KU LEUVEN

Changes of climate hazards in the Lake Victoria basin

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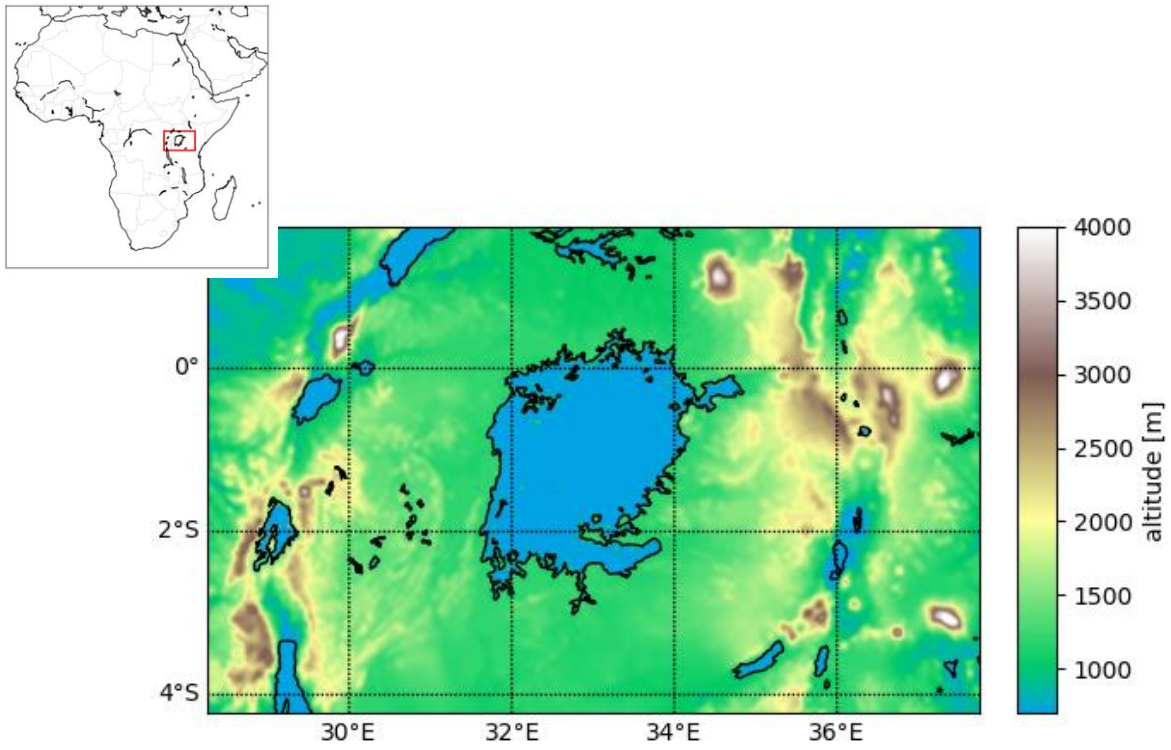
Climate hazards in the Lake Victoria region



Uganda – 8 Dead After More Floods in Kasese

22 MAY, 2020 BY FLOODLIST NEWS IN AFRICA, NEWS

At least 8 people have died in flash floods in the Western Region of Uganda.

Third body of Kasese mudslide victims recovered

The Independent May 26, 2020 NEWS Leave a comment

Rescue efforts have l

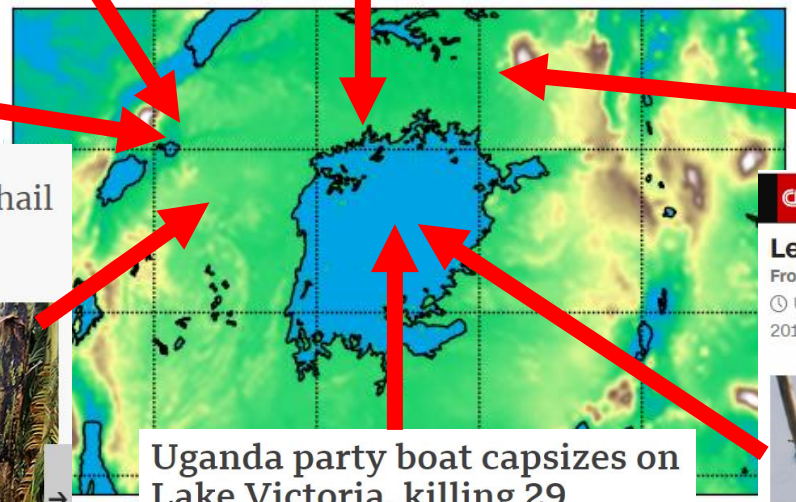
Kasese, Uganda | T
woman, one of the
incident. The landsl

Daily Monitor NEWS BUSINESS OPED SPECIAL REPORTS MAGAZINES SPORTS

KCCA develops master plan to curb city flooding

FRIDAY JUNE 5 2015

A flooded section of Entebbe Road near Clock Tower [illegible]xling is one of the challenges city authorities are grappling with. FILE PHOTO



AFRICA

4 killed in fresh landslides in eastern Uganda

Many feared dead after Tuesday's heavy rains cause floods, landslides in Bududa district

Hamza Kyeyune | 04.12.2019

Home \ Regional \ Storm leaves over 2,000 households in hail

Storm leaves over 2,000 households in hail

By Deusdedit Ruhangariyo
Added 22nd February 2018 01:49 PM

WEATHER | CATASTROPHIES

MBARARA - **Over 2,000 households in Bukiro sub-county, Kashaari county in Mbarara district were left in disarray after a sporadic storm that broke the short January dry spell recently.**

Uganda party boat capsizes on Lake Victoria, killing 29

25 November 2018

REUTERS

Saturday's accident occurred off Uganda's Mukono district, near Kampala

CNN World

Lethal weather on 'world's most dangerous lake'

From Errol Barnett, CNN

Updated 1448 GMT (2248 HKT) January 17, 2013

Photos: Life on Africa's biggest lake

Lake Victoria - But fishermen are often at risk because the lake's erratic weather conditions cause frequent accidents.

Goals

What are “climate extremes”?

How do these extremes change
in a warming climate?

What are atmospheric conditions
preceding these extremes?

Goals

What are “climate extremes”? → Extreme Value Analysis (fitting Generalized Pareto Distribution)

How do these extremes change in a warming climate? → CCLM Surrogate climate projections (ERA5 + CMIP6 ensemble perturbation)

What are atmospheric conditions preceding these extremes? → Climate extreme composites

Simulation set-up

PD & EoC
COSMO-CLM 5.0 , ‘tropical set-up’
Convection-permitting resolution (2.8 km)
FLake coupled, Two-Moment microphysics scheme activated

Present-Day (PD)	End-of-century (EoC)
(2005) 2006-2016	(2080) 2081-2091
ERA5	ERA5 + ΔCMIP6 SSP5 8.5 (2070/2100 - 1995/2025)

Surrogate climate projections

CMIP6 model ensemble at daily temporal resolution for PD and EoC.

- 3D variables: *ps, tas, uas, vas, huss* at surface
- 4D variables: *zg, ta, ua, va, hus* at pressure levels

ΔCMIP6 fields at hourly temporal resolution, spatially matching ERA5 grid.

- 4D variables: *p, ta, ua, va, hus* at ERA5 model levels

Surrogate climate projections

CMIP6 model ensemble at daily temporal resolution for PD and EoC.
- 3D variables: *ps, tas, uas, vas, huss* at surface
- 4D variables: *zg, ta, ua, va, hus* at pressure levels

- (1995-2025) and (2070-2100) averages --> annual cycle
- Ensemble means for PD and EoC
- Smoothing: temporal (3 main Fourrier components) and spatial (Gaussian filter)
- Climate signal Δ=EoC-PD
- Horizontal (bilinear/conservative) and vertical (linear) interpolation of Δ to ERA5 grid
- Linear interpolation over time (daily --> hourly resolution)

ΔCMIP6 fields at hourly temporal resolution, spatially matching ERA5 grid.
- 4D variables: *p, ta, ua, va, hus* at ERA5 model levels

Mean and extreme precipitation

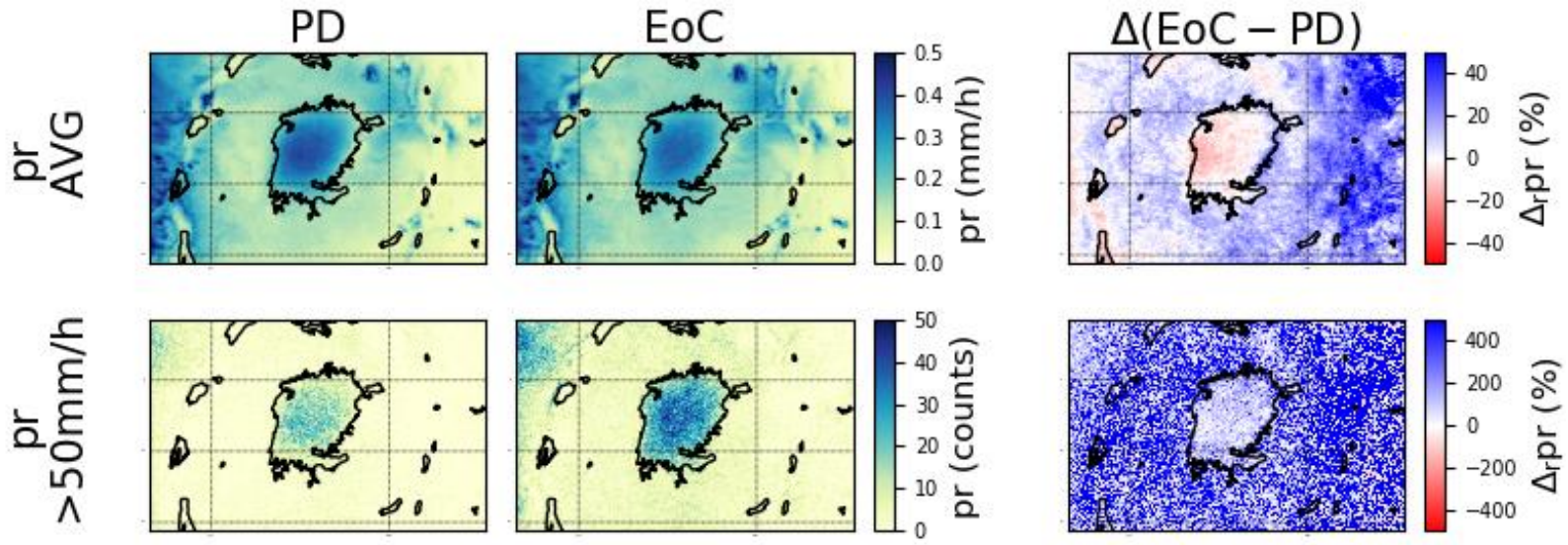


Fig.1. Mean precipitation for both PD and EoC runs and the relative difference.
Number of extreme rainfall events (pr>50 mm/h) and the relative change.

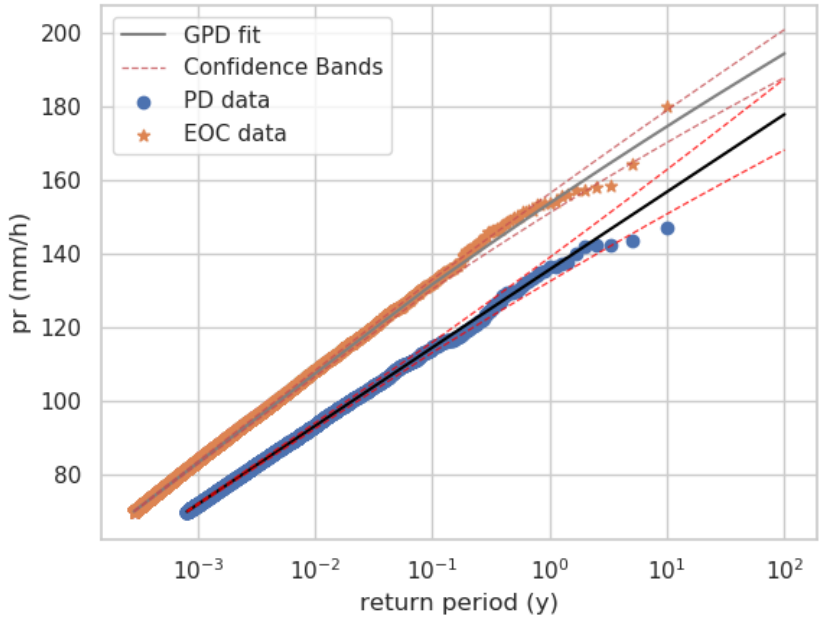


Fig.2. Return level plot for PD and EoC extreme over-lake rainfall.

Atmospheric conditions around extreme composite?

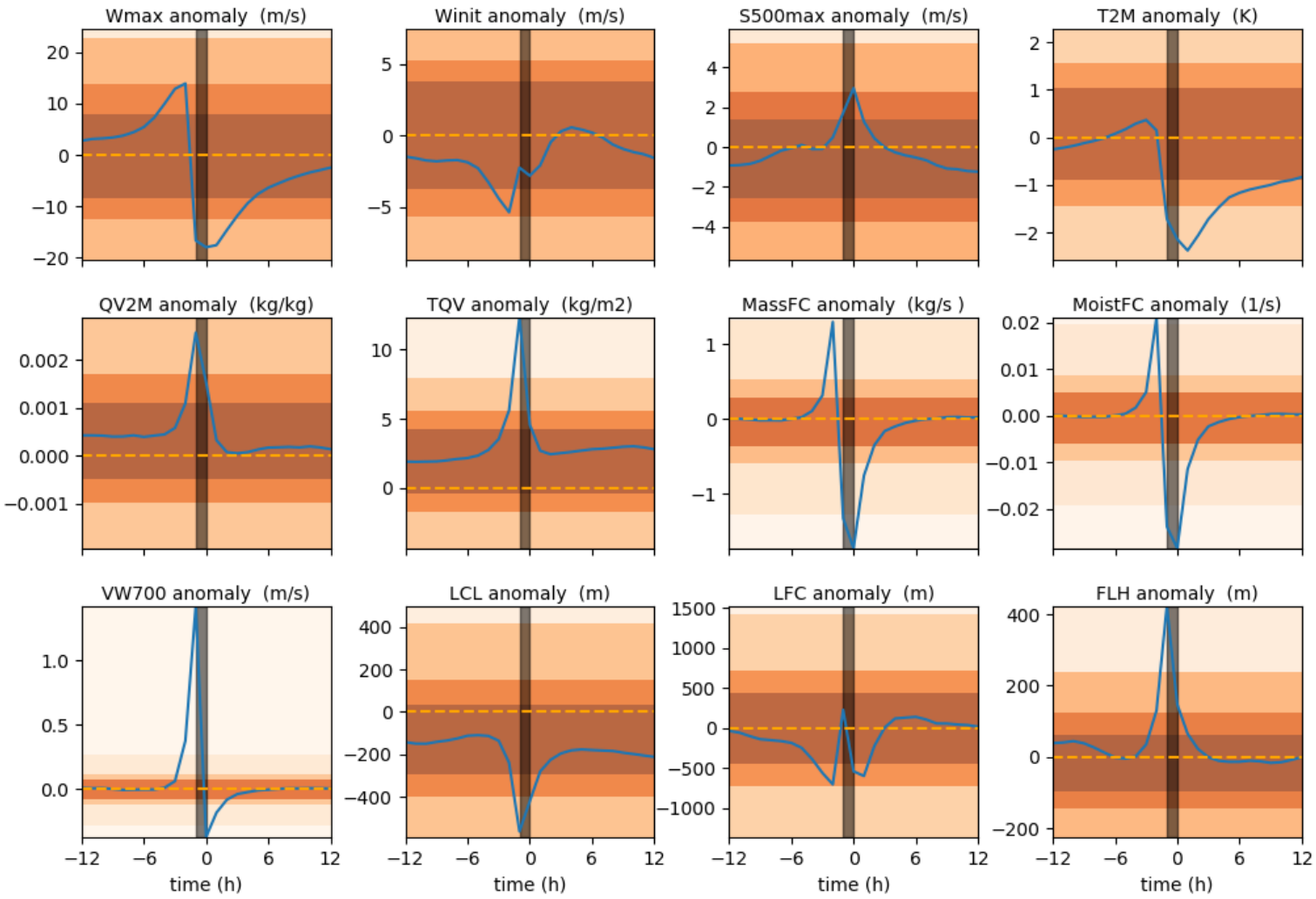


Fig.3. Atmospheric condition anomalies before and after a composite of extreme over-lake rainfall events (pr>75mm/h). The orange bands represent the 75, 85 and 95 percentiles of all (non-extreme) conditions.

Do pre-storm conditions determine storm intensity?

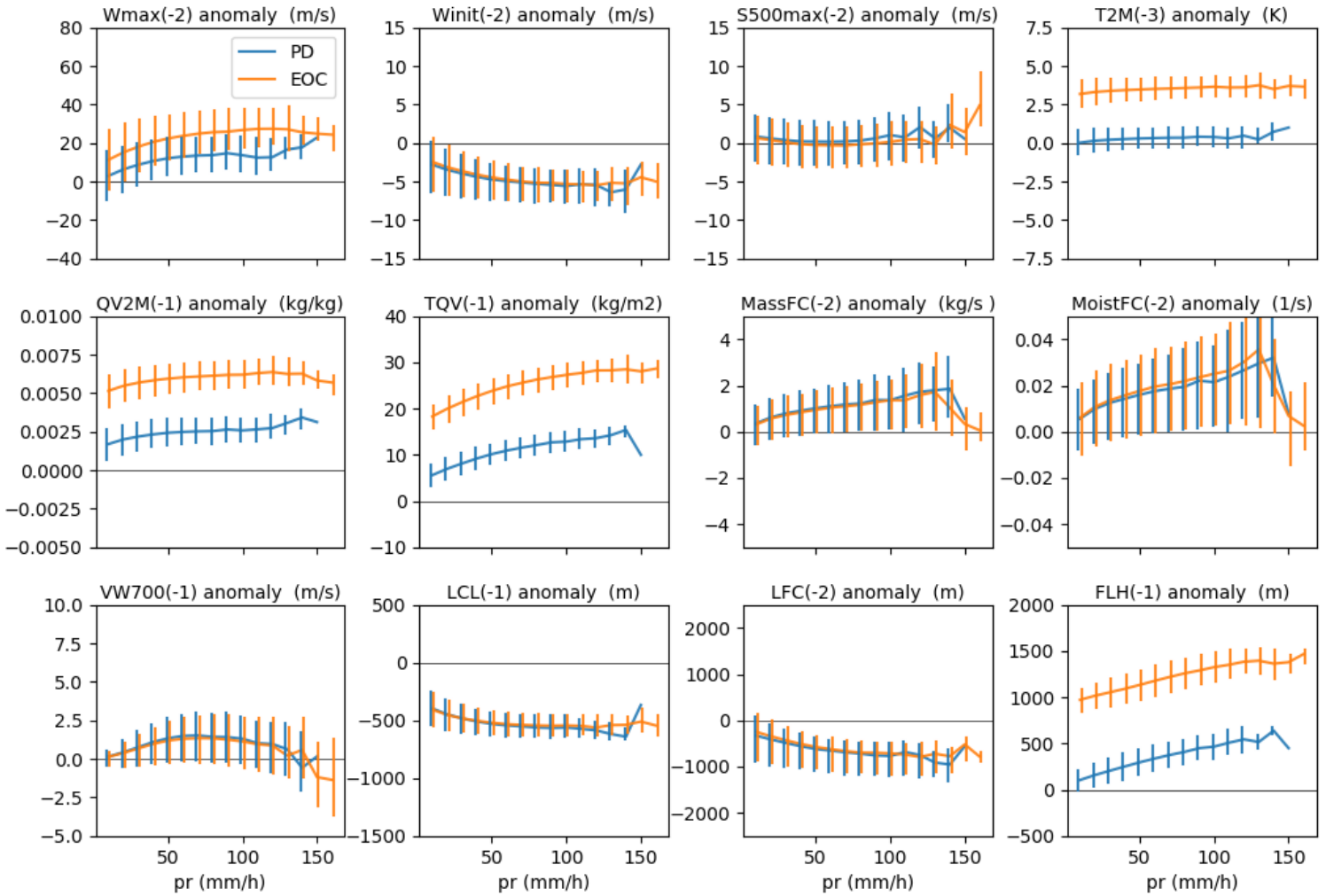


Fig.4. Atmospheric condition anomalies 1, 2 or 3 hours before a composite of extreme over-lake rainfall events of different intensities, for both present-day (PD) and end-of-century (EoC) runs.

Multivariate view on extreme conditions (1)

pr > 75 mm/h -- LAKE (PD)

pr > 75 mm/h -- LAKE (EoC)

EoC - PD

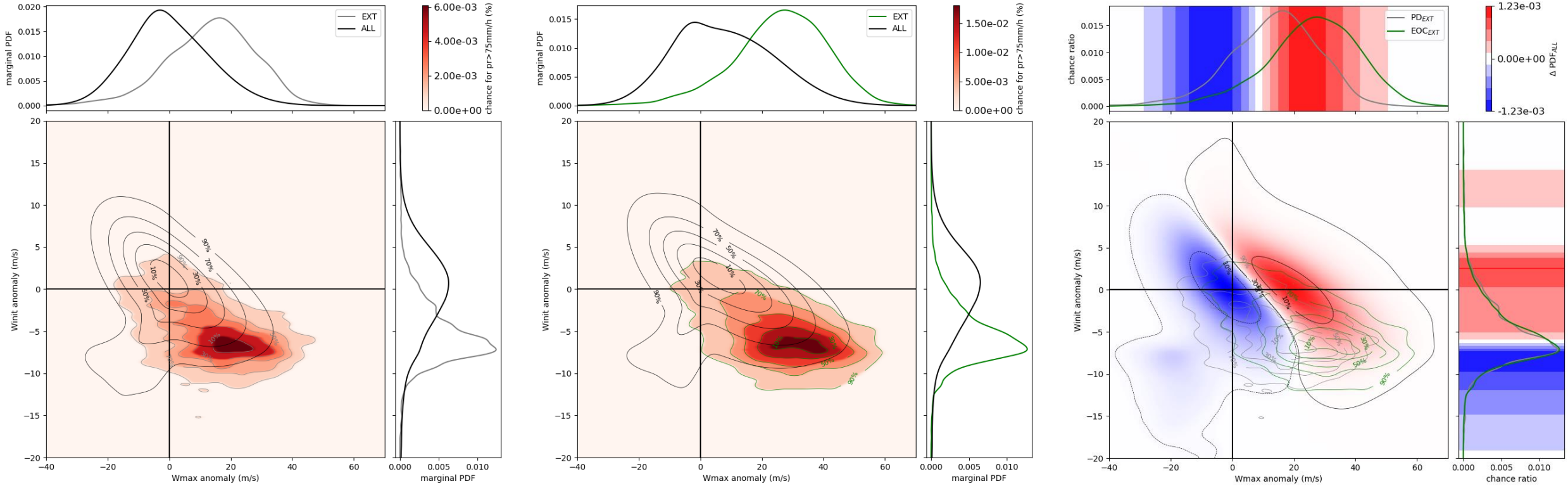


Fig.5. Combined atmospheric condition anomalies required to produce extreme over-lake rainfall event (pr>75 mm/h) in PD, EoC and the difference, given by grey and green contours. Black contours and blue-red colors in the difference plot represent all (non-extreme) conditions.

Multivariate view on extreme conditions (2)

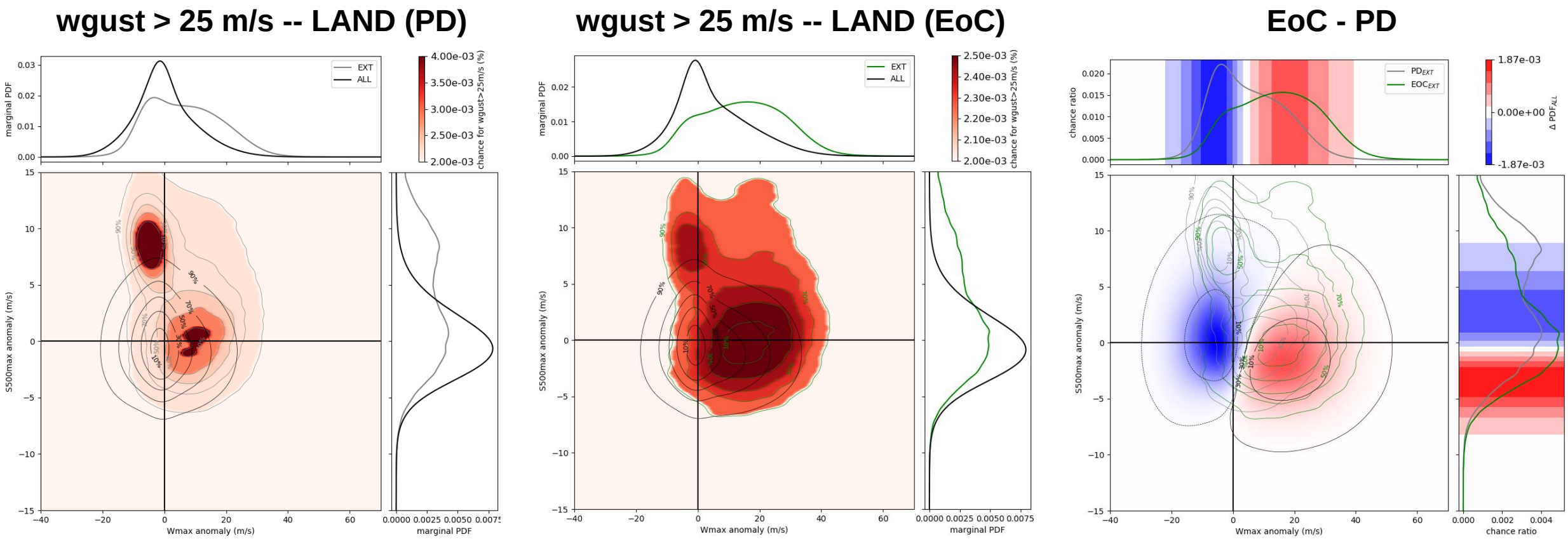


Fig.6. Same as Fig.5 but for over-land extreme wind gusts.

Conclusion

- Weather hazards affect the Lake Victoria region

- Total over-lake precipitations will decrease, but extremes occur more often and intensify

- High-CAPE
Low-CIN
High moisture content
High moisture flux convergence

  are required to produce intense rainfall

- CAPE and moisture content will increase in future

- A multivariate approach is necessary to explain future changes in extremes.

Thank you! Questions?

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