Land Surface Initialization
Impact on Forecasts and Current Methods

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Predictability Contained in Components

Adapted from Dirmeyer
Predictability Contained in Components

Predictability

~10 days

~2 months

Decadal

Atmosphere

Adapted from Dirmeyer
Predictability Contained in Components

\[ \text{Atmosphere} \]

\[ \text{Ocean} \]

\[ \approx 10 \text{ days} \]

\[ \approx 2 \text{ months} \]

Adapted from Dirmeyer
Predictability Contained in Components

- Atmosphere
- Land
- Ocean

~10 days
~2 months
Decadal

Adapted from Dirmeyer
Predictability Contained in Components

Atmosphere

Land

Ocean

Adapted from Dirmeyer
Land Surface effects on Forecasts

24-h forecast valid 0000 UTC May 25 2002

(Holt et al 2006, MWR)
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Predictability Contained in Components

Atmosphere

Land

Ocean

Predictability

~10 days

~2 months

Decadal

Adapted from Dirmeyer
Land Surface Effects on Seasonal: GLACE-2

Maximum Harvestable Predictability in Models (Ensemble)

16-30 days

46-60 days

Predictability ($r^2_{ideal}$ with land ICs minus $r^2_{ideal}$ w/o land ICs)

(Koster et al 2011, JHM)
Land Surface Effects on Seasonal: GLACE-2

Maximum Harvestable Predictability in Models (Ensemble)

16-30 days

46-60 days

Predictability ($r_{\text{ideal}}^2$ with land ICs minus $r_{\text{ideal}}^2$ w/o land ICs)

(Koster et al 2011, JHM)
Land Surface Effects on Seasonal: GLACE-2

Maximum Harvestable Predictability in Models (Ensemble)

16-30 days
- Precip.
- Air Temp.

46-60 days
- Precip.
- Air Temp.

Predictability ($r_{\text{ideal}}^2$ with land ICs minus $r_{\text{ideal}}^2$ w/o land ICs)

(Koster et al 2011, JHM)
Describe CLM spin-up
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Start “Cold”
Constant Moisture and Temperature

Land Surface Model
Describe CLM spin-up

Start “Cold”
Constant Moisture and Temperature

Spin-up
Loop over until state variables equilibrate

Land Surface Model
Describe CLM spin-up

**Spin-up**

*Loop over until state variables equilibrate*

**Observed Atmosphere**

- Temp
- Humidity
- Pressure
- Precip
- Radiation

**Land Surface Model**

Start “Cold”

Constant Moisture and Temperature

Describe CLM spin-up

Spin-up
Loop over until state variables equilibrate

Observed Atmosphere
Temp  Humidity  Pressure  Precip  Radiation

Land Surface Model

Discrepancy in Soil Moisture [%]

Soil Moisture
Spin up Cycle

Describe CLM spin-up

Spin-up

Loop over until state variables equilibrate

Observed Atmosphere

Temperature  Humidity  Pressure  Precipitation  Radiation

Now run coupled to the Atmosphere

Atmospheric Model

Land Surface Model

Describe CLM spin-up

**Spin-up**

Loop over until state variables equilibrate

**Observed Atmosphere**

- Temp
- Humidity
- Pressure
- Precip
- Radiation

Now run coupled to the Atmosphere

**Atmospheric Model**

**Land Surface Model**

***NOTE: This procedure is similar when doing short-term forecasting***
Available Operational Products

Global Land Data Assimilation System (GLDAS)

GLDAS_NOAH10_M.2.0 Soil moisture content (40 - 100 cm)
Available Soil Moisture Products for assimilation?
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In-situ observations of soil moisture

North American SM Database (Quiring et al. 2017, BAMS)
Available Soil Moisture Products for assimilation?

In-situ observations of soil moisture

Remotely Sensed: SMOS, SMAP, etc...

North American SM Database (Quiring et al. 2017, BAMS)

SMAP global soil moisture
Available Phenological Products for assimilation?

Variables such as: NDVI, LAI, greeness, etc...

Can we assimilate this type of information without breaking the model?

Notaro et al. 2017 used daily observed LAI in CLM