

# Radiative forcing due to land use changes derived from GlobAlbedo product

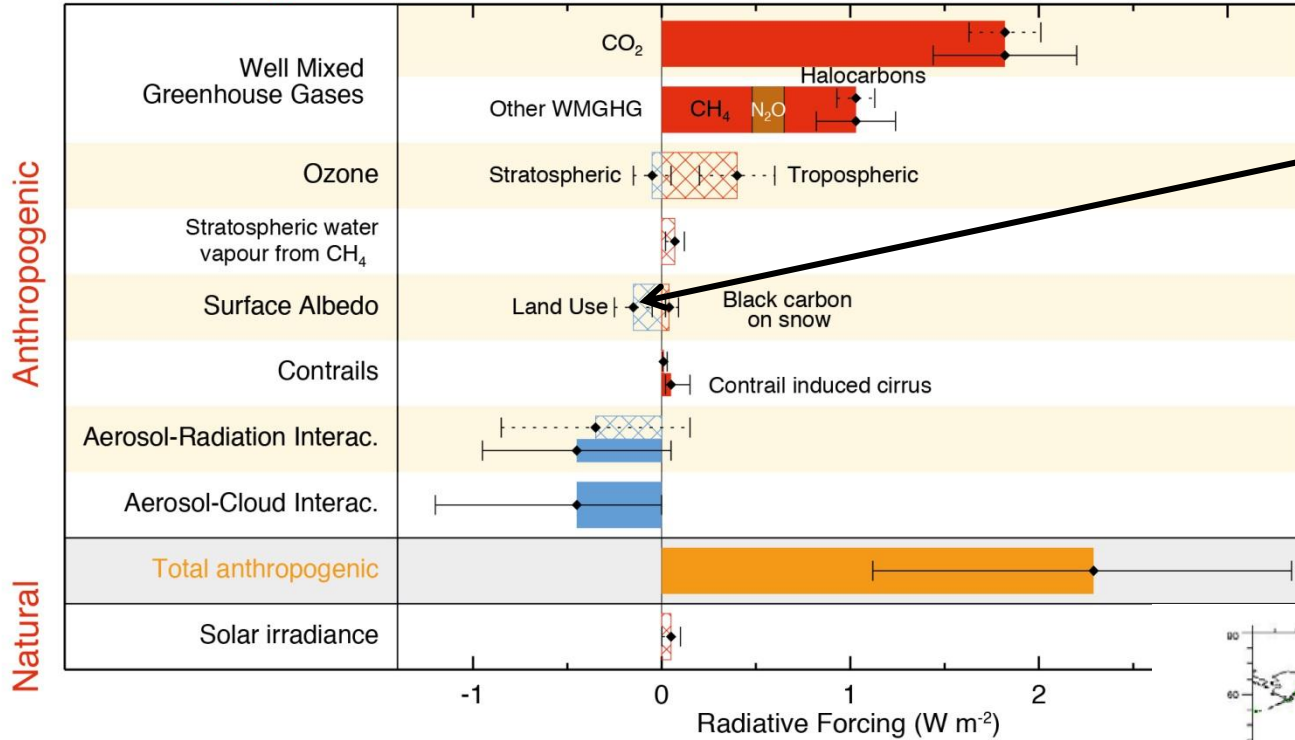
Gunnar Myhre  
CICERO, Norway

Said Kharbouche, Bjørn Samset, Ryan Bright

# Radiative forcing of land use change

Radiative forcing of climate between 1750 and 2011

Forcing agent

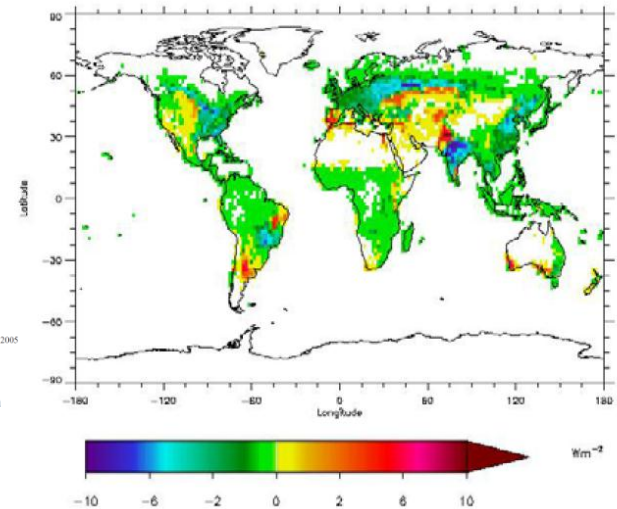


Myhre et al., Chapter 8, IPCC AR5, 2013

GEOPHYSICAL RESEARCH LETTERS, VOL. 32, L21410, doi:10.1029/2005GL024004, 2005

Radiative forcing due to anthropogenic vegetation change based on MODIS surface albedo data

Gunnar Myhre,<sup>1,2</sup> Maria M. Kvilevåg,<sup>1</sup> and Crystal B. Schaaf<sup>3</sup>



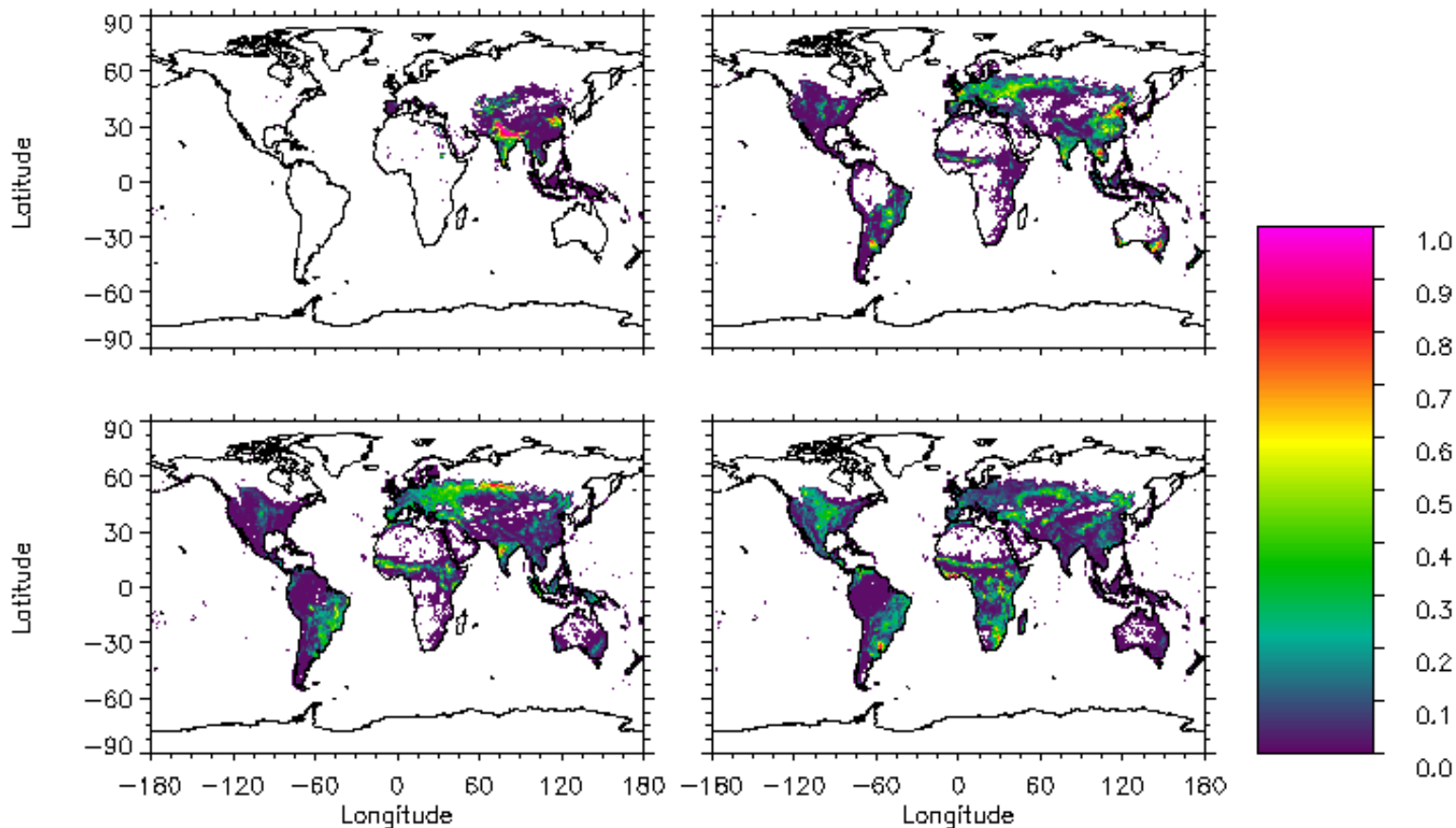
# Globcover vegetation classification

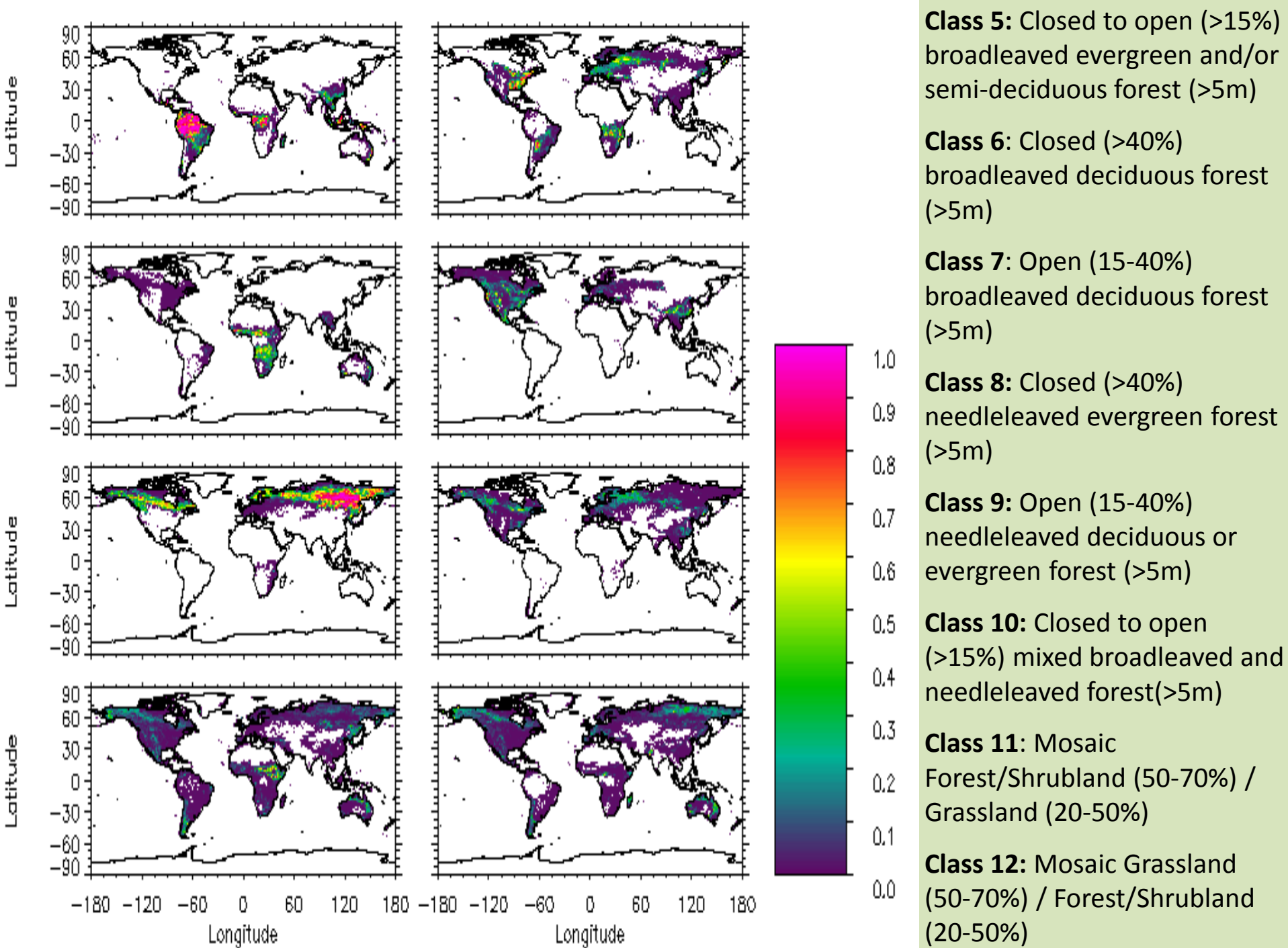
**Class 1:** Post-flooding or irrigated croplands

**Class 2:** Rainfed croplands

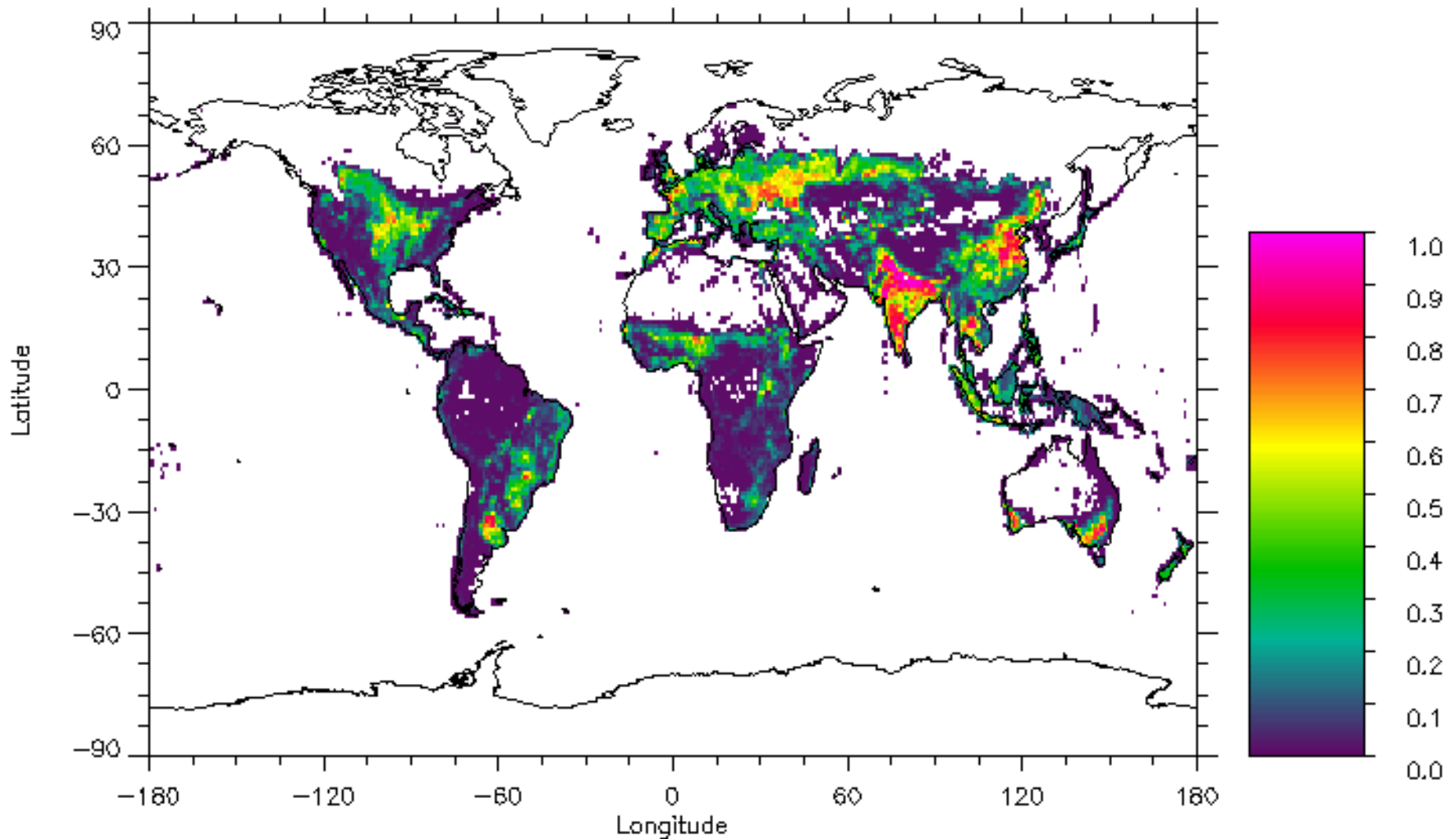
**Class 3:** Mosaic Cropland (50-70%) / Vegetation (grassland, shrubland, forest) (20-50%)

**Class 4:** Mosaic Vegetation (grassland, shrubland, forest) (50-70%) / Cropland (20-50%)

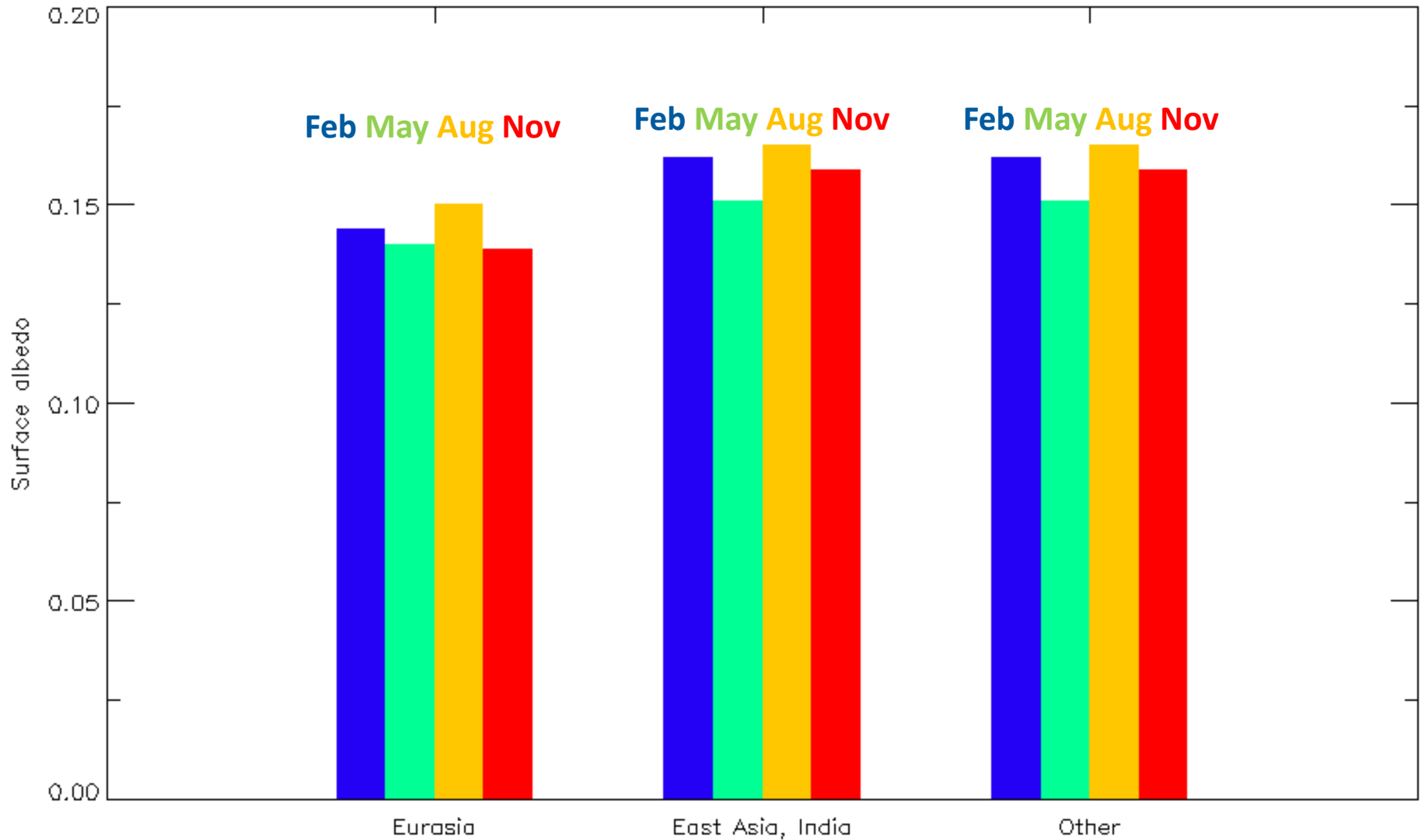




# Cropland fraction

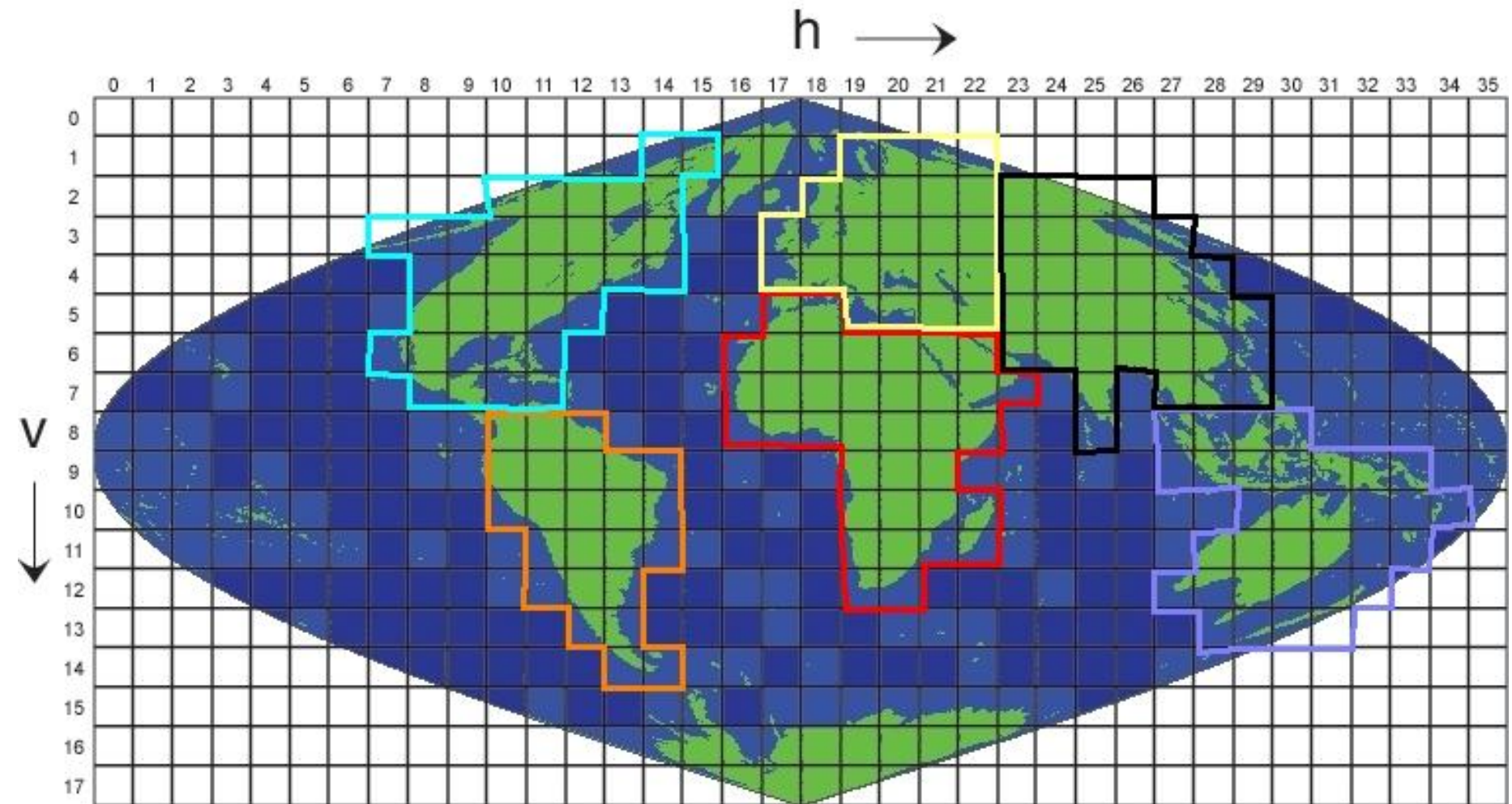


# MODIS values

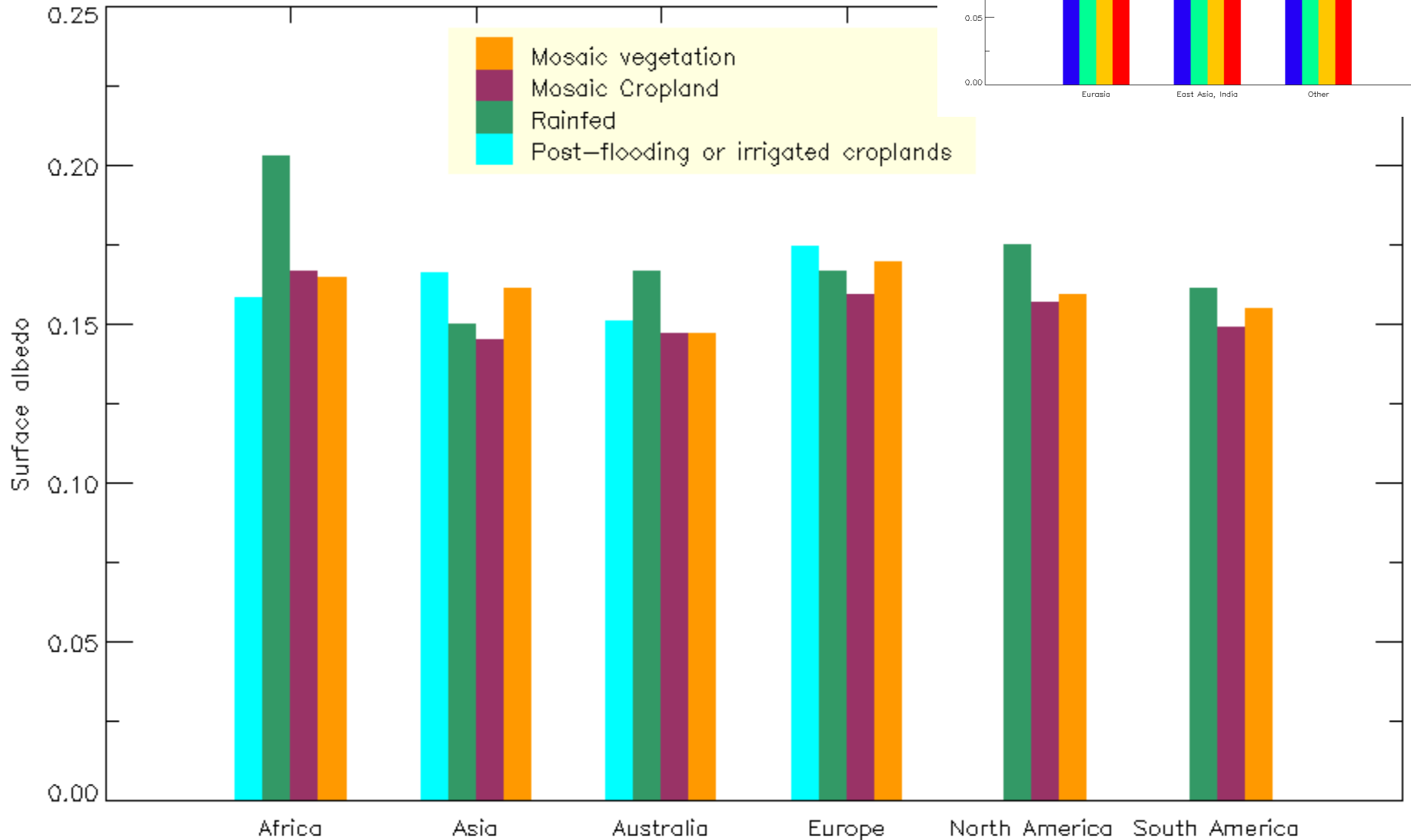


Black-sky values for the visible spectrum

# GlobAlbedo values for 6 regions



# GlobAlbedo values

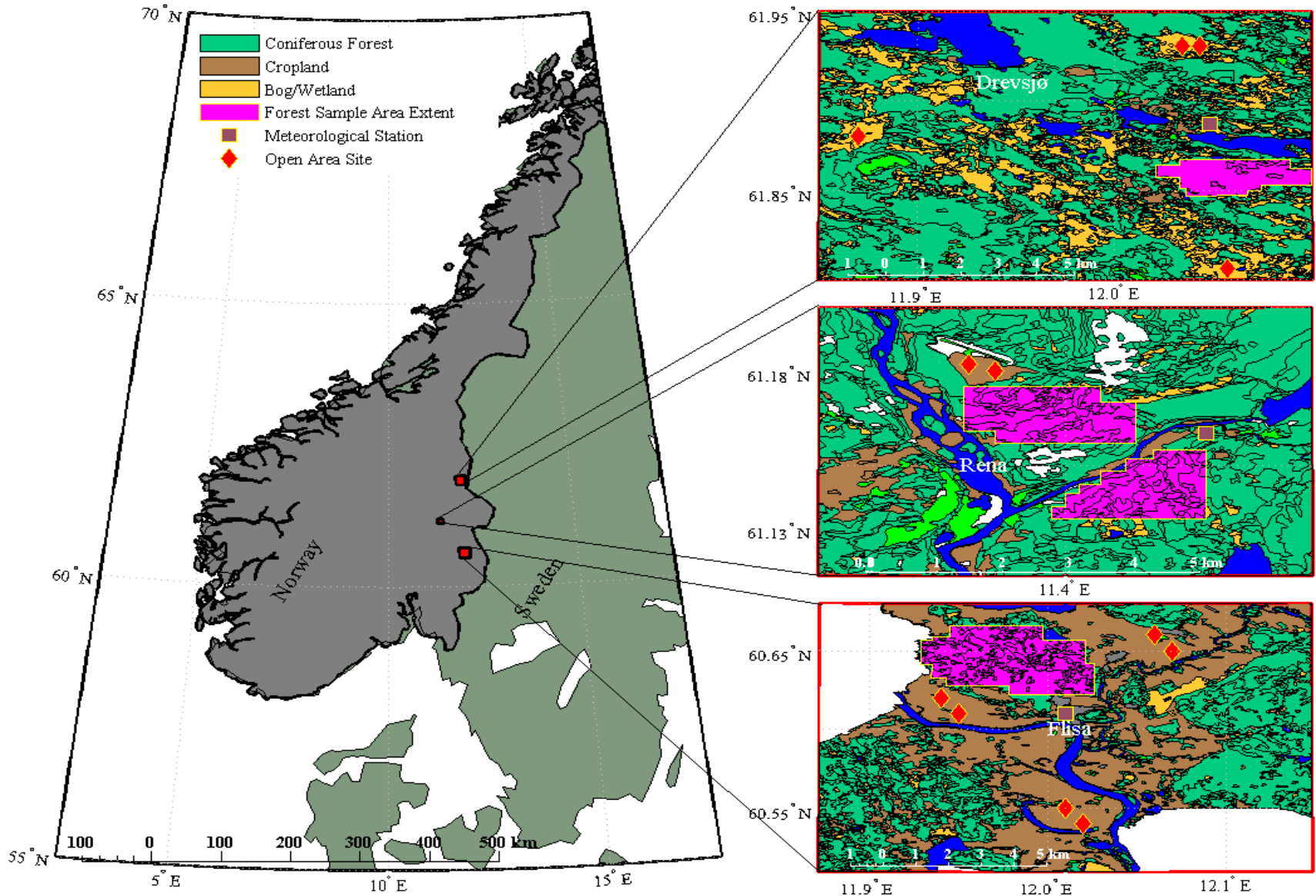




# Importance of snow cover on surface albedo

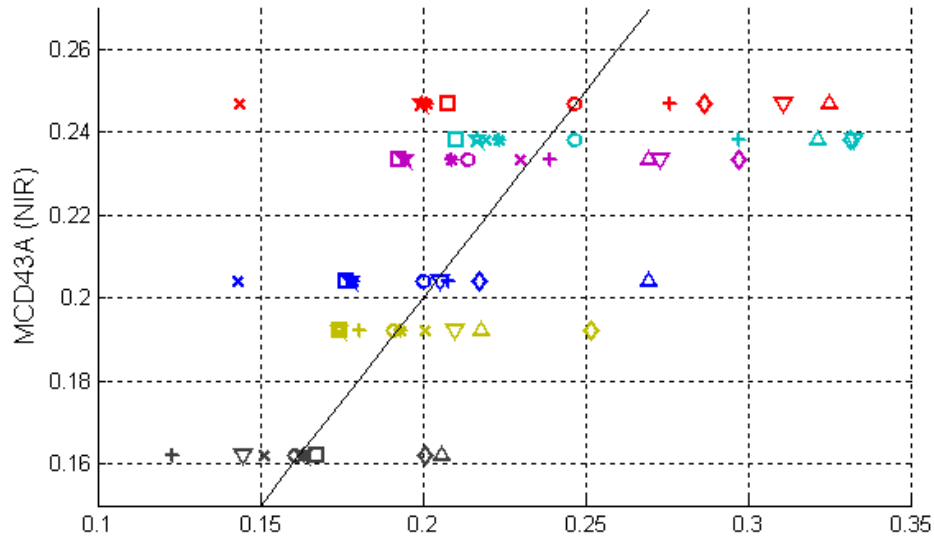


# Importance of snow cover parameterization for surface albedo change

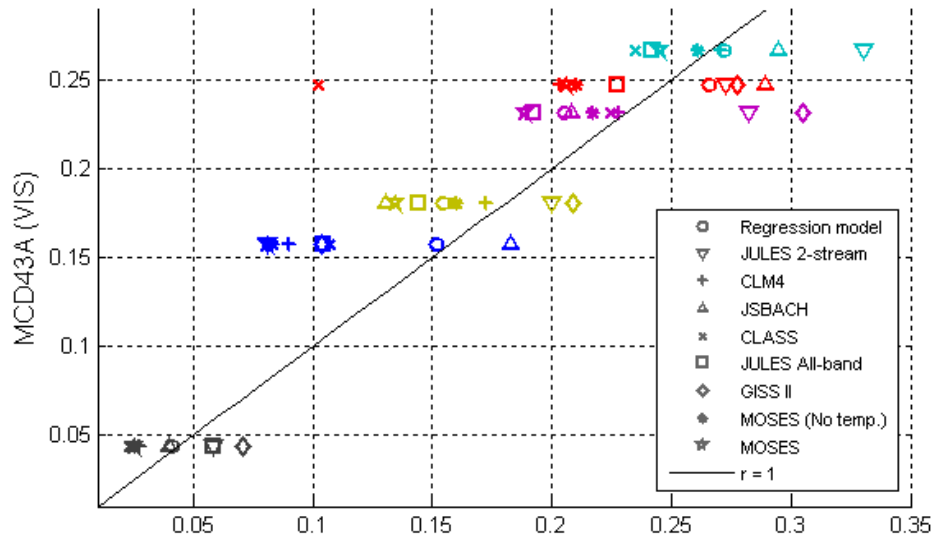
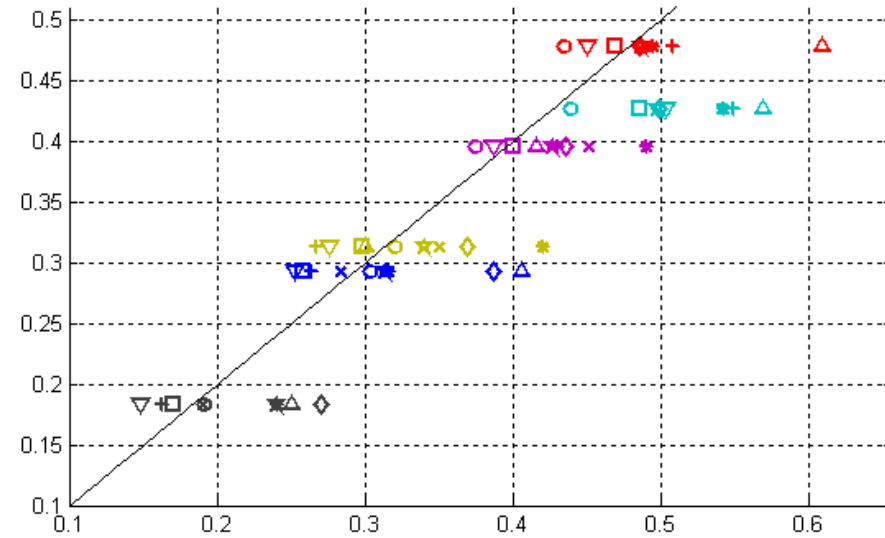


# MIP Norwegian case study

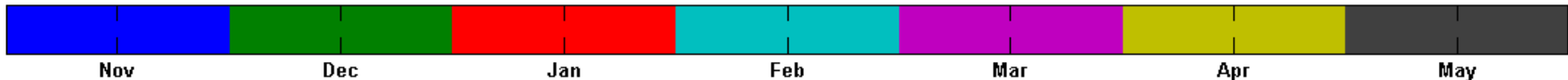
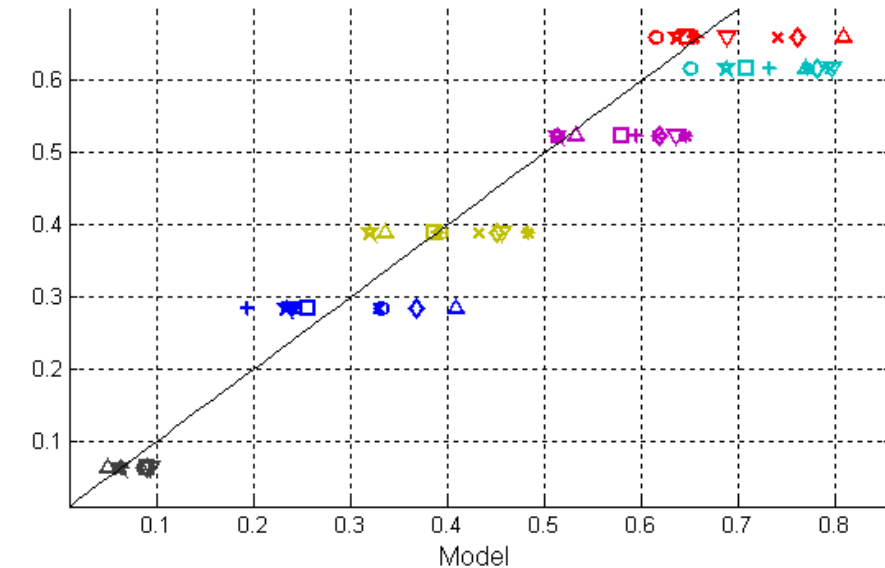
Forest



Open



Model



# 2007-2009 Mean Bias, $\Delta\alpha$ (Open – Forest)

|                                | Nov.-May Mean | $R_s\downarrow$ -weighted Nov.-May Mean | Nov.-May Mean | $R_s\downarrow$ -weighted Nov.-May Mean |
|--------------------------------|---------------|-----------------------------------------|---------------|-----------------------------------------|
|                                | NIR           |                                         | VIS           |                                         |
| Regression Model               | 0.00          | 0.01                                    | 0.02          | 0.03                                    |
| JULES 2-stream                 | -0.05         | -0.04                                   | 0.05          | 0.04                                    |
| CLM4                           | 0.01          | 0.01                                    | 0.04          | 0.03                                    |
| JSBACH                         | 0.02          | 0.00                                    | 0.06          | 0.02                                    |
| CLASS                          | 0.07          | 0.04                                    | 0.12          | 0.07                                    |
| JULES All-band                 | 0.02          | 0.01                                    | 0.05          | 0.04                                    |
| GISS II                        | 0.01          | 0.01                                    | 0.05          | 0.03                                    |
| MOSES v. 1999                  | 0.05          | 0.04                                    | 0.03          | 0.01                                    |
| MOSES v. 1999 - No temp. model | 0.07          | 0.07                                    | 0.08          | 0.08                                    |

$$MB = \frac{1}{N} \sum_{i=1}^N (\Delta\alpha_{Model} - \Delta\alpha_{Obs.})$$

- Total forest sample area = ~29 km<sup>2</sup>
  - LAI → 0.45 – 2.51
  - Height → 0.5 – 16 m
  - CC% → 1% - 76%

# Radiative forcing

Global and annual mean  $-0.1 \text{ Wm}^{-2}$

