



The importance of Land Surface Forcing in climate modeling:

Incorporation of the land surface database Ecoclimap in the Rossby Centre regional Atmospheric model

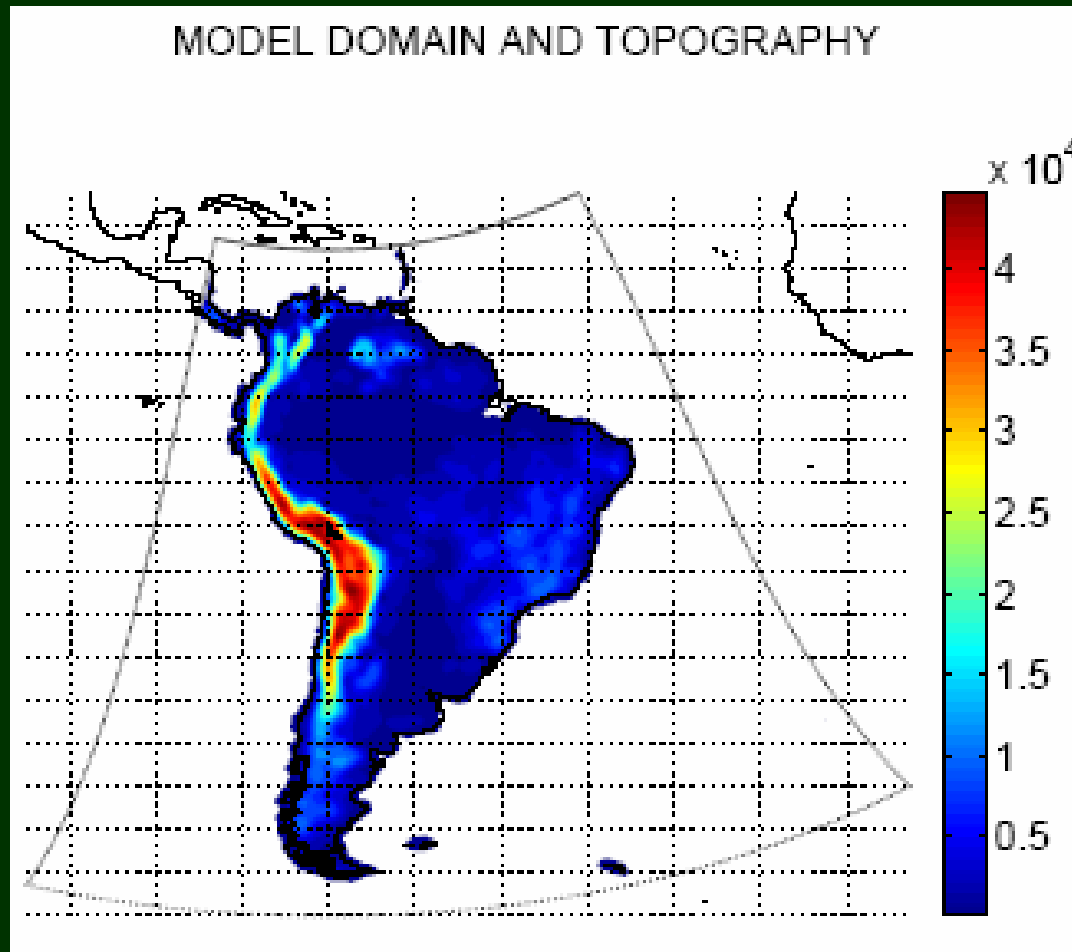
Anna Sörensson, Patrick Samuelsson



Outline

- + RCA and its land surface scheme
- + Results from the first test simulations with the original model version
- + Ecoclimap
- + How Ecoclimap is used in RCA
- + Comparison of results using the original RCA version and the version that includes Ecoclimap.

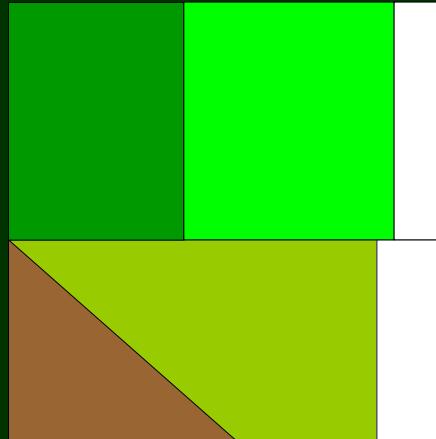
The model RCA



The model RCA - Land Surface Scheme

4 / 6 tiles with separate surface fluxes, averaged at the lowest atmospheric level:

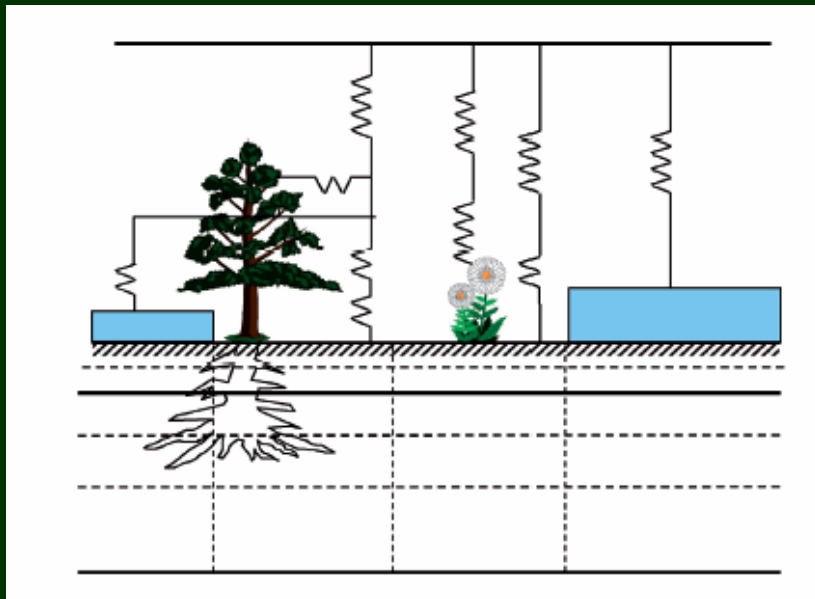
Deciduous and coniferous forest



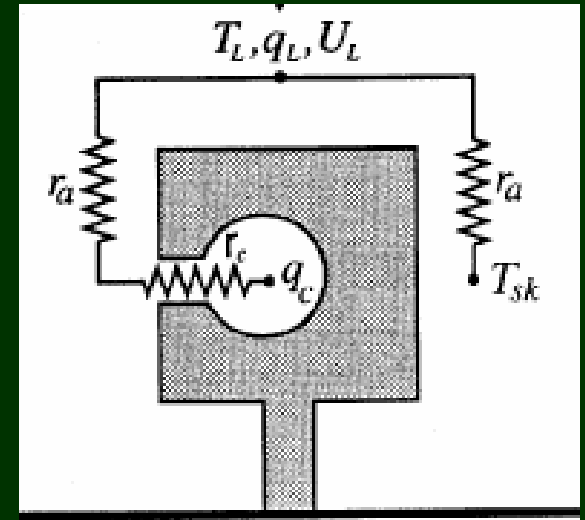
Snow at forest floor

Open land - with vegetation or bare land

Snow over open land



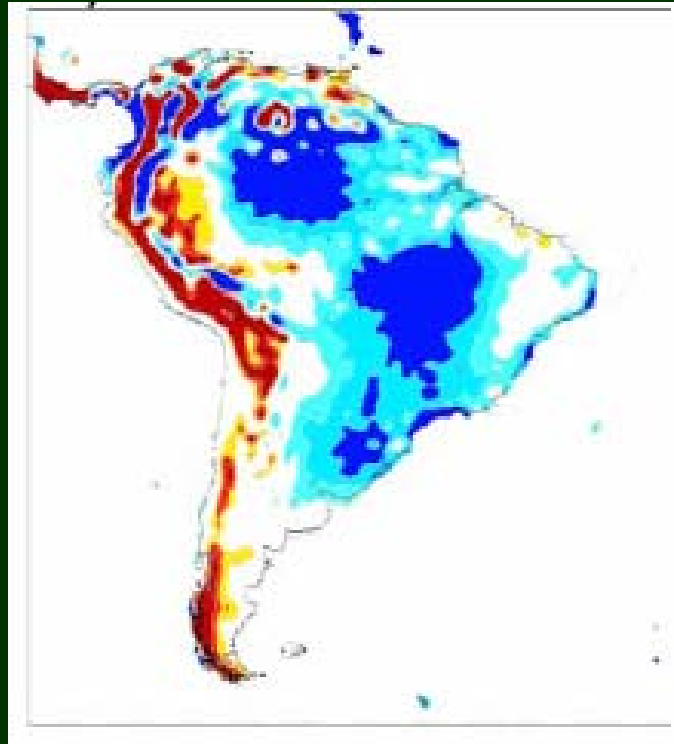
Samuelsson et al., 2006



Henderson-Sellers and McGuffie, 1987

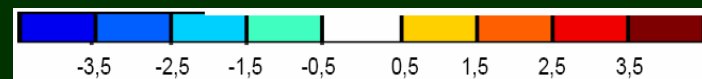
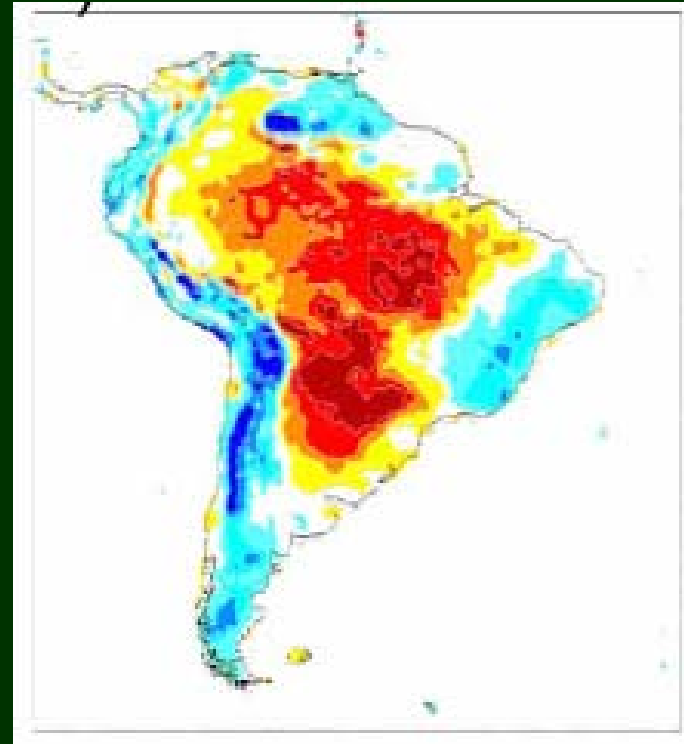
Annual biases of the original RCA version (RCA - CRU data)

Precipitation



mm/month

T2m



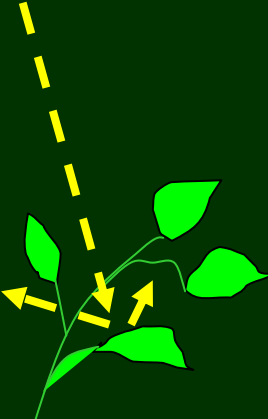
°C

Model Development (Ecoclimap)

- + RCA was developed for Europe, and in particular for high latitudes.
- + To transfer the model to South America it was necessary to incorporate processes that had not been considered.

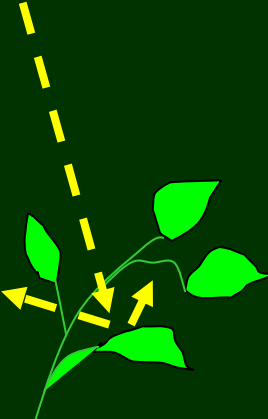
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 - + For each tile, the albedo is constant.
 - + The leaf area index is a function of lat/lon

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New land surface database - Ecoclimap

Ecoclimap - Masson et al. (2003)

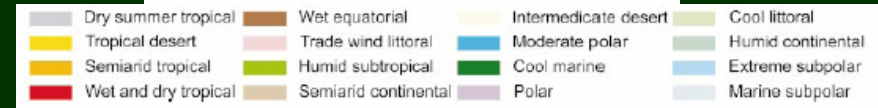
- + Land cover map and water mask at a 1-km resolution, University of Maryland (UMD; Hansen et al. 2000).
- + Climate map Koeppe and De Long (1958) over the globe.
- + Normalized difference vegetation index (NDVI) inferred from 1-km observations, (NOAA) satellites.
- + Soil texture from The Food and Agriculture Organization (FAO, 1988) database at 10-km resolution.

Ecoclimap - Masson et al. (2003)

15 land surface types



16 climates

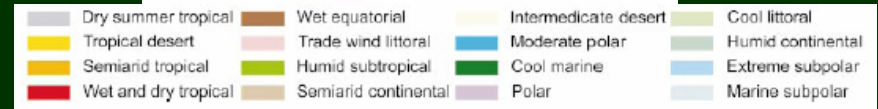


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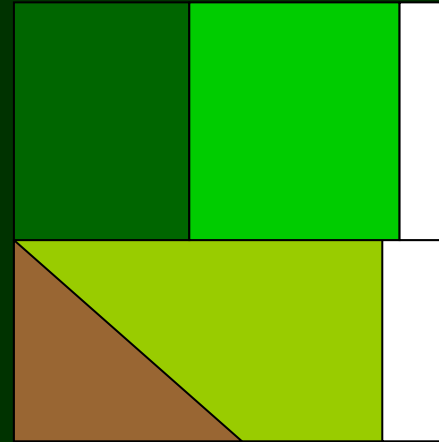
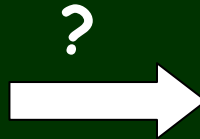


215 ecosystems over the globe

Resolution: 1 km, monthly values of vegetation parameters.

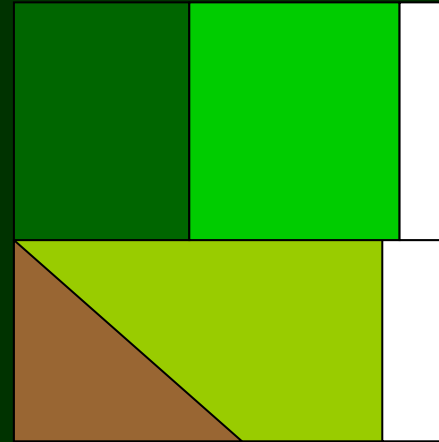
Ecoclimap - its incorporation in RCA

215 ecosystems



Ecoclimap - its incorporation in RCA

215 ecosystems



+ Soil / Rooting depth: The 215 ecosystems were grouped into the four RCA tiles.

The rooting depth for the two forest types are weighted (for each grid square) into a common rooting depth.

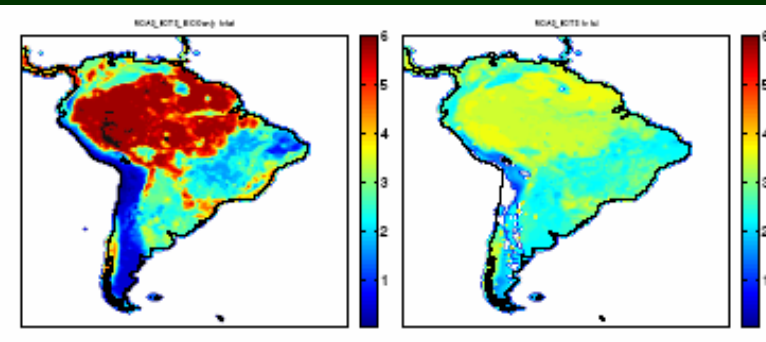
+ The Ecoclimap values of vegetation parameters such as e.g. LAI, albedo, roughness, minimal stomata resistance and emissivity are used.

Important differences between the original RCA and RCA with Ecoclimap

Leaf Area Index

RCA with Ecoclimap

RCA



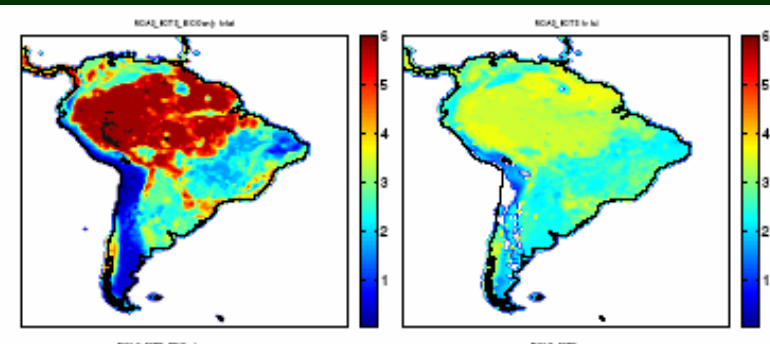
summer

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Leaf Area Index

RCA with Ecoclimap

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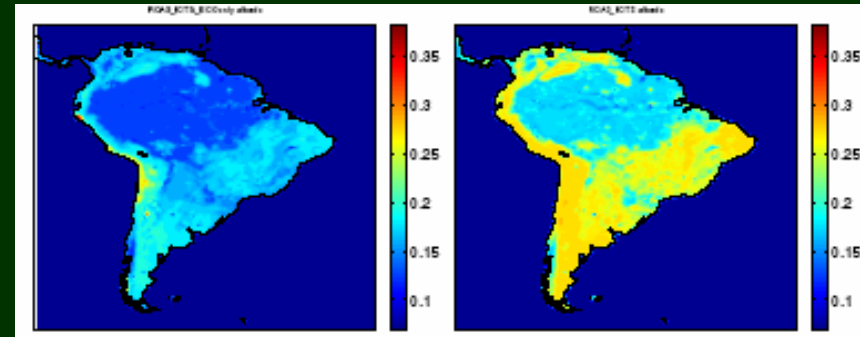


summer

Albedo

RCA with Ecoclimap

RCA

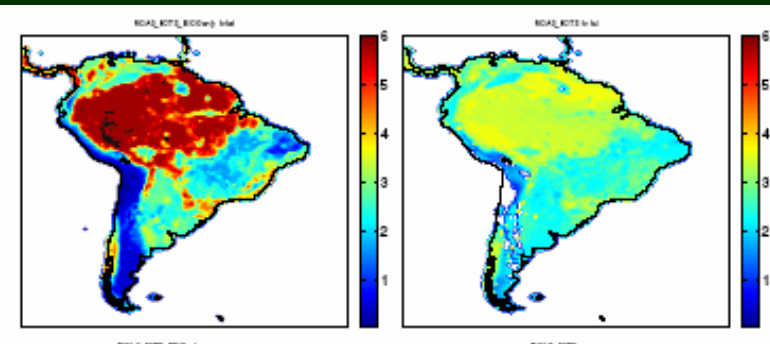


Important differences between the original RCA and RCA with Ecoclimap

Leaf Area Index

RCA with Ecoclimap

RCA

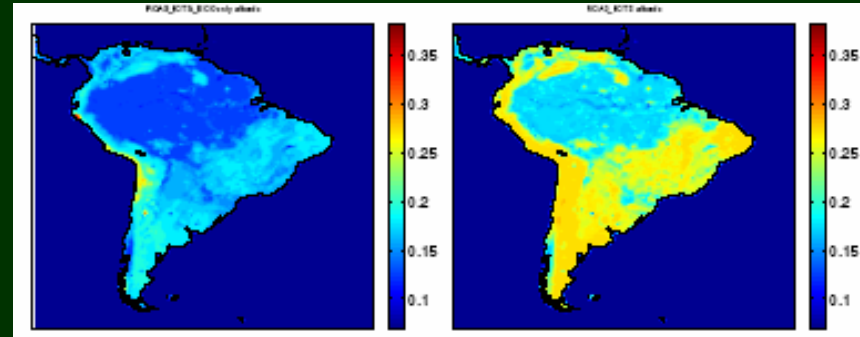


summer

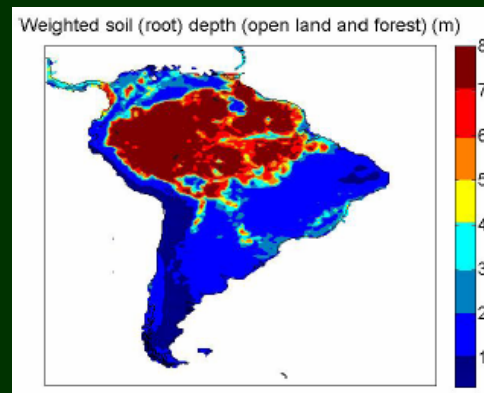
Albedo

RCA with Ecoclimap

RCA



Soil/rooting depth

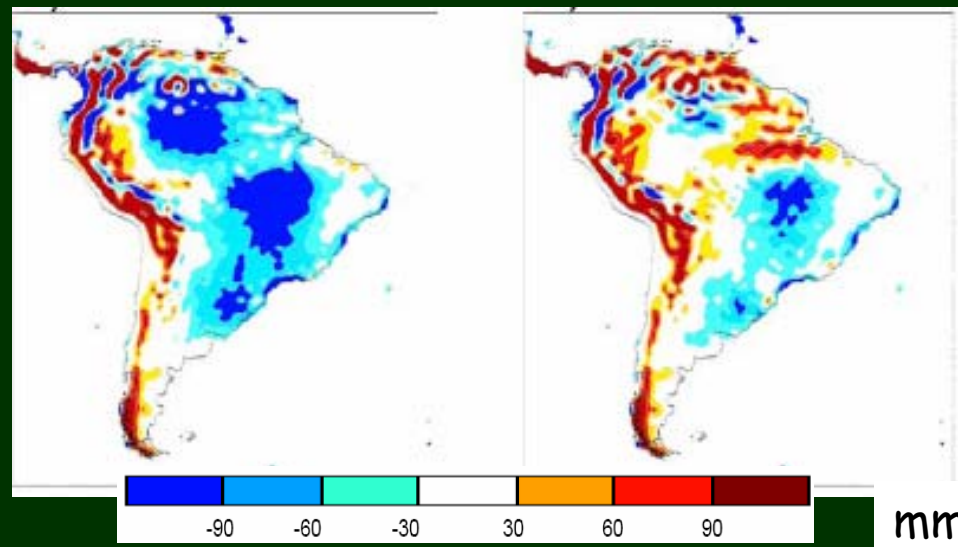


Annual biases of the original RCA version and RCA with Ecoclimap

Precipitation

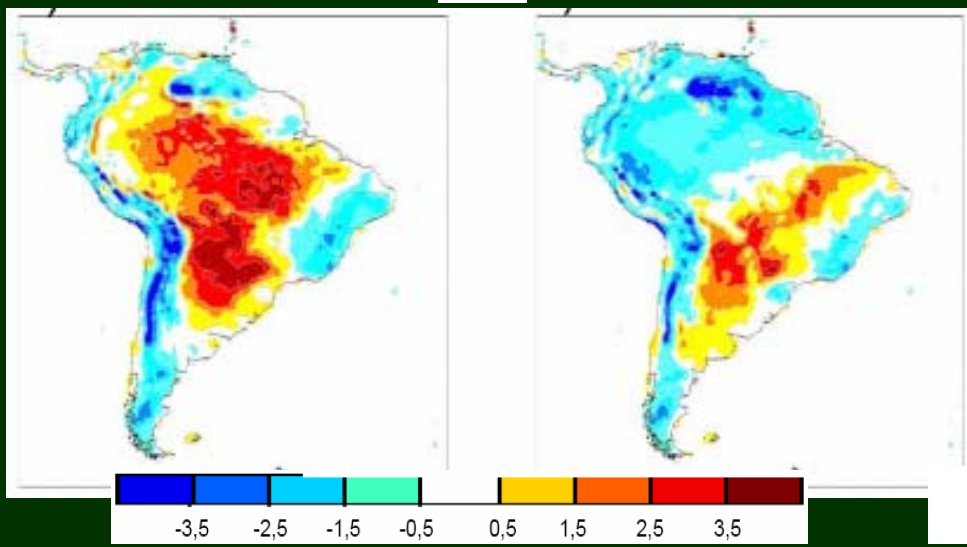
RCA

RCA_ECO



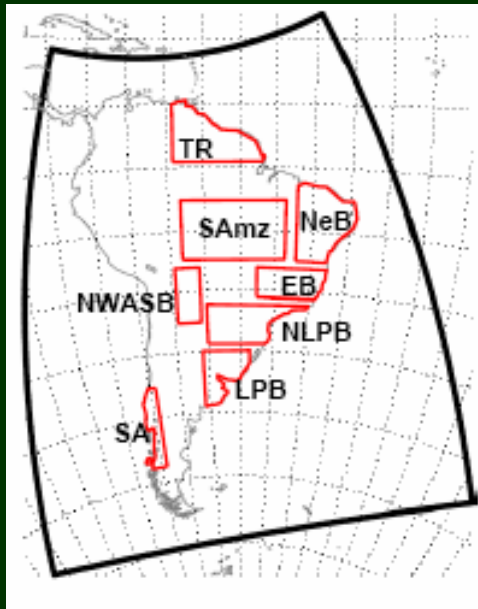
mm/month

T2m

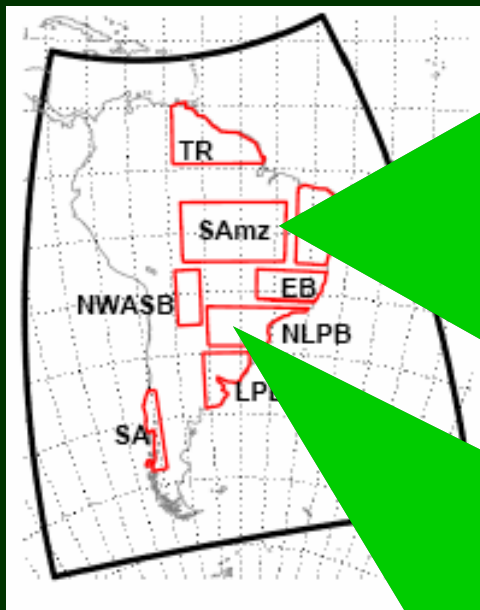


°C

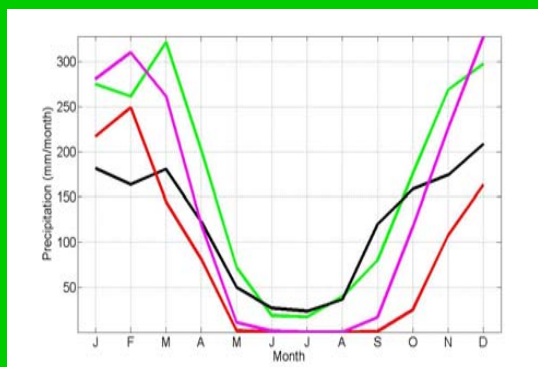
Annual cycles of the original RCA version and RCA with Ecoclimap



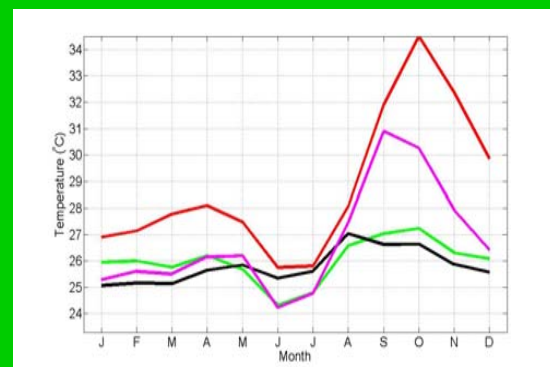
Annual cycles of the original RCA version and RCA with Ecoclimap



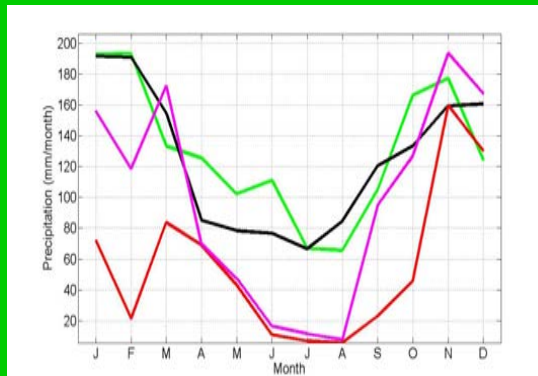
Precipitation



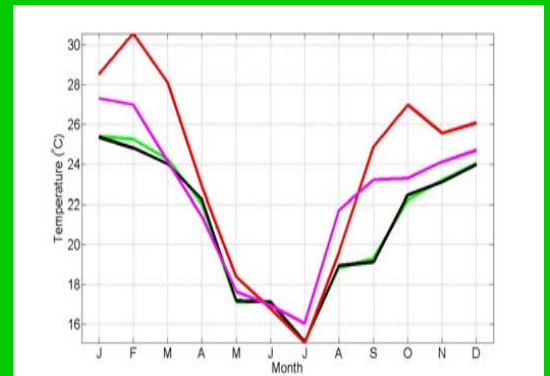
T2m



Precipitation



T2m



Green: CRU
Black: ERA40
Red: RCA3
Pink: RCA3_ECO



CONCLUSIONS





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This is just one
example





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Land surface
forcing is
important!!





CONCLUSIONS

This is just one
example

RCA - Soil / rooting
depth, LAI, and
albedo made the
greatest difference

Land surface
forcing is
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Thank you for your attention!

