ALBERI

Assessing Links between Biogenic Emissions and Remotely-sensed photosynthesis Indicators

Diego G. Miralles
Universiteit Gent

Trissevgeni Stavrakou, Jean-François Müller, Maite Bauwens, Beata Opacka
Royal Belgian Institute for Space Aeronomy (BIRA-IASB)

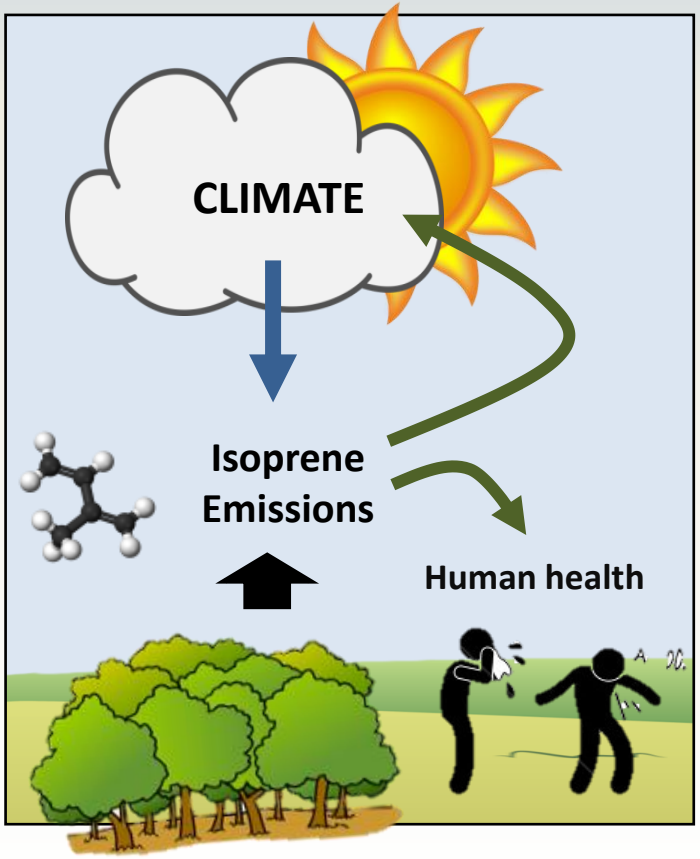
Alex Guenther
University of California

Why do we care about biogenic emissions?

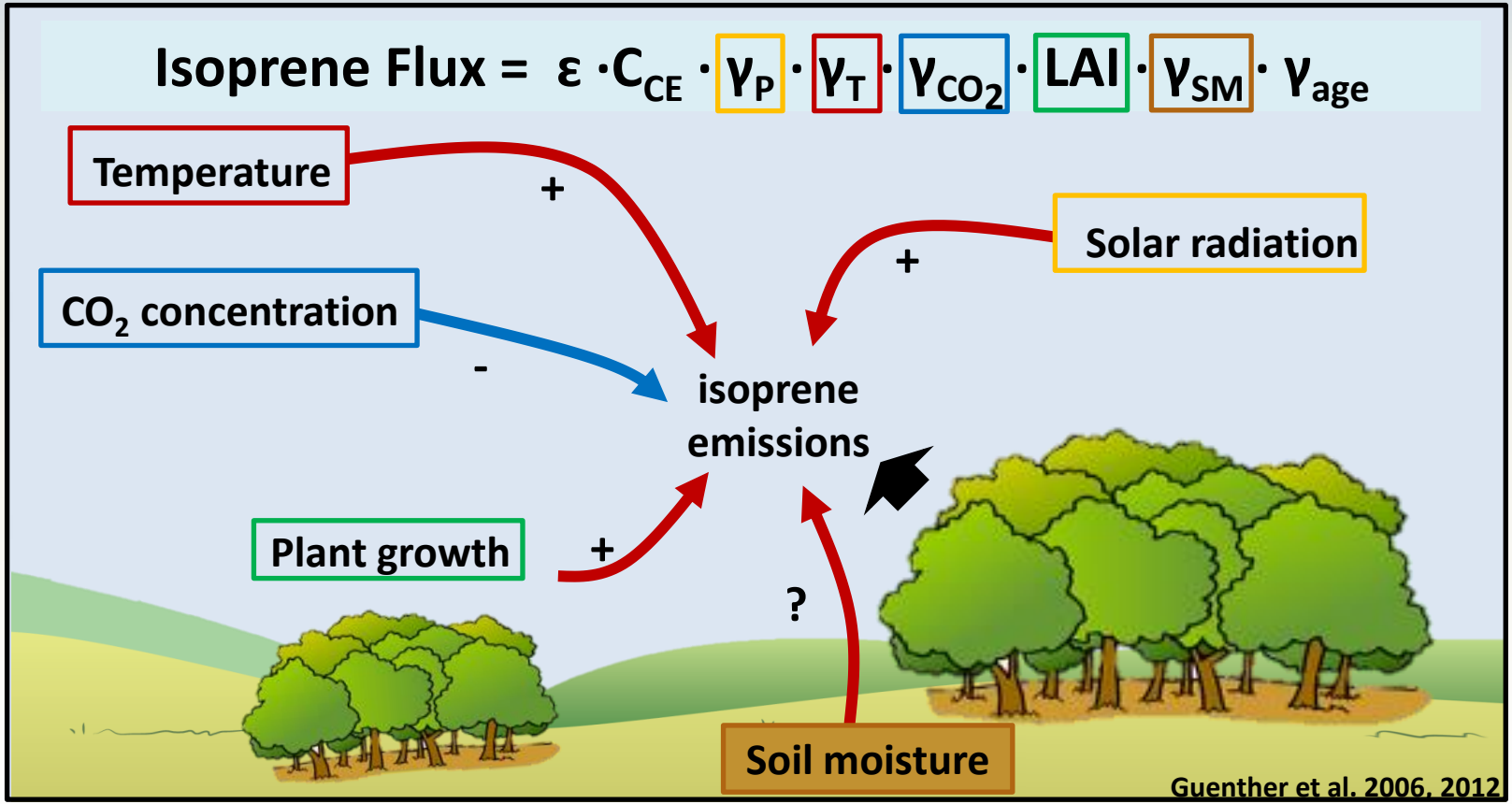
- Plants emit about 1100 Tg/yr BVOC globally in the atmosphere
- Central in atmosphere-biosphere-climate interactions
- 500 TgC/yr is emitted as isoprene

- Highly reactive: leads to the formation of:
  - O_3 under polluted conditions
  - secondary organic aerosols (SOA)

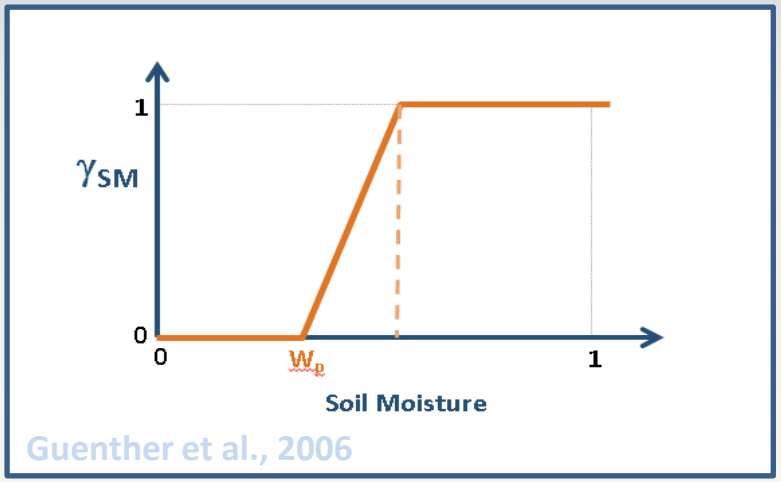
- Strongly influenced by meteorology



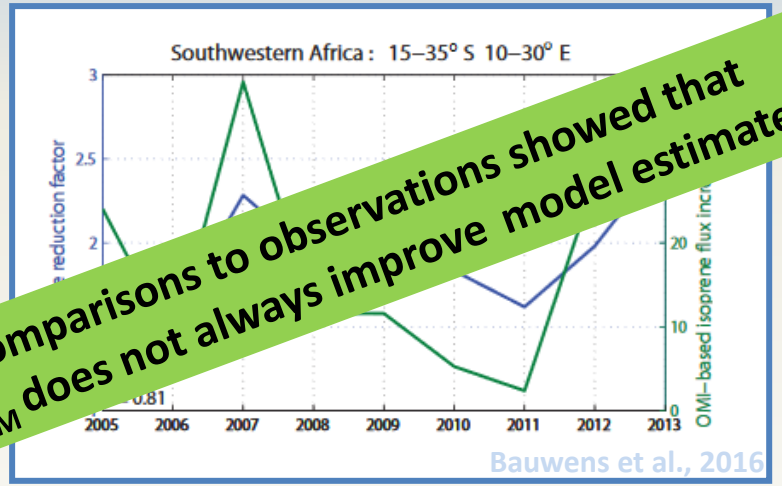
BVOC emission model MEGAN



Soil moister as modeled now



Guenther et al., 2006



Bauwens et al., 2016

comparisons to observations showed that γ_{SM} does not always improve model estimates

Since 2016

$\gamma_{SM} = 1$

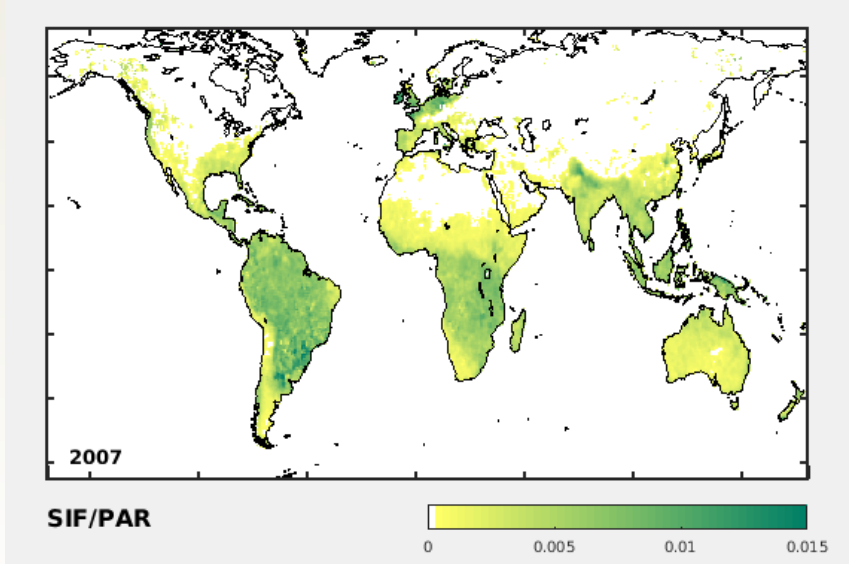
$$\text{Isoprene Flux} = \varepsilon \cdot C_{CE} \cdot \gamma_P \cdot \gamma_T \cdot \gamma_{CO_2} \cdot LAI \cdot \cancel{\gamma_{SM}} \cdot \gamma_{age}$$

SIF as drought indicator ?

- A recent study based on field measurements showed that drought leads to:
  - lower SIF and ISOPRENE flux
  - lower formaldehyde columns

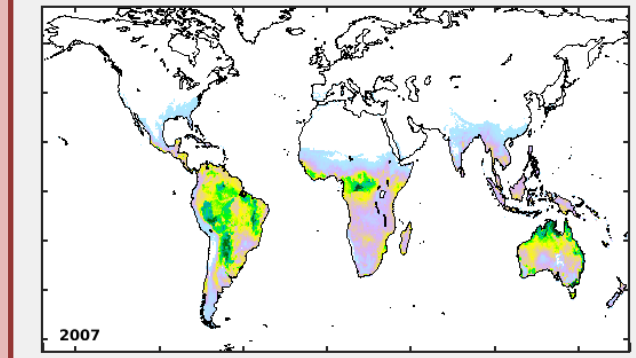
  Zheng et al. 2017

- Long-term and global observations!



WORKPLAN

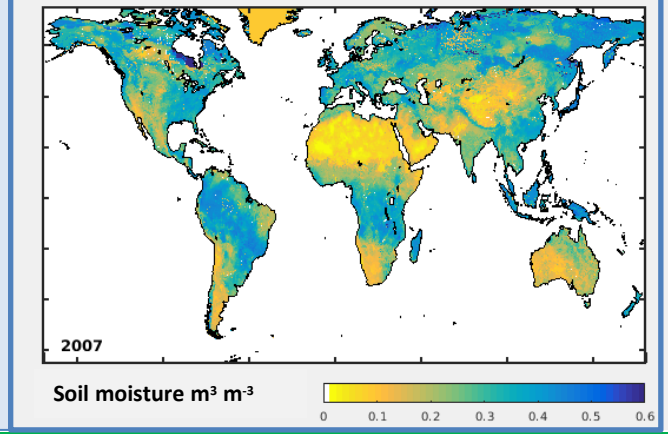
WP1: BIRA



MEGAN model updates
- LUC & LCC
- CO_2
- Validate against HCHO

Implement in MEGAN

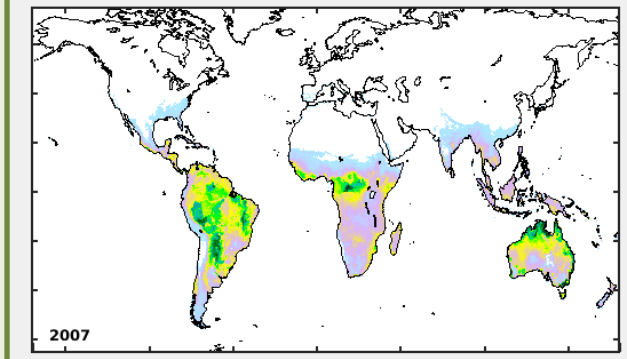
WP2: U GENT

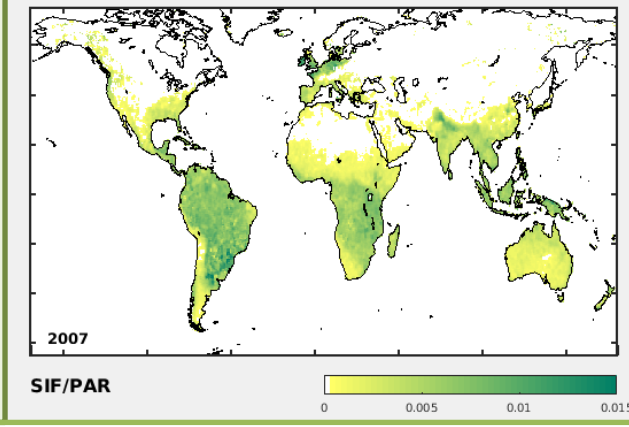


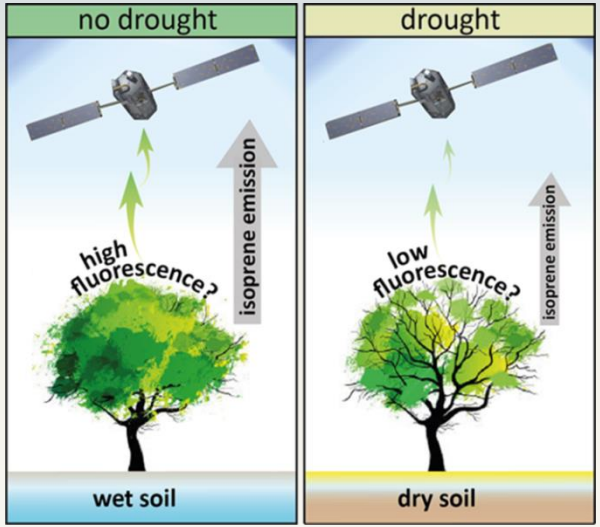
- Develop observation-based root-depth soil moisture
- Assimilate SMAP data
- Validate using *in situ* data

WORKPLAN: Goal of ALBERI

WP3: BIRA+UGENT+UCalifornia



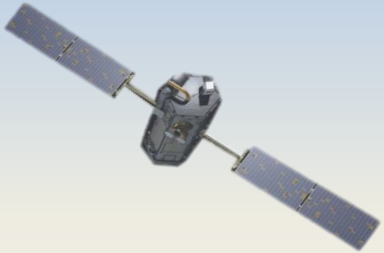




Establish an empirical link between biogenic VOC emissions and a remotely-sensed photosynthesis indicator such as SIF

modulate the shape of the γ_{SM} function per pixel

Improve emission estimates



Innovation project
ALBERI kicked-off in September 2019
2-yr duration

http://alberi.aeronomie.be

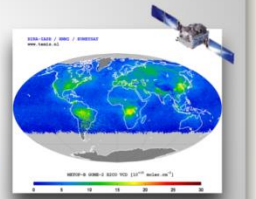
Time for questions

Workplan

WP1 : MEGAN model updates (not related to soil moisture stress) and validation (BIRA-IASB, UCI) T0 →T0+12

- Account for changes in climate, land use, and tree composition, role of CO_2

- Use MODIS (leaf area index, surface temperature and radiation)

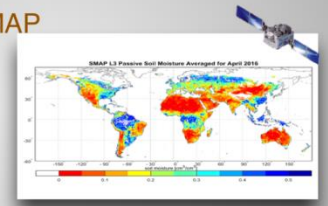


- Evaluate the updates against OMI HCHO and IMAGES model simulations

WP2 : Root-zone soil moisture retrieval consistent with MEGAN (UGent), T0 →T0+12

- Assimilation of SMAP soil moisture data

- Explore data assimilation of the SMAP brightness temperature data

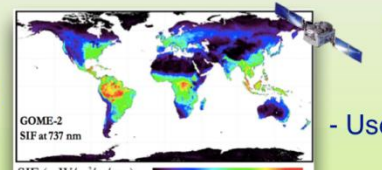


- Validate the root-depth soil moisture using in situ data
- Implement in MEGAN

WP3 : Observation-driven soil moisture stress parameterization and validation (BIRA-IASB, UCI, UGent), T0+8 →T0+24

- Identify regions with major droughts

- Use root-zone soil moisture content and satellite SIF yield to modulate the shape of soil moisture stress



Case study : summer 2018 European drought

- Use 2018 TROPOMI retrievals of HCHO and SIF, assess

Why ALBERI – VOC's health and climate