Biogeophysical effects from land-cover changes in Europe

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Motivation

- The biogeophysical effect from land-cover changes is not well constrained. It might be comparable to greenhouse-gas forcing.

- Most previous studies are made with GCMs which tend to overestimate the albedo effect
Properties of different land covers

**Forest**: Low albedo, High evaporation

**Open land**: High albedo, Low evaporation

- **Deforestation**
  - Higher albedo → Lower temperature
  - Less evaporation → Higher temperature
  - Lower albedo → Higher temperature

- **Afforestation**
  - More evaporation → Lower temperature
Two models

RCA4

HCLIM

Rossby Centre regional atmospheric climate model
(Strandberg et al., 2014)

HARMONIE climate model
(Lindstedt et al., 2015)

Both models are driven by ERA-Interim with the same land cover for 1981-2010 after one year spin up
Three set ups

Control | Afforestation | Deforestation

Fraction forest

Δ Fraction forest

DEFOR-CTL Δ Fraction forest

Change in fraction forest
Results – temperature difference
Deforestation

DJF
JJA
DJF
JJA

RCA4
HCLIM
Results – temperature difference
Afforestation

DJF
JJA
DJF
JJA

RCA4
HCLIM
Results – albedo difference
Afforestation
Results – evaporation difference
Afforestation
Conclusions

- The effect of afforestation/deforestation on temperature is ±2°C
- The biogeophysical effect depends on regional characteristics
- The results are highly model dependent
- The biogeophysical forcing still needs to be better constrained
- Afforestation as a mitigation strategy is uncertain when it comes to regional climate effects
- The same goes for larger croplands for production of biofuel
The End?

You’re wrong!

No! You’re wrong!
Results – albedo difference
Deforestation

DJF                             JJA                             DJF                           JJA
RCA4                                                               HCLIM

DEFOR-CTL alblmean, DJF
alblmean, JJA
DEFOR-CTL alblmean, DJA
DEFOR-CTL alblmean, DJF
DEFOR-CTL alblmean, JJA
Results – evaporation difference
Deforestation

RCA4

HCLIM
References
