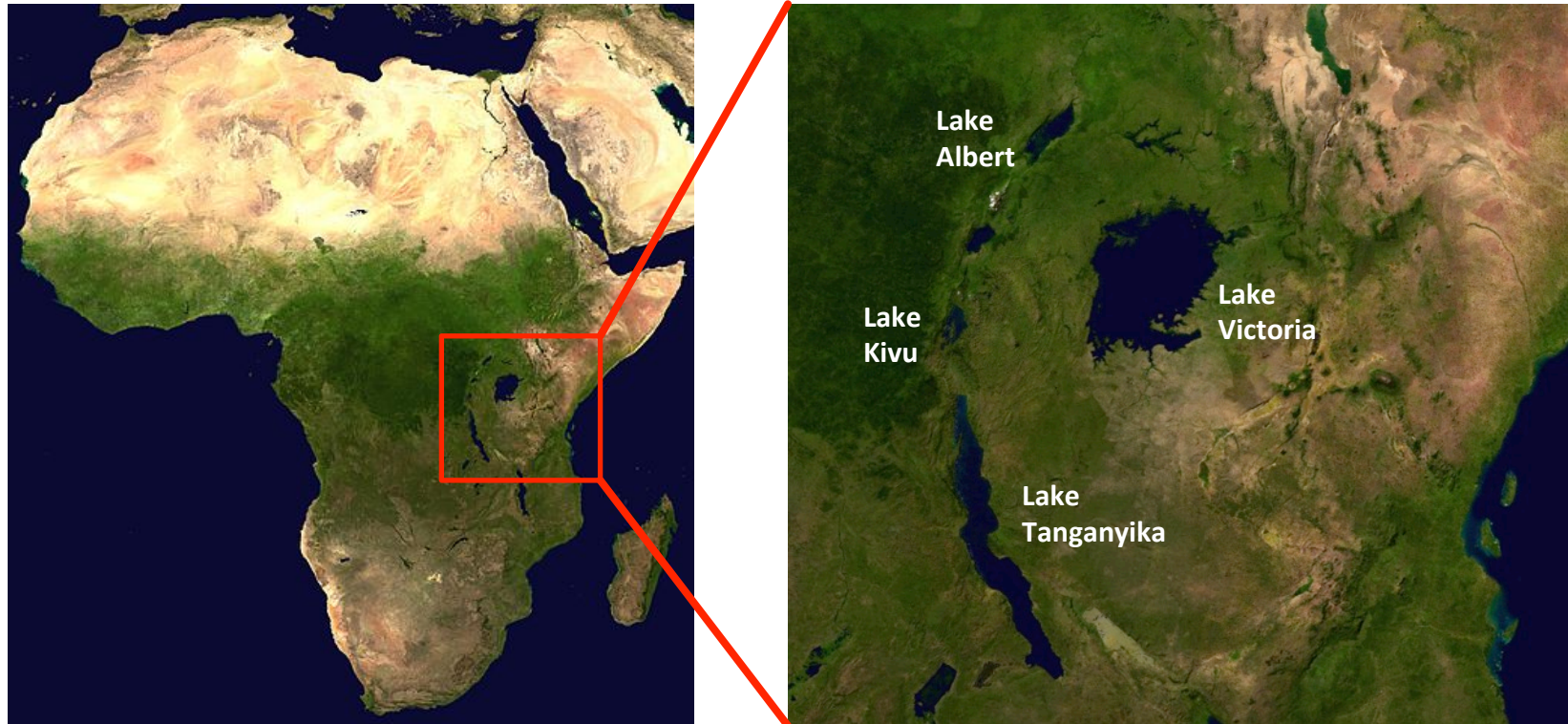(Photo: Tomaz Kunst / Shutterstock)

Early warnings of extreme thunderstorms over Lake Victoria

Wim Thiery, Lukas Gudmundsson, Kristopher Bedka, Fred Semazzi, Stef Lhermitte, Patrick Willems, Nicole Van Lipzig & Sonia Seneviratne

Presenting author: Nicole van Lipzig

Introduction: The African Great Lakes

Lake Albert

Lake Kivu

Lake Victoria

Lake Tanganyika

(source: NASA)

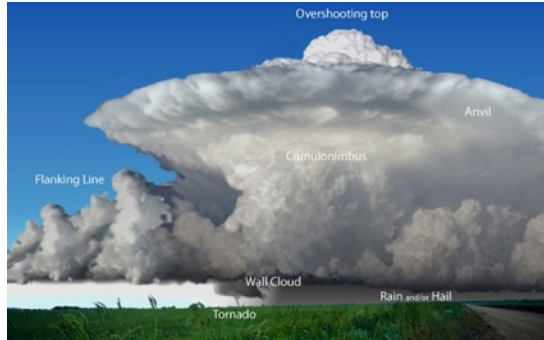Lake Victoria: > 300 km long

Introduction: Ecosystem services

- Fishing
- Drinking water
- Electricity
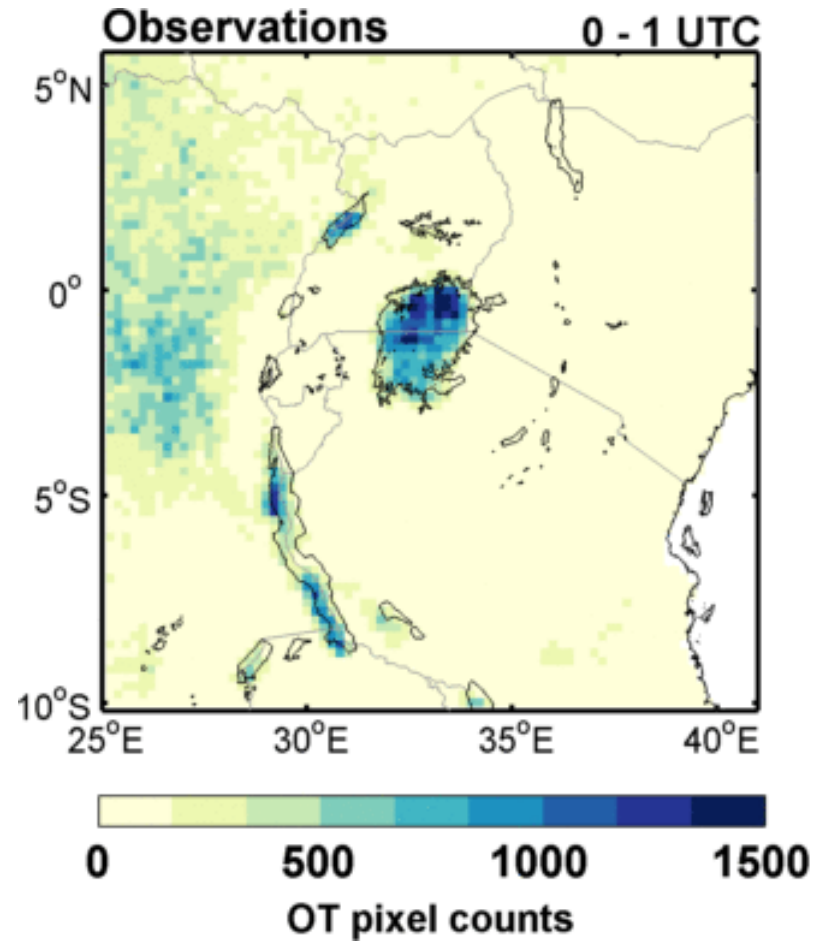- Lake Victoria supports 200 000 fishermen

(Lake Victoria, © Yann Arthus-Bertrand)
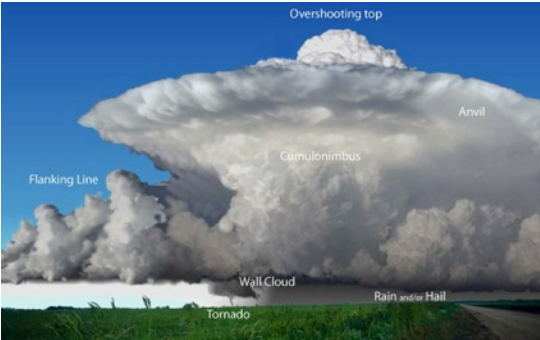
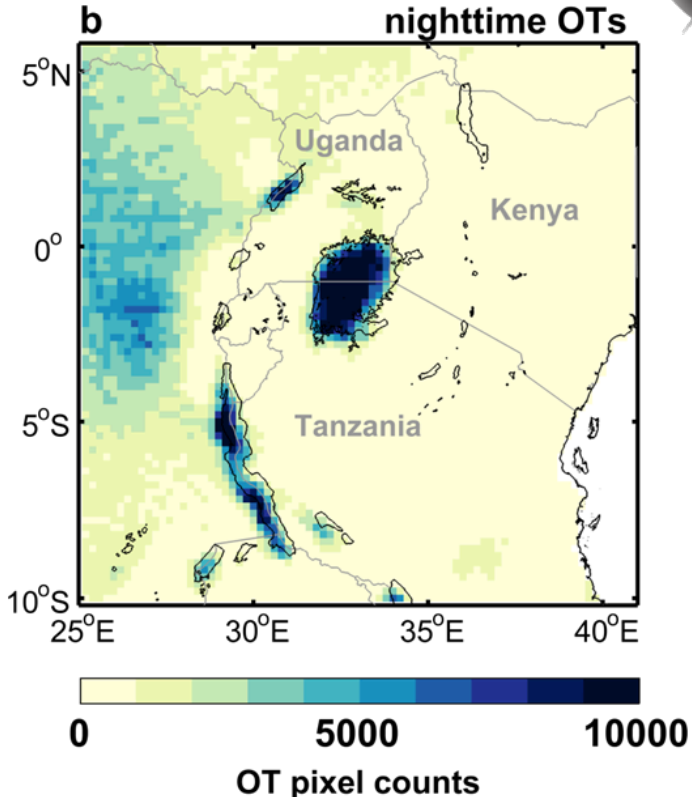# Introduction: SEVIRI on MSG
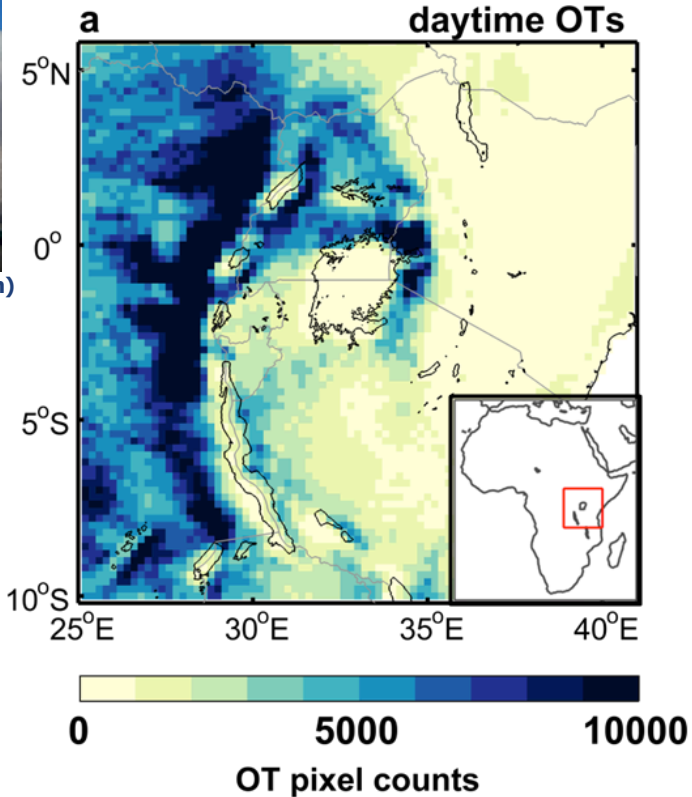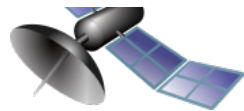

(severe-wx.pbworks.com)

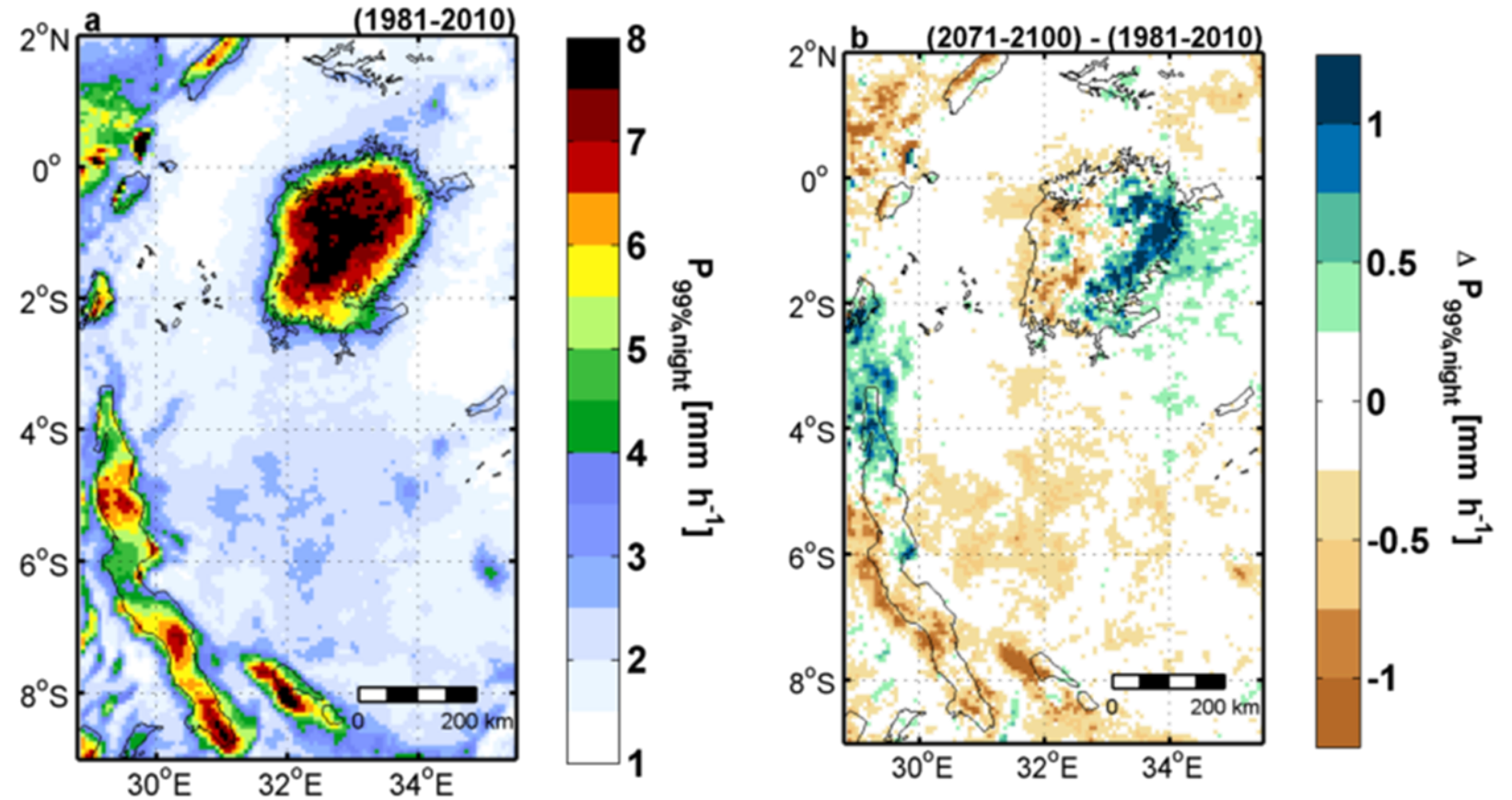2005-2013

Introduction: SEVIRI on MSG

(severe-wx.pbworks.com)

clear lake imprint on thunderstorm occurrence

Climate change: extreme precipitation

- Regional climate model COSMO-CLM² coupled to Flake

- 7 km grid spacing

- CTL:1999-2008 (ERA-Interim)

- HIST: 1981-2010 (CORDEX-Africa - MPI-ESM-LR)

- RCP8.5: 2071-2100 (CORDEX-Africa - MPI-ESM-LR)

(Thiery et al., 2016 Nature Comm.)

Climate change: understanding the controls
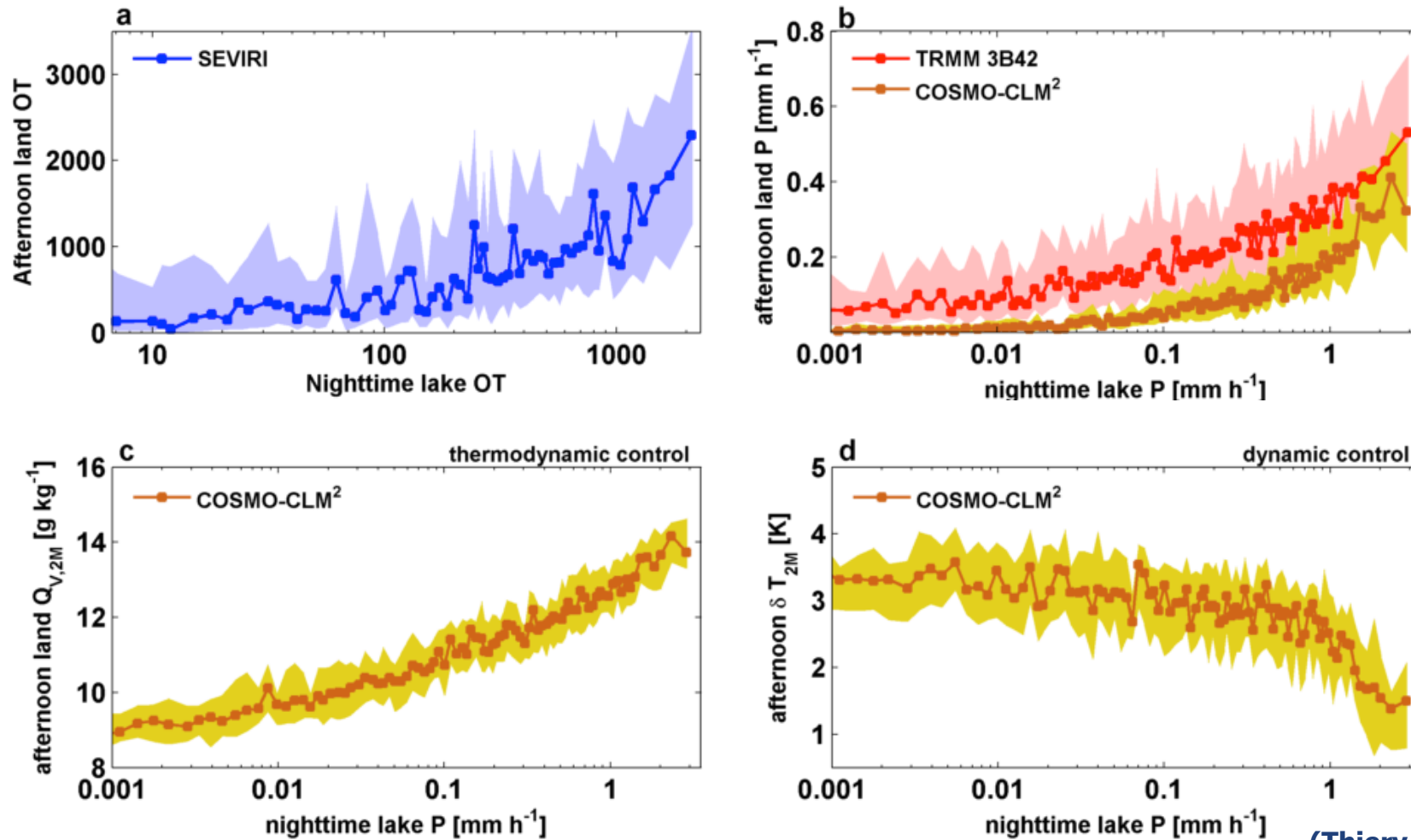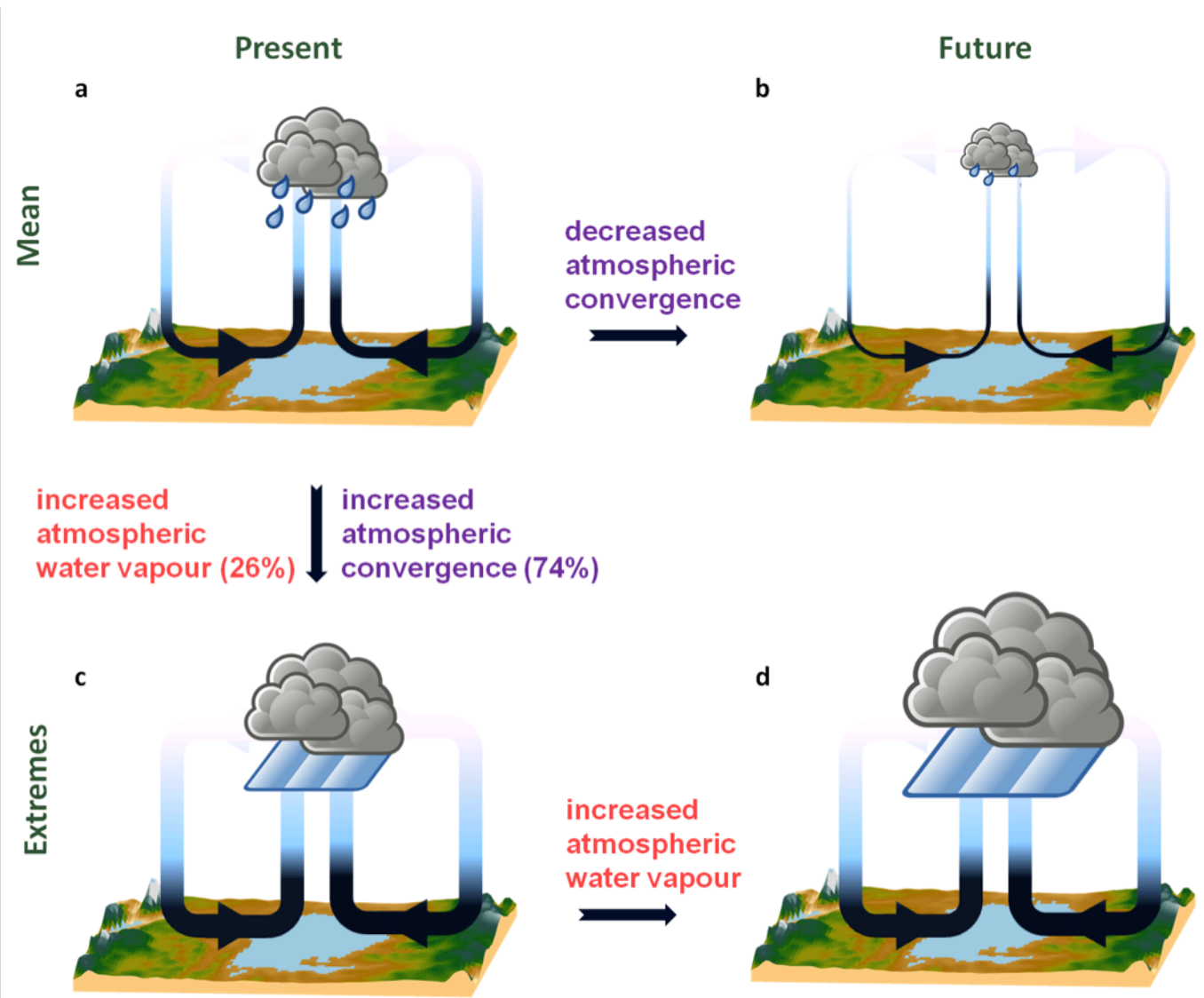

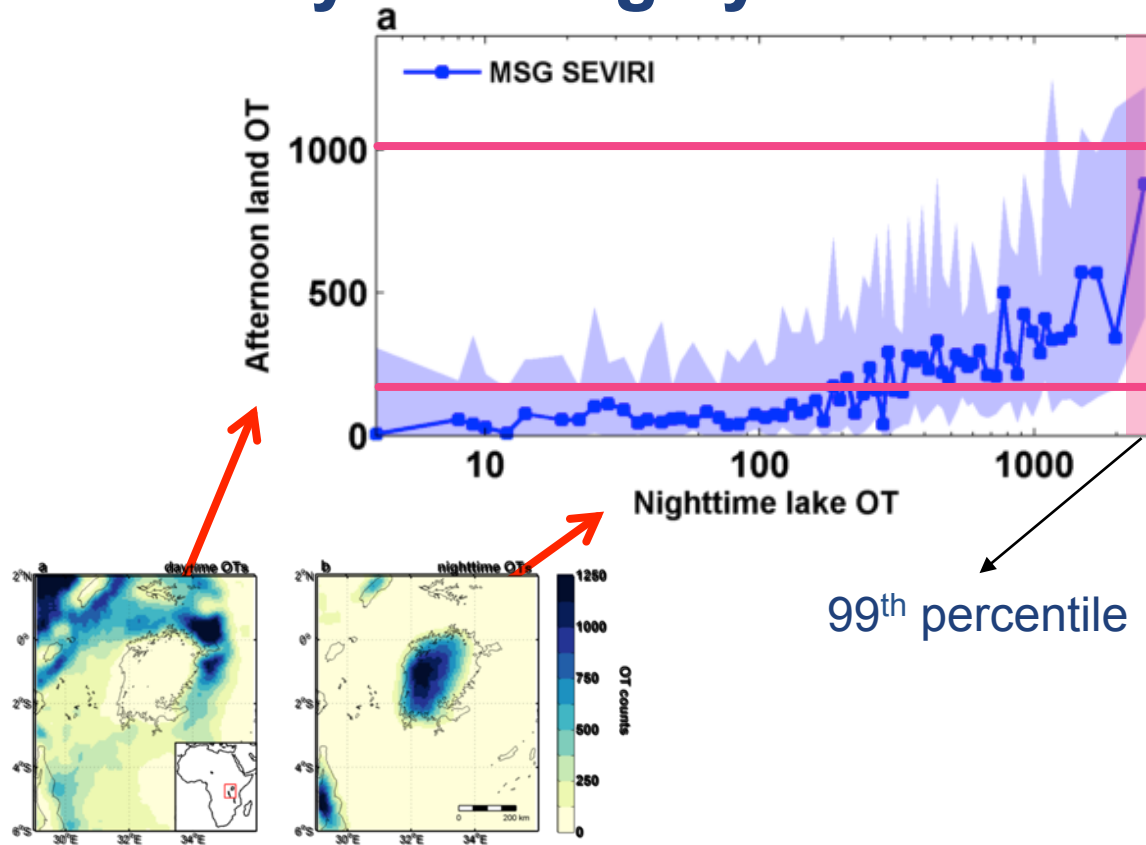(Thiery et al., 2016 Nature Comm.)

26%: increased atmospheric water vapour
74% increased atmospheric convergence

Climate change: extreme precipitation

(Thiery et al., 2016 Nature Comm.)

Towards an early warning system

Log. Reg.: "tonight there will be an extreme event" (X% threshold prob.)

99th percentile

Issue warning

Assess skill

(Thiery et al., 2017 ERL)

Methods: proof of concept

- Logistic regression
- Binary predictant:
  - 'nighttime lake OTs > 99th percentile'
- Predictor:
  - 'afternoon land OTs'
  - 'nighttime lake OTs' (i.e. persistence forecast)
- Model parameters
  - Lead time = 7h
  - Aggregation time = 6h
    - → night = 22-09 UTC; day = 10-15 UTC
  - Land pixel selection = square

(Thiery et al., 2017 ERL)
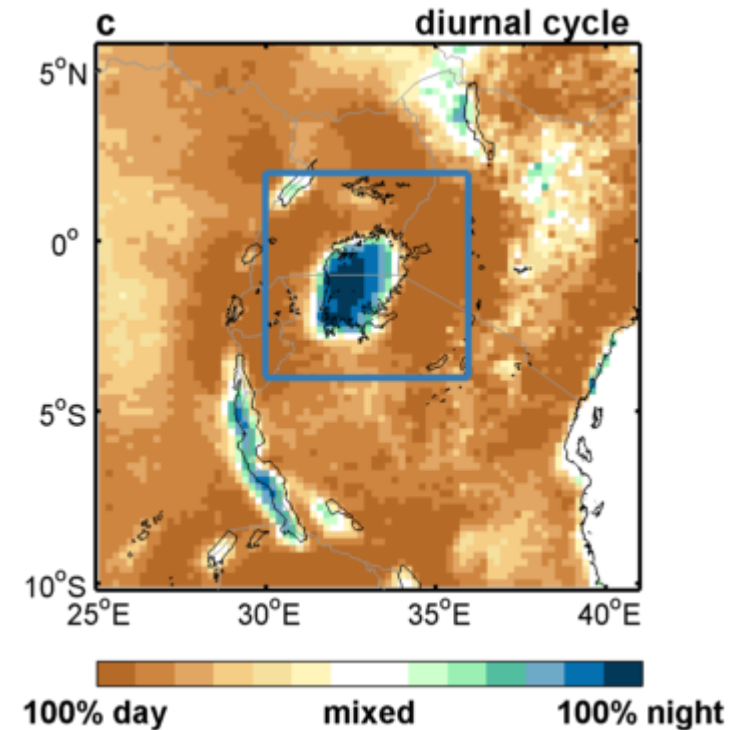
Results: Proof of concept storm predictability

Difference between hit rate and false alarm largest

(Thiery et al., 2017 ERL)

Methods: optimization

a

d   correlation

AUC

Lead time

aggregation time

r_{crit}

Rank correlation

(Thiery et al., 2017 ERL)
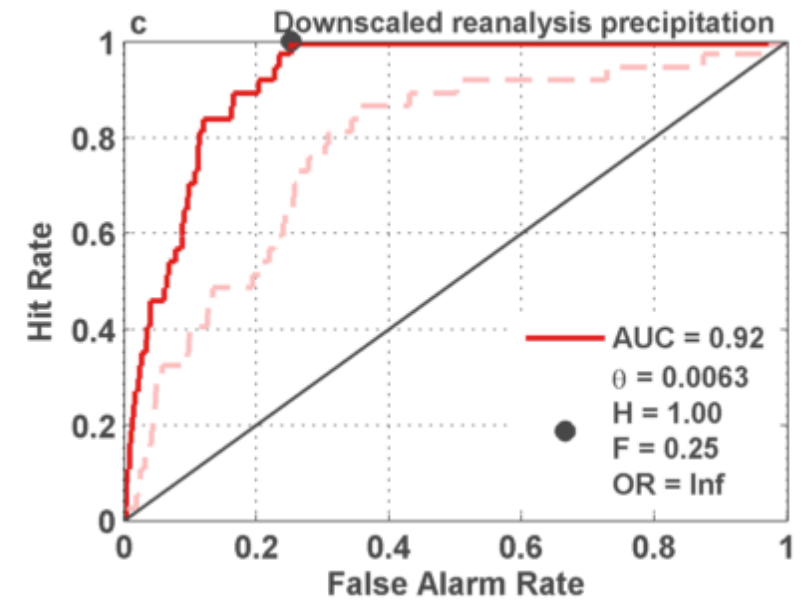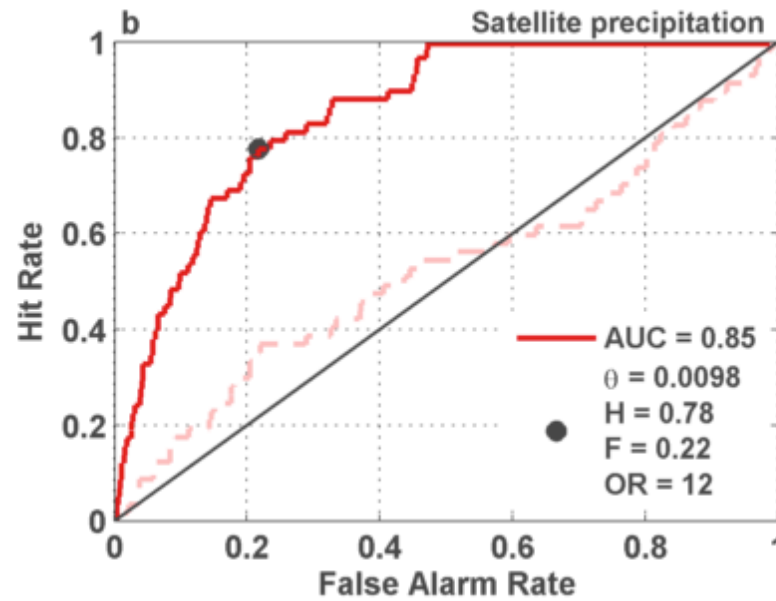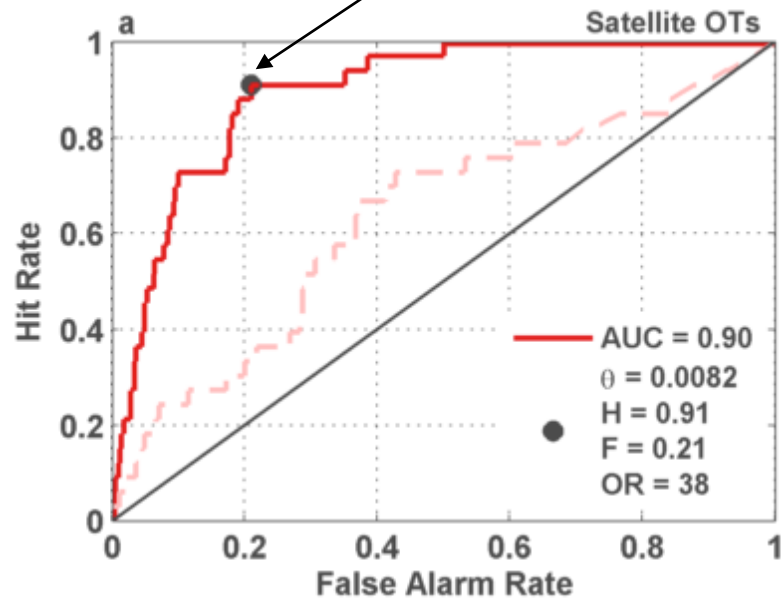
Results: optimization
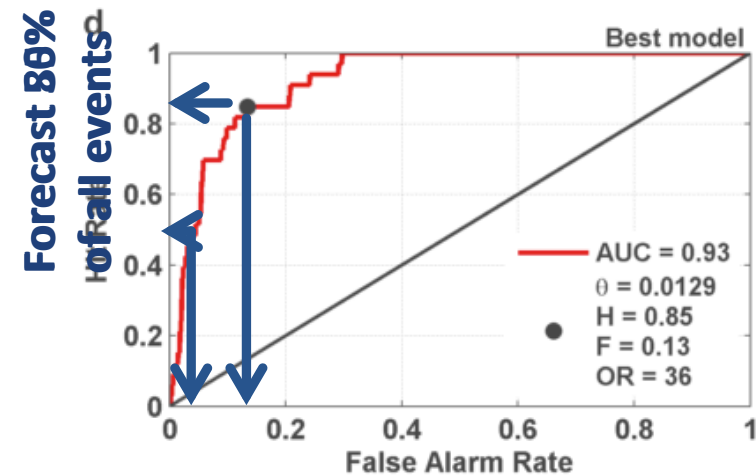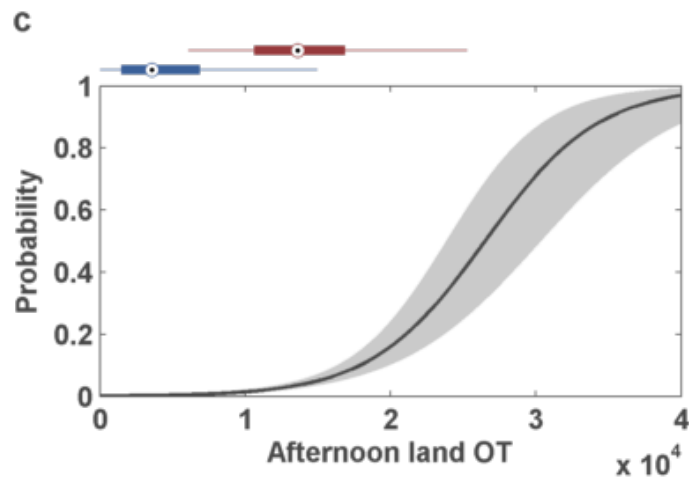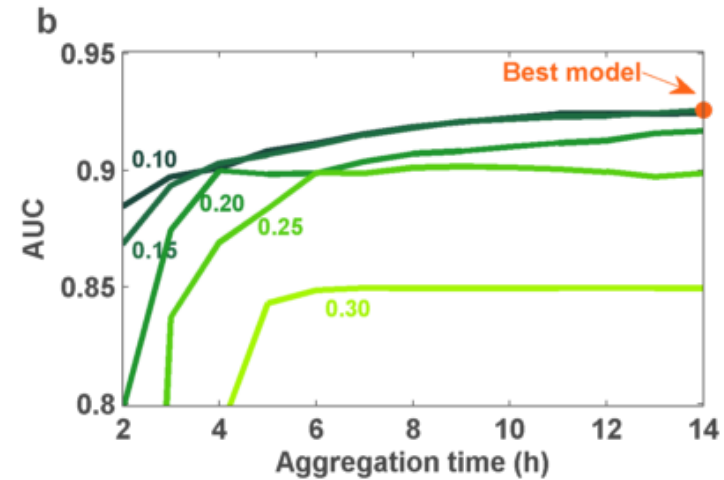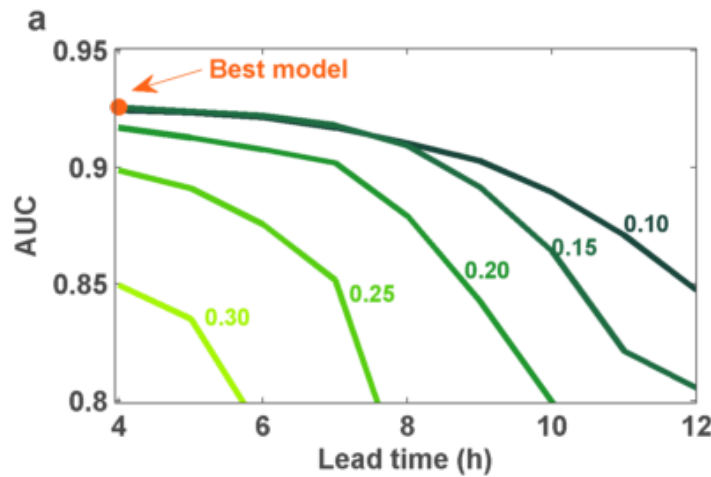
(Thiery et al., 2017 ERL)

False alarms
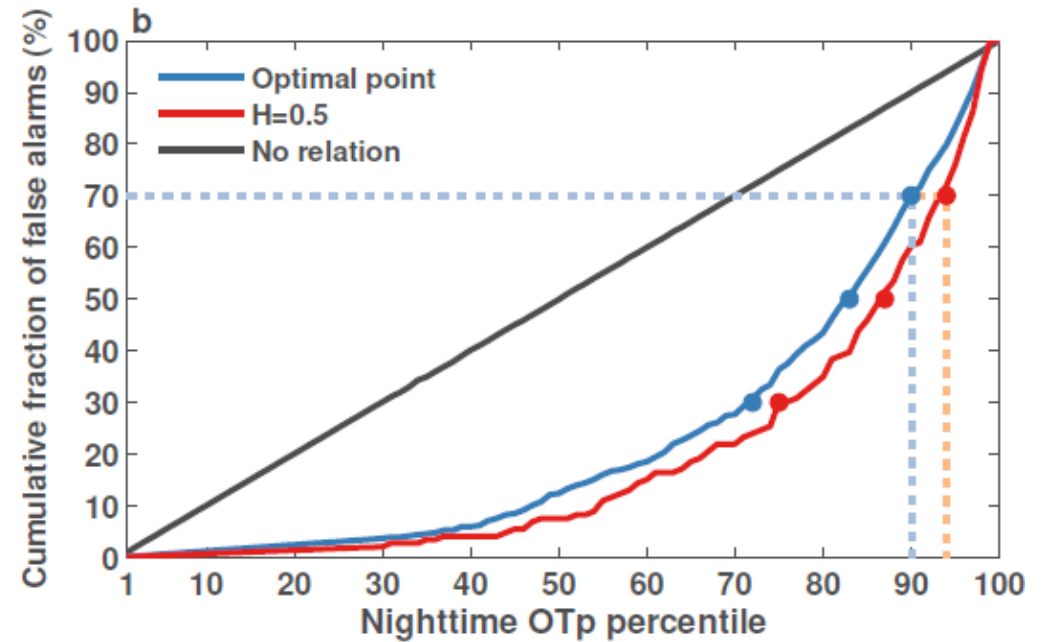
(Thiery et al., 2017 ERL)

30%, 50%, 70% of all false alarms correspond to nights with OT above 90th, 83rd and 72nd percentile

Conclusions and outlook

- Highly skillful prediction system
- Able to forecast nearly all events, but at the expense of a 'large' false alarm rate
- Expert decision needed for 'optimal point' selection
- Computationally cheap, open access

- Improve skill
- Test for other lakes

MATLAB 7.12.0 (R2011a)

File   Edit   View   Debug   Parallel   Desktop   Window   Help

Current Folder: C:\Users\u0079068\Documents\Research\EWS_Victoria\VIEWS

Shortcuts   How to Add   What's New

Current Folder

« Documents ▸ Research ▸ EWS_Victoria ▸ VIEWS ▸

Name ▲

version_20161215
LICENSE
main.m
mf_fix_netcdf4_dimid.m
mf_get_OT_today.m
mf_VIEWS.m
NASA_LARC_SEVIRI_OTDETECTION_2017097.0400.nc
NASA_LARC_SEVIRI_OTDETECTION_2017097.0415.nc
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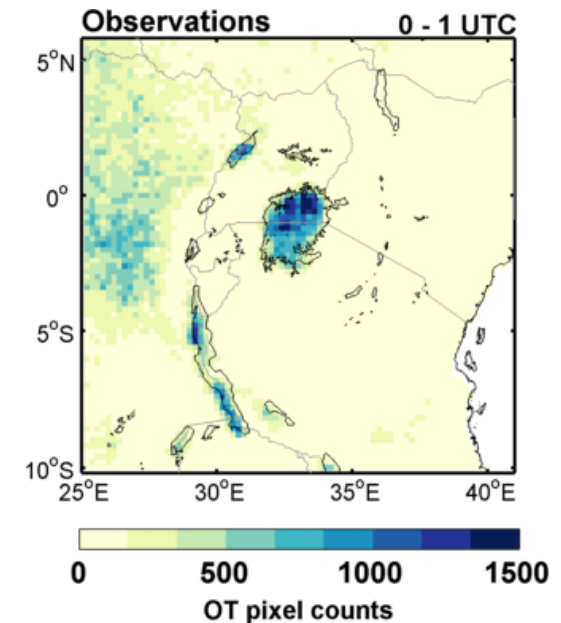NASA_LARC_SEVIRI_OTDETECTION_2017097.0500.nc
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NASA_LARC_SEVIRI_OTDETECTION_2017097.0545.nc
NASA_LARC_SEVIRI_OTDETECTION_2017097.0600.nc
NASA_LARC_SEVIRI_OTDETECTION_2017097.0615.nc
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NASA_LARC_SEVIRI_OTDETECTION_2017097.0945.nc

version_20161215 (File Folder)

Command Window

Time is 13:46h on 27/9/2017

downloading OT data from https://clouds.larc.nasa.gov/prod/exp/lake_victoria

NO WARNING (Whole lake)

NO WARNING (Uganda)

NO WARNING (Kenya)

NO WARNING (Tanzania)

Elapsed time is 7.313106 seconds.

fx >>

Workspace

Select da...

Name ▲	Value
LOGR_OT_best	<1x1 struct>
LOGR_OT_best_Ken	<1x1 struct>
LOGR_OT_best_Tan	<1x1 struct>
LOGR_OT_best_Uga	<1x1 struct>
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OT_rpath	'https://clouds.l
ans	0
flags	<1x1 struct>
hours_day	[10,11,12,13,14,1
hours_night	<1x12 double>
model_best	'OT_models_be!
perc_severe	99
res_reg	0.2000

Start

Thanks! Questions?

(Photo: Tomaz Kunst / Shutterstock)