RADAR POLARIMETRIC SIGNATURES OF SEVERE CONVECTIVE STORMS: TOWARDS AN EARLY WARNING SYSTEM FOR LAKE VICTORIA BASIN

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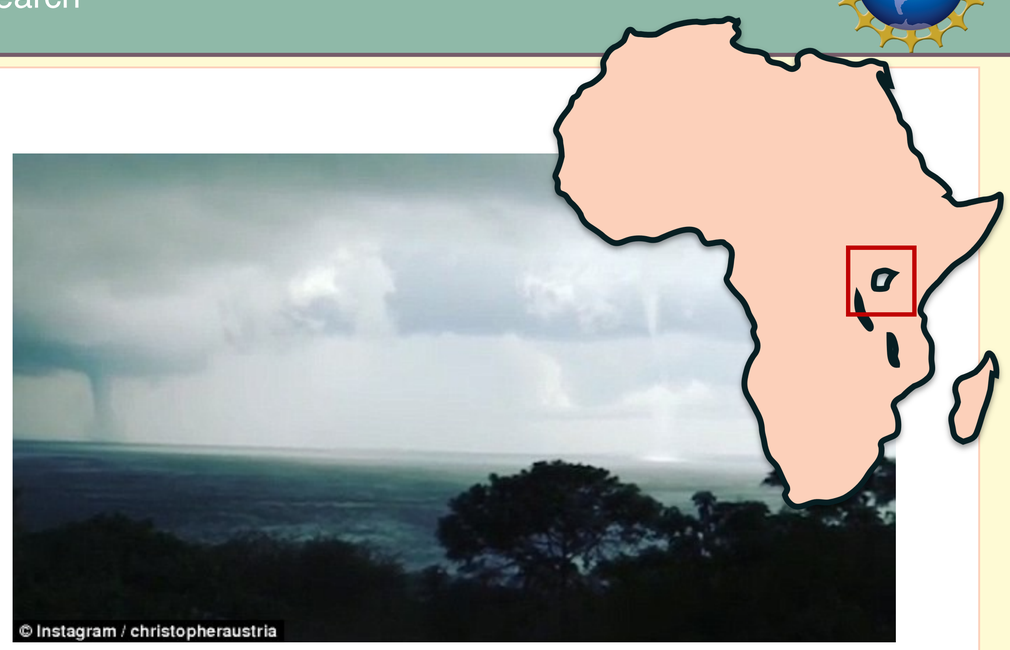
SEVERE WEATHER IN LAKE VICTORIA

> *" […] conditions when dark clouds descend in the form of a tail and touch the water surface," referred to locally as "**Nsoke**" (waterspouts)."*
> - Kiwanuka-Tondo, J. et al. (2019)

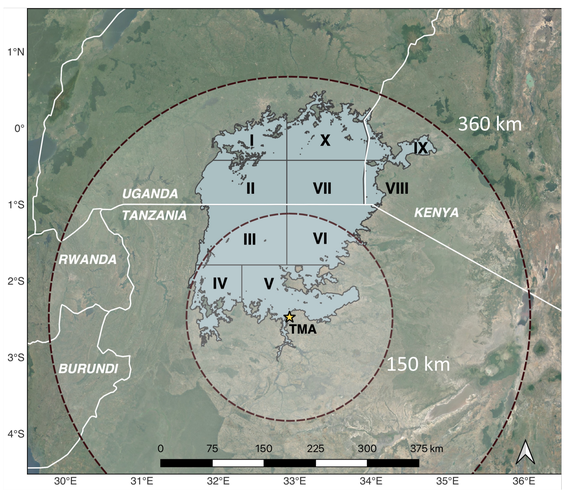
- Largest freshwater lake in Africa and a global hotspot for severe thunderstorm activity: ~**1,000 fishermen die annually due to severe weather-related accidents**
- **Only 40% of Africa's population has access to Early Warning Systems** (State of Africa 2020)
- **Major lack of meteorological observations and capacity to monitor and forecast weather hazards** (WMO 2020; del Moral Méndez et al. 2023).
- Africa (1.2 billion people and 30 million km^2) **has only 6% of weather radars compared to the total number of US and European radars combined** (1.1 billion people and 20 million km^2) (Tzachor et al. 2023)



Two waterspouts in Lake Victoria (July 2016). Picture: Christopher Austria (Instagram)

RADAR DATA

Tanzania Meteorological Authority **S-band dual-polarization** radar in Mwanza (TMA)




TMA Radar in Mwanza (TZ). Photo: Rita Roberts

TMA radar specifications:

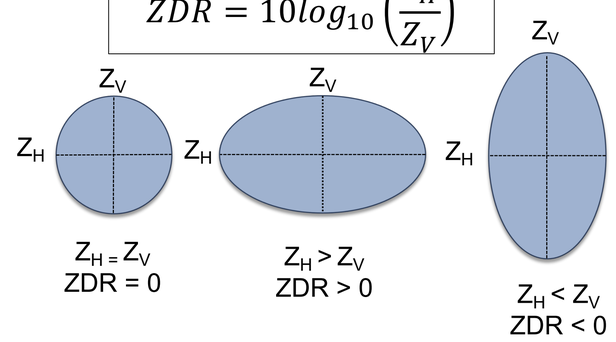
- **Elevation [m.a.s.l]:** 1150
- **Manufacturer:** Enterprise Electronics Corporation (EEC)
- **Wavelength [cm]:** 10
- **Beamwidth [°]:** 1
- **Gate width [km]:** 0.125
- **Moments:** Z, V, ZDR, KDP*, ρHV*
- **PRF [pulses s^{-1}]:** Dual: High (1000)/Low (400)

Single vs dual-polarization radar

- Different dual-pol products indicate **how matter interacts with the phase and amplitude** of electromagnetic waves
- **Valuable information in the operational arena** (i.e., nowcasting, real-time monitoring, decision-making processes, etc.)

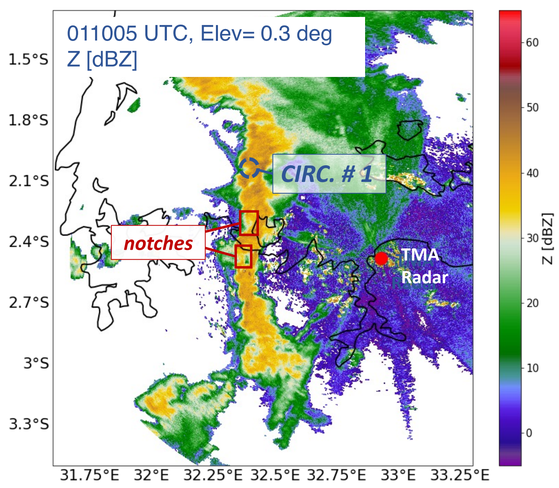
Differential reflectivity, ZDR [dB]

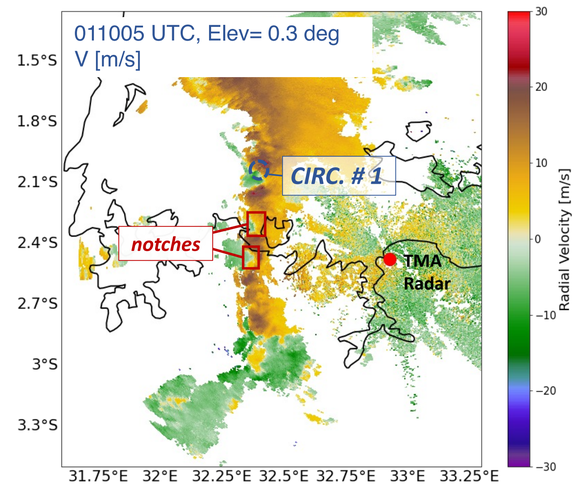
$$ZDR = 10log_{10}\left(\frac{Z_H}{Z_V}\right)$$

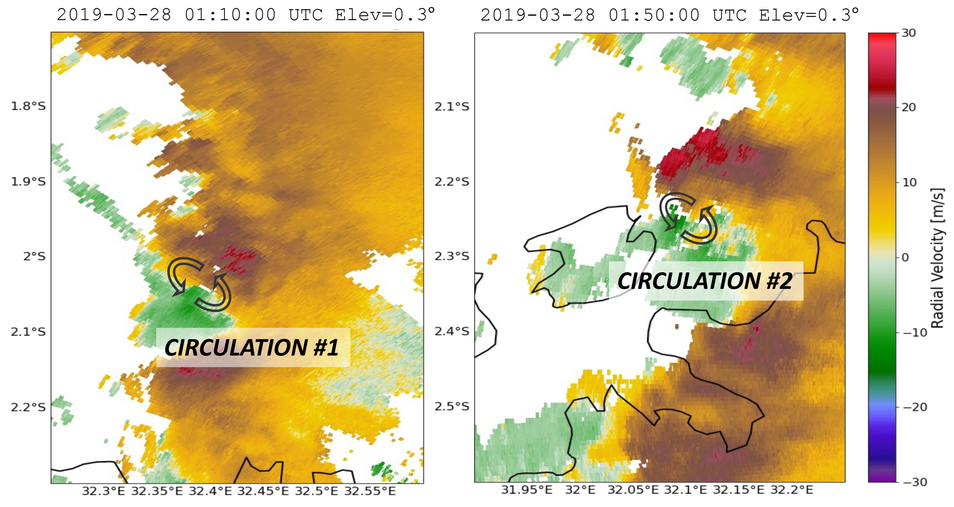


- ZDR column: **updraft intensification**
- ZDR ring: **mid-level max vorticity** (updraft rotation-supercell)
- ZDR arcs: **low-level rotation** along inflow side of forward flank

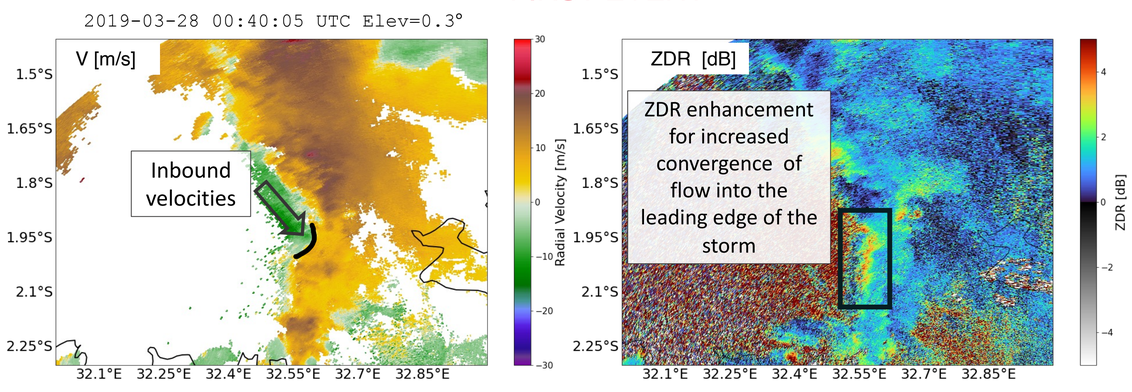
CASE STUDY: LINEAR CONVECTIVE SYSTEM - 28.03.2019

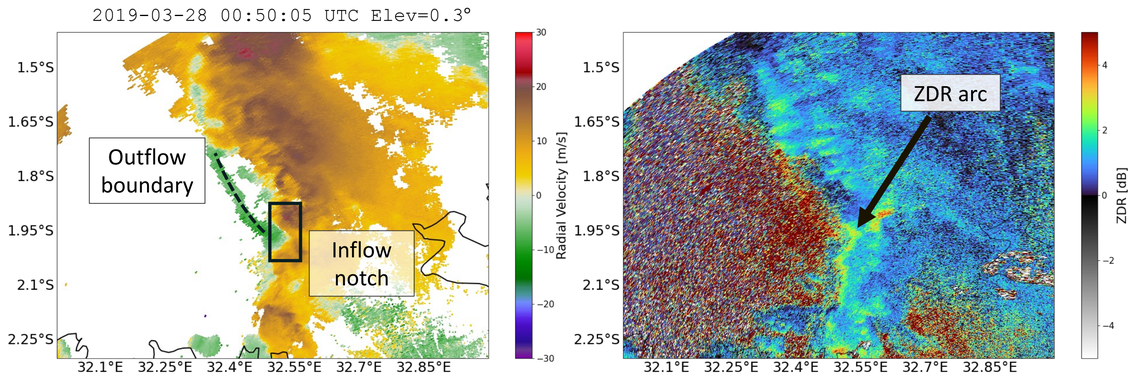


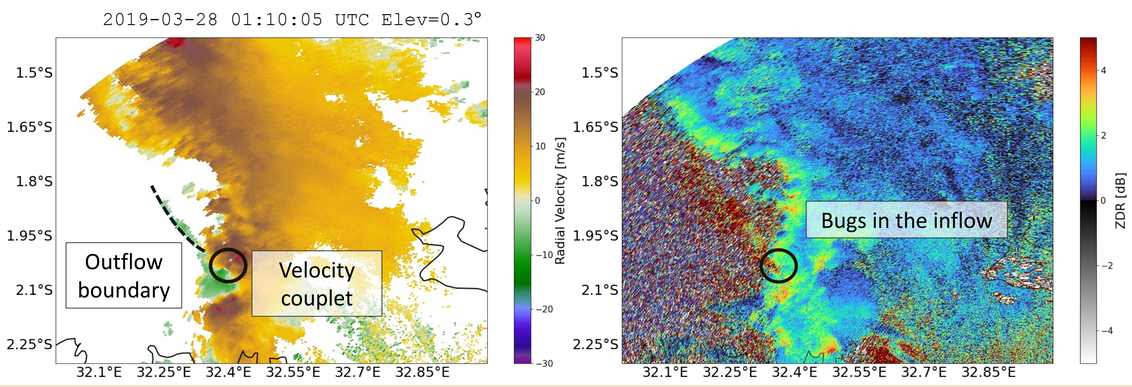




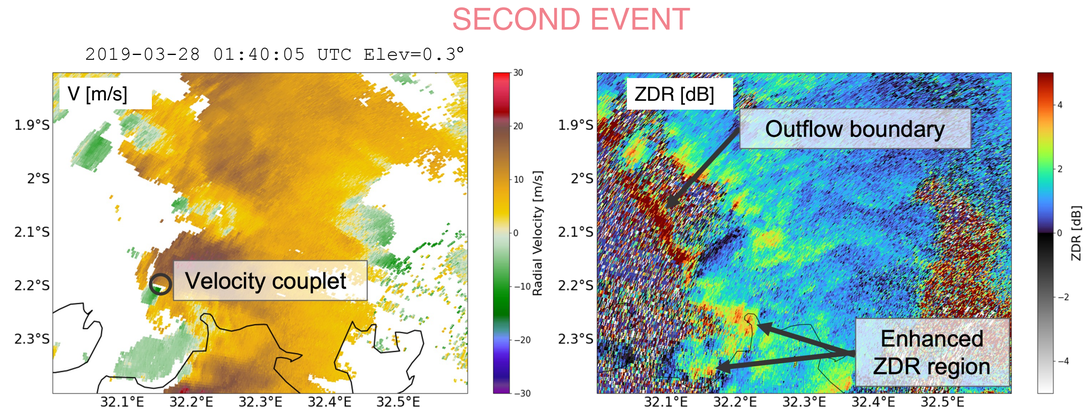
FIRST EVENT

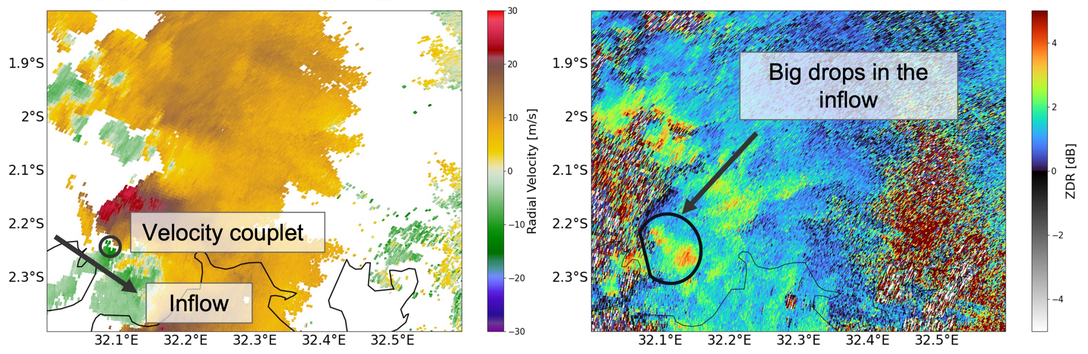






SECOND EVENT





- Dual-pol capabilities from the TMA radar provide a **better understanding of severe convection over Lake Victoria.**
- **Potential early warnings of possible severe phenomena** by identifying signatures in the radar imagery with real-time monitoring and nowcasting.
- **Potential for automatic dual-pol features identification within TITAN** (see poster WCRP #281)
- **Need for** radar nowcasting, dual-pol severe weather signatures **training**, and radar calibration for different cases at the NMHS.

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