JULES & CLASSIC

Peter Cox
CLASSIC Partners

- University of Wales Swansea (Mike Barnsley, Sietse Los, Peter North, Graham Weedon)
- CEH Wallingford (Richard Harding, Chris Taylor)
- CEH Monks Wood (France Gerard)
- University of Durham (Brian Huntley, Bob Baxter)
- Met Office, Hadley Centre (Martin Best, Stephen Sitch)
- University of Leicester (Heiko Balzter, Joerg Kaduk)
- University of Exeter (Peter Cox)
The CLASSIC Mission

To utilise Earth Observation to quantify interactions between the land surface and the atmosphere on diurnal to decadal timescales
CLASSIC Goals

- To improve the understanding of feedbacks between the land surface and atmosphere;
Models agree on location of hotspots, but disagree on the importance of land’s influence on rainfall.

Koster et al., 2004
CLASSIC Goals

- To improve the understanding of feedbacks between the land surface and atmosphere;

- To improve the representation of land-surface processes in climate and Earth system models;

..through contributions to the development of JULES and land-surface datasets....
Science Priorities & JULES Developments

- **Diffuse Radiation**
- **Aerosols**
  - Diffuse radiation effects on NPP
  - Runoff of Snowmelt on Frozen Soils

- **Soil Moisture**
  - Drought Deciduous Phenology
  - Soil water Stress

- **Vegetation**
  - Deciduous Phenology

- **Evaporation**

- **Precipitation**

- **Snow Cover**
  - Snow Albedo

- **Solar Radiation**
  - Surface Albedo

- **Temperature**

**Surface State**

**Surface Fluxes**

**Climate**
Improvements to JULES: Contribution of CLASSIC

- Land-surface characteristics from EO, including LAI and albedo (Dec 2006)
- Radiation transfer through the canopy, including diffuse radiation and sun-fleck effects (June 2007)
- Drought-deciduous leaf phenology (June 2007)
- Models of surface albedo (Oct 2007)
- Snow and frozen soil modelling, including snowmelt runoff on frozen soils (Dec 2007)
- Soil water stress and plant water status (Mar 2008)
Existing albedo in HadGAM has large biases, notably over the Sahara.
Impact of new albedo in HadGAM GCM :
Change in Temperature at 1.5m in JJA

contours show changes in albedo
Impact of new albedo in HadGAM GCM:
Enhances African monsoon precip (shaded) and affects Asian monsoon
Improvements to JULES: Contribution of CLASSIC

- Land-surface characteristics from EO, including LAI and albedo (Dec 2006)
- Radiation transfer through the canopy, including diffuse radiation and sun-fleck effects (June 2007)
- Drought-deciduous leaf phenology (June 2007)
- Models of surface albedo (Oct 2007)
- Snow and frozen soil modelling, including snowmelt runoff on frozen soils (Dec 2007)
- Soil water stress and plant water status (Mar 2008)
Improving processes in JULES

- Big leaf – unrealistic representation

- 10-layer improved 'Light mod'
  Far more realistic

- Importance of canopy structure and leaf angle inclination
Improvements to JULES: Contribution of CLASSIC

- Land-surface characteristics from EO, including LAI and albedo (Dec 2006)
- Radiation transfer through the canopy, including diffuse radiation and sun-fleck effects (June 2007)
- Drought-deciduous leaf phenology (June 2007)
- Models of surface albedo (Oct 2007)
- Snow and frozen soil modelling, including snowmelt runoff on frozen soils (Dec 2007)
- Soil water stress and plant water status (Mar 2008)
Soil Moisture Availability Simulated by JULES

Correlation between precipitation and NDVI

a perfect model would show no pixels in lower panel when beta=1 (i.e. unstressed, pink in top panel)

→ encouraging agreement at large-scales
Soil Moisture Availability and dependence of NDVI on rainfall

Orange areas have significant positive correlation between observed precip and NDVI
Improvements to JULES: Contribution of CLASSIC

- Land-surface characteristics from EO, including LAI and albedo (Dec 2006)
- Radiation transfer through the canopy, including diffuse radiation and sun-fleck effects (June 2007)
- Drought-deciduous leaf phenology (June 2007)
- Models of surface albedo (Oct 2007)
- Snow and frozen soil modelling, including snowmelt runoff on frozen soils (Dec 2007)
- Soil water stress and plant water status (Mar 2008)
Improvements to JULES: Contribution of CLASSIC

- Land-surface characteristics from EO, including LAI and albedo (Dec 2006)
- Radiation transfer through the canopy, including diffuse radiation and sun-fleck effects (June 2007)
- Drought-deciduous leaf phenology (June 2007)
- Models of surface albedo (Oct 2007)
- Snow and frozen soil modelling, including snowmelt runoff on frozen soils (Dec 2007)
- Soil water stress and plant water status (Mar 2008)
Science Priorities & JULES Developments

- Diffuse Radiation
- Aerosols
- Soil Moisture
- Vegetation
- Snow Cover
- Evaporation
- Solar Radiation
- Precipitation
- Temperature
- Drought Deciduous Phenology
- Runoff of Snowmelt on Frozen Soils
- Soil water Stress
- Surface Albedo

Surface State

Surface Fluxes

Climate
THE END!