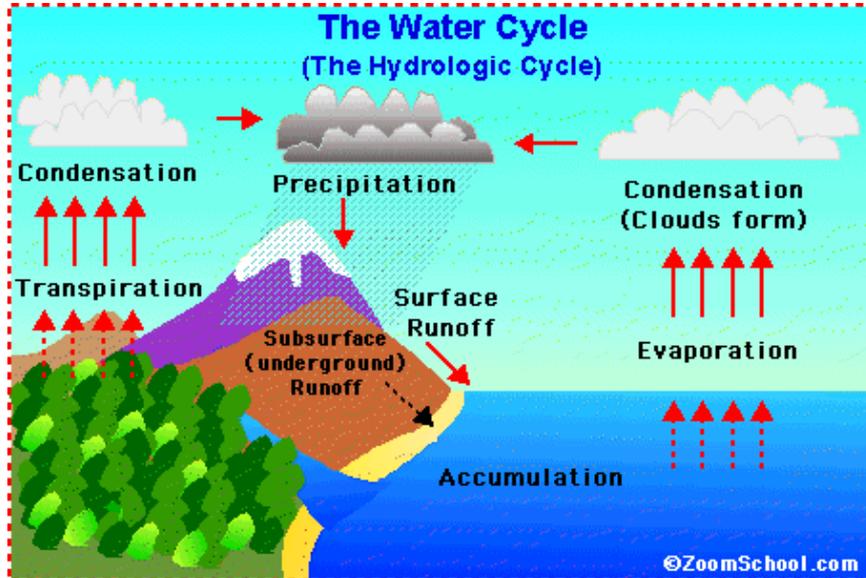# Monitoring evapotranspiration at high resolution with MSG and moderate resolution satellites

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Context

- ## Evapotranspiration (ET) and water cycle

The Water Cycle (The Hydrologic Cycle)

Condensation — Precipitation — Condensation (Clouds form)

Transpiration — Surface Runoff — Evaporation

Subsurface (underground) Runoff — Accumulation

©ZoomSchool.com

Global scale over land: ET represents 58 % of precipitation

- Transpiration: 48 %

- Evaporation from soil: 36 %

- Evaporation from interception: 16 %

From Dirmeyer, 2011 (J. Hydrometeorol., 12, 729-749)

Large discrepancies between time/place/vegetation species

ET seen as a lost of available water

P – ET = ΔW → ET needed for water balance calculation

→ ET knowledge is necessary for many practical applications

Context

- ## Mother project: part of EUMETSAT SAF network

http://www.eumetsat.int/Home/Main/Satellites/GroundNetwork/ApplicationGroundSegment/SAFs/index.htm

Context

- ## Mother project: 'Land Surface Analysis – Satellite Application Facility' (LSA-SAF)

Objectives

http://landsaf.meteo.pt

- – Exploit potential of European meteorological satellites to monitor land surface characteristics and evolution
- – Do R&D activities to derive pertinent variables for various land applications
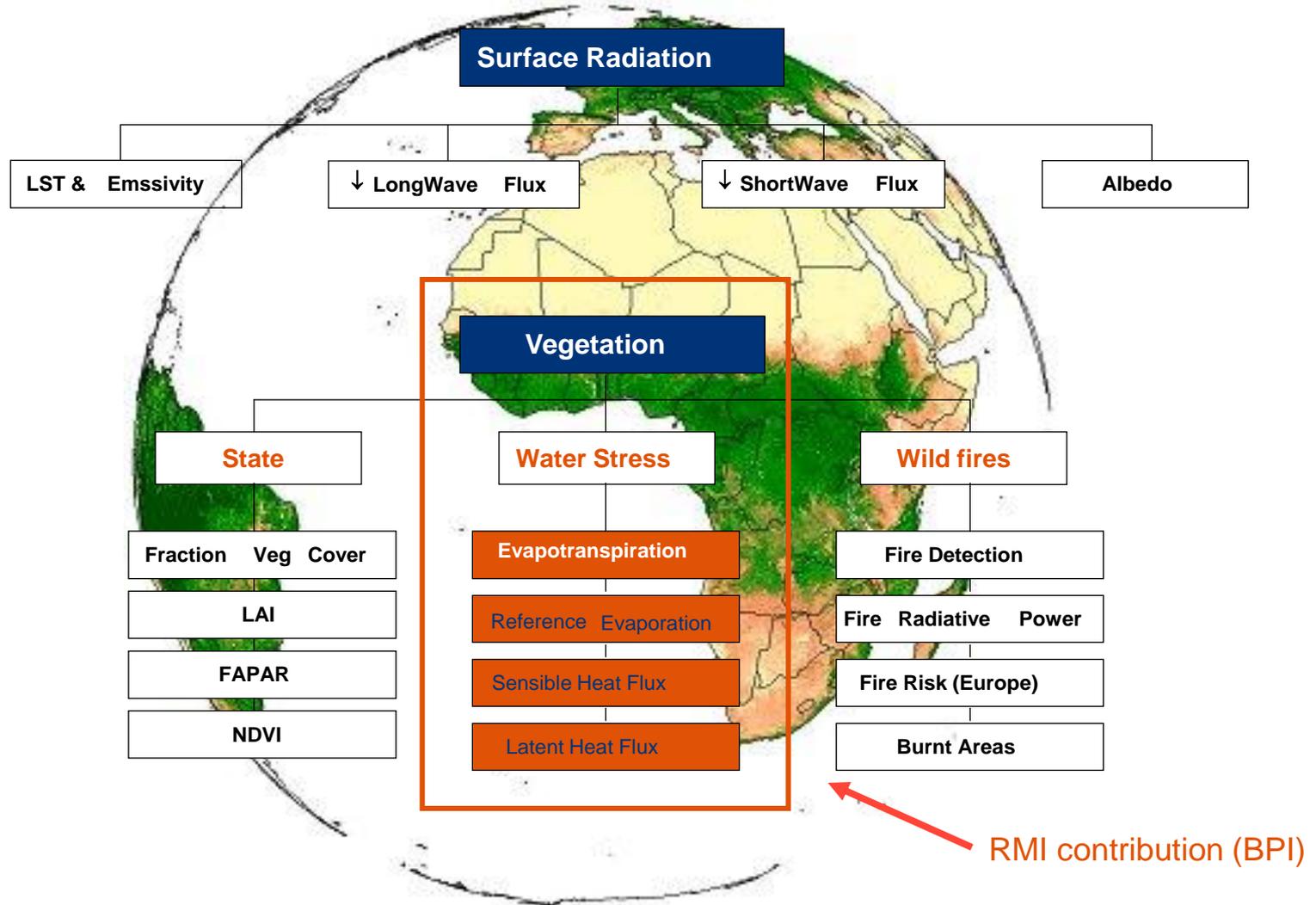- – Assure operational service (products and user support) at host institute

LSA-SAF consortium

- Instituto Português do Mar e da Atmosfera (IPMA), Portugal
- Meteo-France (MF), France
- Royal Meteorological Institute (RMI), Belgium
- IMK, Karlsruhe Institute of Technology (KIT), Germany
- IDL, University of Lisbon, Portugal
- UV, University of Valencia, Spain
- KCL, UK
- VITO, Belgium

Context

- ## Mother project: RMI role (products development)

Surface Radiation
- LST & Emssivity
- ↓ LongWave Flux
- ↓ ShortWave Flux
- Albedo

Vegetation
- **State**
  - Fraction Veg Cover
  - LAI
  - FAPAR
  - NDVI
- **Water Stress**
  - Evapotranspiration
  - Reference Evaporation
  - Sensible Heat Flux
  - Latent Heat Flux
- **Wild fires**
  - Fire Detection
  - Fire Radiative Power
  - Fire Risk (Europe)
  - Burnt Areas

RMI contribution (BPI)

Context

- ## Mother project: RMI role (methodology and output)

  - Physically based land surface modelling
  - Input: LSA-SAF MSG-SEVIRI derived data: radiation, vegetation, thermal properties
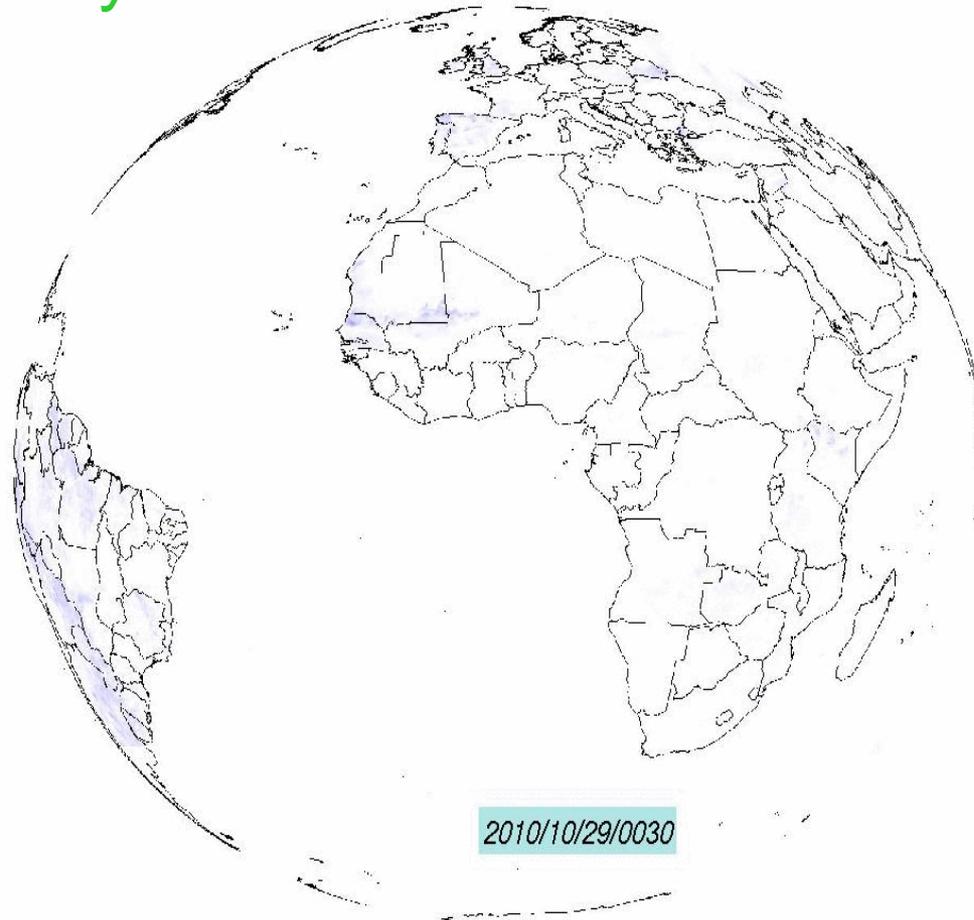 - Output: 30 min ET and daily ET; spatial res: 3*3 km (sub sat.)
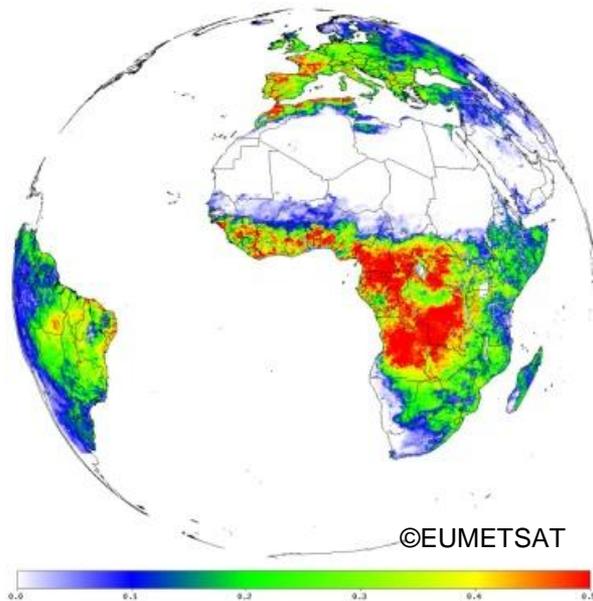
30 min ET (mm h^{-1}), 28/4/2010 15 UTC
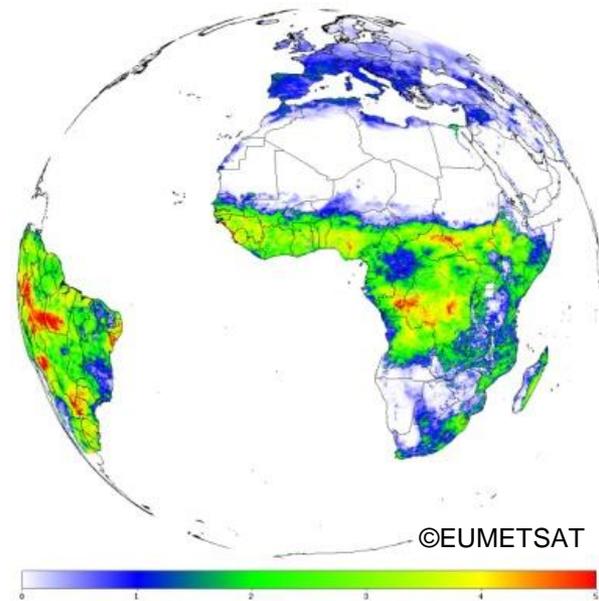
Daily ET (mm d^{-1}): 11/9/2011

- ET diurnal cycle

2010/10/29/0030

©EUMETSAT

Context

- ## Mother project: Users community

    - Hydrology, Land Surface Modelling – carbon fluxes

    - Agriculture and Forestry applications

    - Environmental monitoring

    - Food Security

    → Well suited for large scale monitoring or input to various prediction models

    But …

Context

- ## Main topic

Evapotranspiration retrieval at high resolution and how to combine strengths of respectively geosynchronous and polar space born sensors.

High temporal resolution

Geostationary satellite data

Mother project: LSA-SAF

Ghilain et al., 2011, 2012b, Trigo et al., 2011

Medium spatial resolution

Polar satellite data

Past GLOBAM and PROBA-VET projects

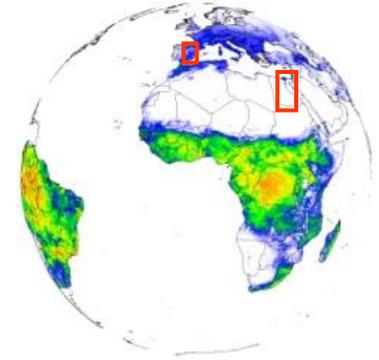Sepulcre et al, 2012, Ghilain et al., 2012a
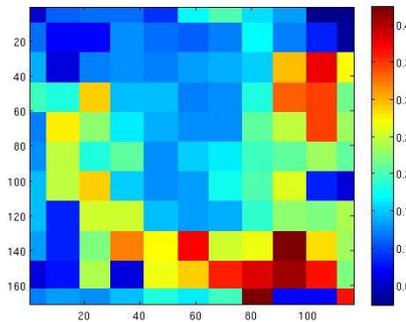
EVA3M project

- ## Feasibility study (PROBA-VET)

  – Downscaling of LSA-SAF ET to obtain maps
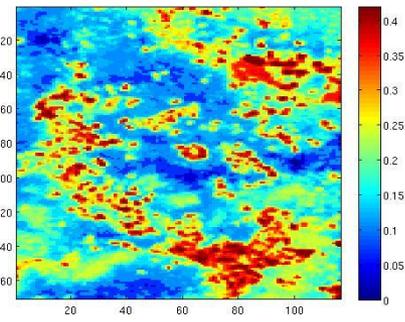   at 300 m using moderate resolution satellite

  – Done on few single cases

  1. Barrax-Albacete: 35% Irrigated fields (Summer + Spring)

2. Nile Valley: Irrigated fields
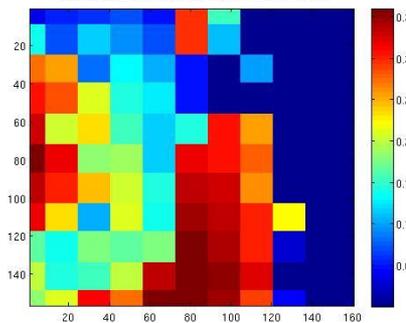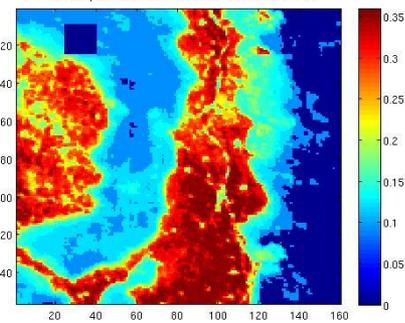
Objectives

- ## EVA3M driving objective
  - ET retrieval at sub-km spatial resolution and at continental scale by combining strengths of geostationary and polar satellites

- ## Methodology: comparing 2 downscaling approaches
  - Downscalling/fusion on ET output ('*a posteriori*' method)
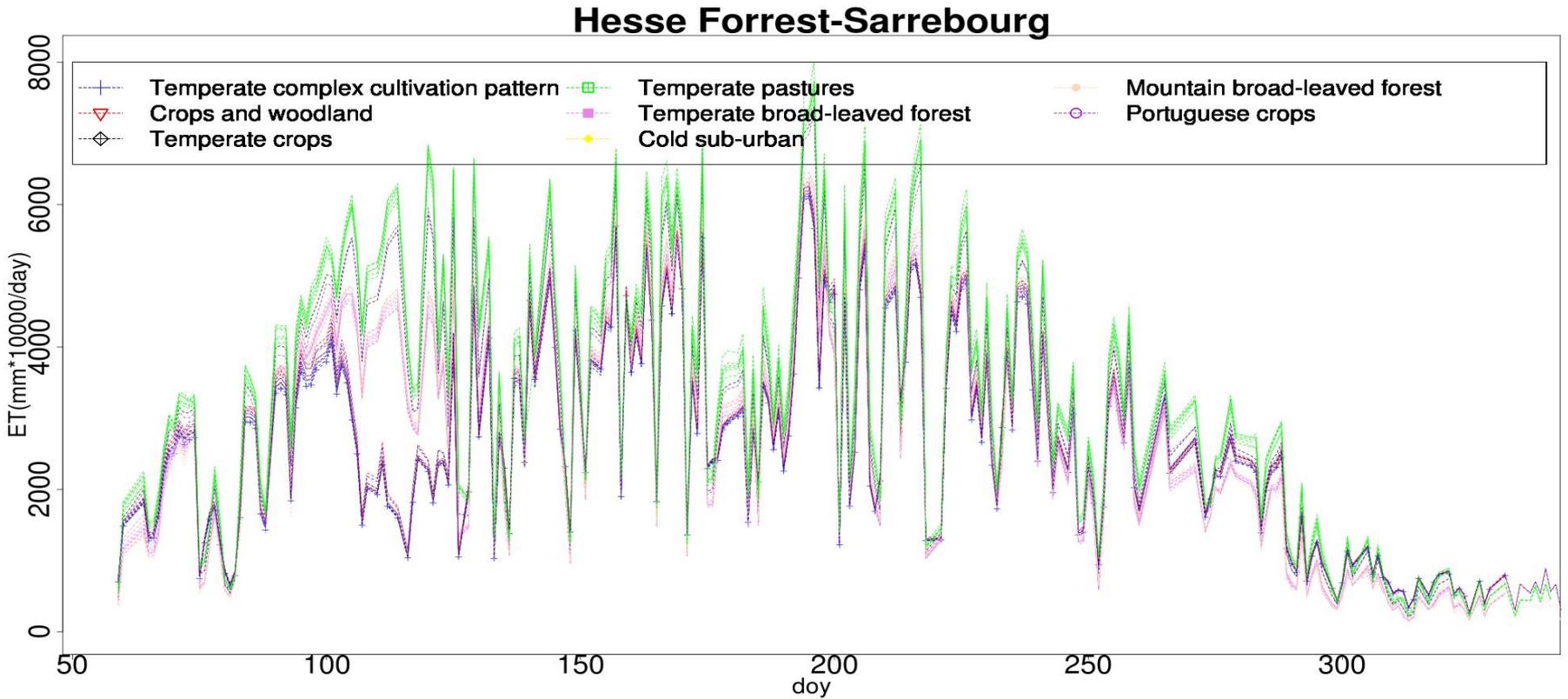 - Using data with higher spatial resolution data prior to ET modelling ('*ab initio*' method)

- ## Satellite data products
  - MSG SEVIRI: ET, DSSF, DSLF, AL, LAI, FAPAR, FVC
  - SPOT -VEG: NDVI, AL
  - MODIS: NDVI, AL, LAI/FAPAR
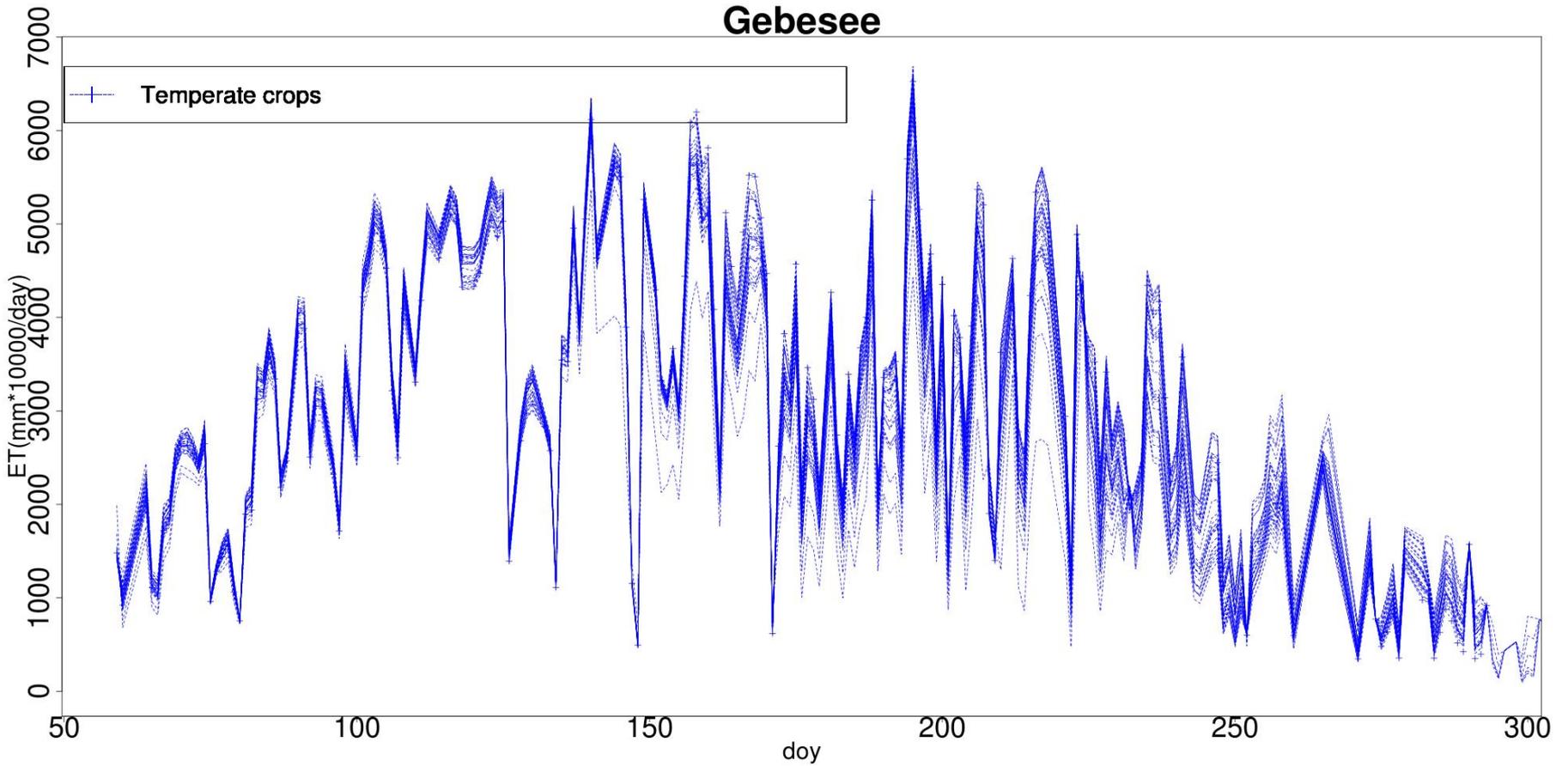 - MERIS: : NDVI, LAI/FAPAR

Tests sites

- ## Validation sites:
  - Fluxnet and AWS data from NWS

Hesse Forest-Sarrebourg (FR)

deciduous broadleaf forest

Tests sites

Hesse Forrest-Sarrebourg

Legend:
- Temperate complex cultivation pattern
- Crops and woodland
- Temperate crops
- Temperate pastures
- Temperate broad-leaved forest
- Cold sub-urban
- Mountain broad-leaved forest
- Portuguese crops

Y-axis: ET(mm*10000/day)
X-axis: doy

Gebesee (DE)

station GebE -VGT

cropland

Tests sites

Gebesee

End of presentation

Thanks for listening !