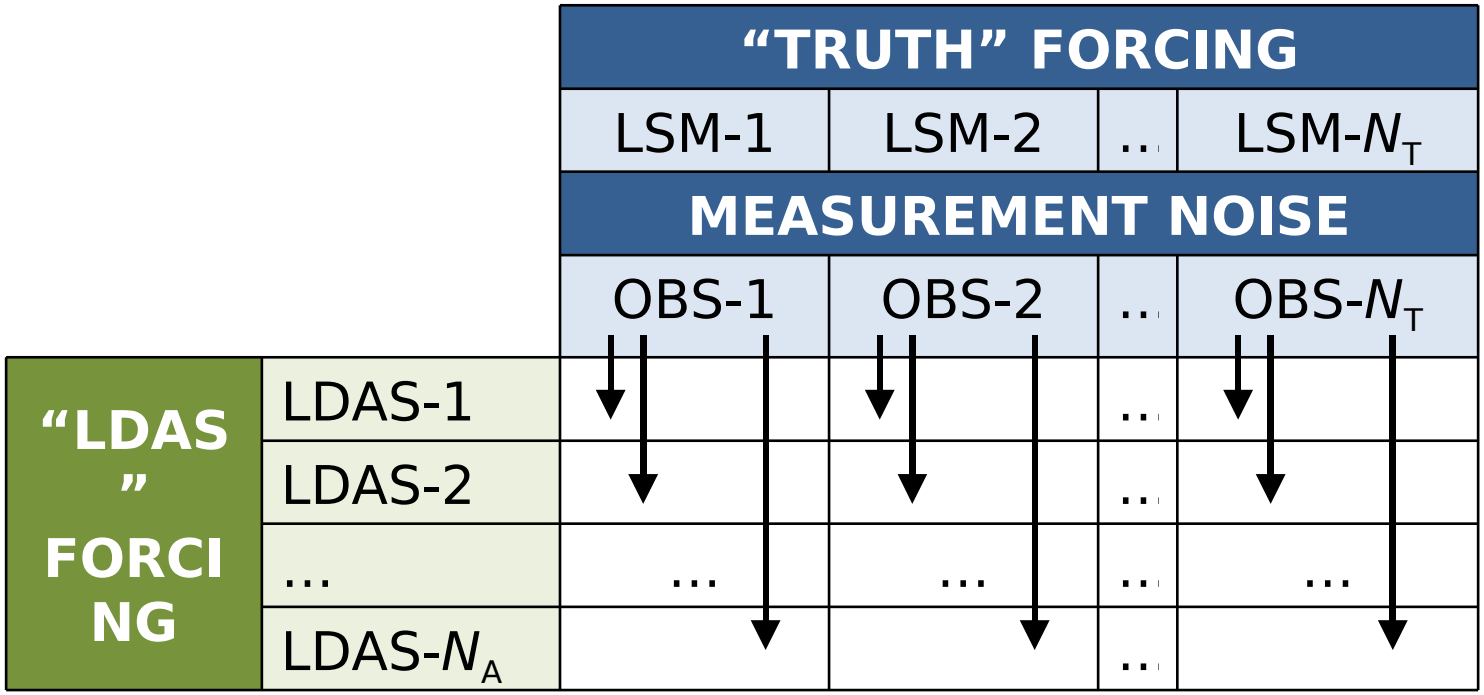


*Normalized ROOT ZONE soil moisture improvement from assim. of SURFACE soil moisture

Key findings:

- Identical twin experiments overestimate the skill contributed by the assimilation.
- Stronger coupling between surface and root zone (VCS) leads to more efficient assimilation.
- If assimilation system is properly set up, the skill improvement depends only weakly on the land model.

PILDAS-1 experiment design



Assimilate N_T sets of synthetic obs. into N_A assimilation systems.

N_T = # truth integrations (no more than # participant groups)

N_A = # LDAS integrations (possibly $N_A >> N_T$)

➔ $N_T \cdot N_A$ assimilation integrations

PILDAS-1 logistics

“Core group”:

- Disseminates LDAS input data (forcing, synthetic obs).
- Collects and post-processes LDAS output.
- Coordinates analysis of results and publications.

“Participants”:

- Generate synthetic truth data and LDAS output.
- Contribute to analysis of results.

PILDAS-1 experiment setup

Tentative experiment setup (**details TBD!**):

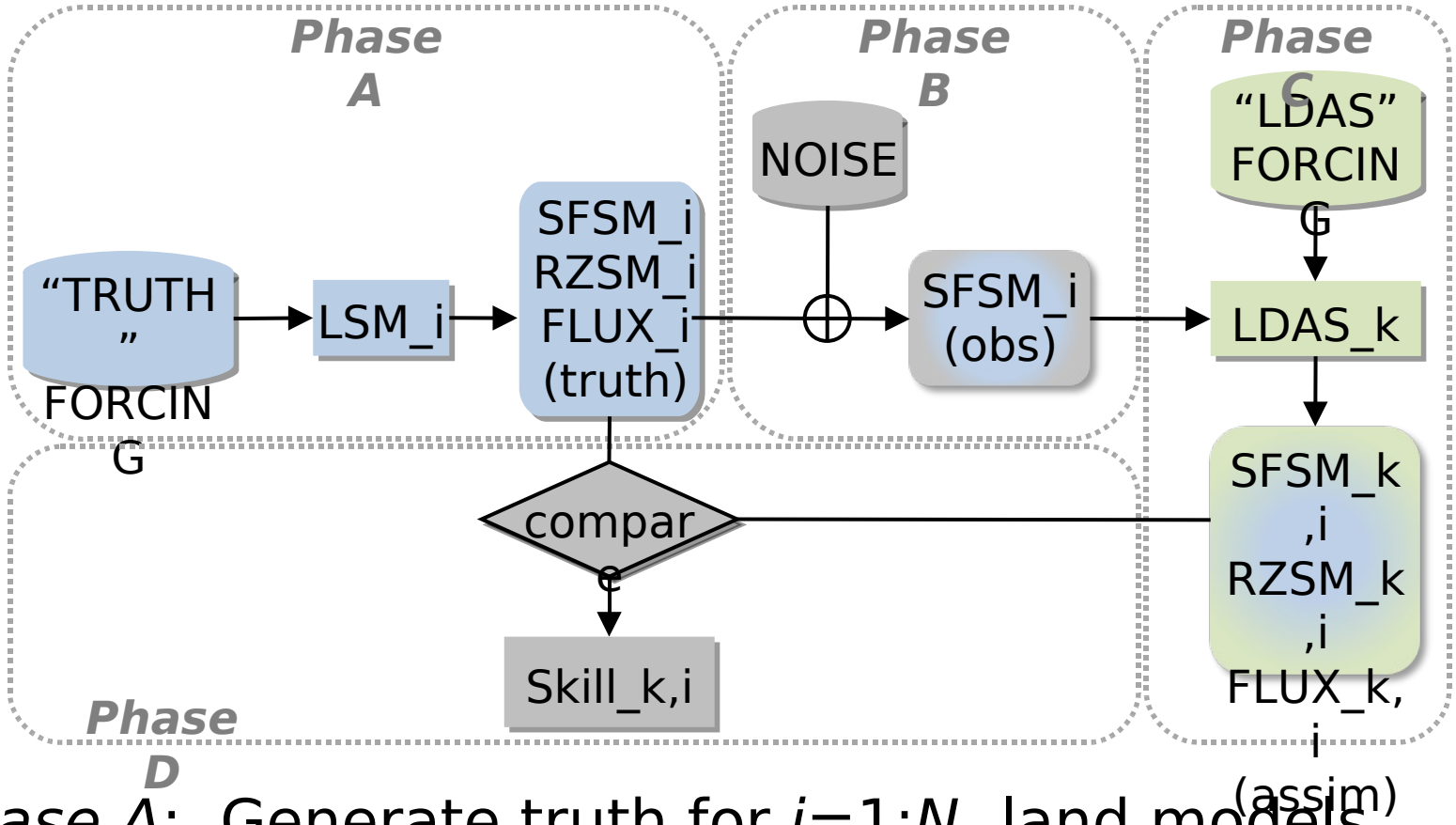
- Domain: Red-Arkansas river basin
- Exchange grid: 0.25 deg lat/lon
- Duration: 2002-2008

Forcing data will be provided and LDAS output is expected on the **exchange grid**.

Participating systems may run on their **native grids**.

Participating systems use **native model parameters** (land cover, soil texture, …).

PILDAS-1 flowchart



Phase A: Generate truth for i=1:N_T land models (participants).

Phase B: Generate i=1:N_T sets of synthetic observations (core).

Phase C: Generate N_A open loop and $N_A \cdot N_T$ assim. runs

PILDAS-1 Phase C

Phase C:

- Participants **must** assimilate all N_T sets of synthetic observations at least once into their default LDAS.
- Participants **may** additionally use LDAS variants (different model, different assimilation method, different assimilation parameters,…).
- Participants choose assimilation algorithm and assimilation parameters.
- LDAS output must include assimilation diagnostics (O-F, increments, error parameters, …).

PILDAS-1 Phase D

Phase D:

- Core group computes skill metrics, including
  - “Normalized Information Contribution” (Kumar et al. 2009)
  - “Vertical Coupling Strength” (Kumar et al. 2009)
  - Assimilation diagnostics (O-F mean, O-F variance etc.)

PILDAS-1 concerns and open issues

- Assimilate **surface soil moisture** or brightness temperature?
- **Make truth data available** to all participant groups prior to their delivery of assimilation output?
- **Limit N_T** (# truth data sets, ie. # required assim. integrations)?
- Require assimilation diagnostics (O-F) on exchange grid or native grid?
- **Infrastructure** (web server, postdoc) and **funding**?
- **Dry-run** with just two institutions.
- Are systems **ready** and are resources (staff, computing) **available** for participation (ECMWF, CMC, …)?
- Development of error checking and post-processing

PILDAS-1 timeline

Jun 2010: Disseminate experiment plan to select participants.

Aug 2010: Refine experiment plan.

Sep 2010: Disseminate experiment plan to potential participants.

Dec 2010: Finalize domain and exchange grid. Prepare forcing data.

Feb 2011: Conduct dry-run of entire experiment with 2 institutions.

Mar 2011: Phase A – Truth integrations.

Jun 2011: Phase B – Generation of synthetic observations.

Aug 2011: Phase C – Data assimilation experiments.

Oct 2011: Phase D – Analysis of experiments.

PILDAS-1 potential participants

Institution	POC
NASA/GMAO	**R. Reichle**
Meteo-France	**J.-F. Mahfouf**
ECMWF	**P. de Rosnay, G. Balsa**
Environment Canada	**S. Belair**
UK Met Office	***M. Best, S. Pullen***
KNMI	B. van den Hurk
University of Colorado	A. Slater
Princeton University	***E. Wood***
Observatoire de Paris	C. Jimenez
University of Tokyo	***T. Koike***
University of Melbourne	J. Walker
NASA/HSB	**S. Kumar, C. Peters-L**
J. Santanello	
Argentina	H. Lozza
MIT	D. Entekhabi, D. McLaughlin
UCLA	S. Margulis
NCEP	M. Ek
NESDIS	X. Zhan
Colorado State University	A. Jones
USDA	***W. Crow***
CESBIO/SMOS	Y. Kerr
US Air Force Weather Agency	J. Eylander
University of Tokyo	T. Oki
???	**???**

Which of these groups have an assimilation system ready?

Are we missing anyone?

Thank you for your attention!

Any questions?