

# Coordinated Regional Downscaling Experiment (CORDEX)



JSC 36 presentation, 8 April 2015



# **CORDEX – Scientific Challenges**

To advance and coordinate the science and application of regional climate downscaling through global partnerships

1. To better understand relevant regional/local climate phenomena, their variability and changes, through downscaling.
2. To evaluate and improve regional climate downscaling models and techniques
3. To produce coordinated sets of regional downscaled projections worldwide
4. To foster communication and knowledge exchange with users of regional climate information.

# CORDEX – Scientific Challenges

## ✧ Added value

Internal variability & added value as functions of scale; Bias correction uncertainties and consistency; User-oriented metrics

## ✧ Human element

Coupling of regional climate and coastal megacities; Bridging with urban parameterisation development; Land use change

## ✧ Coordination of regional coupled modelling

Ocean-ice-atmosphere; Lakes; Dynamic land surface; Natural fires; Atmospheric chemistry; Carbon cycle; Aerosols; Marine biogeochemistry

## ✧ Precipitation

Convective systems; Coastal storm systems; MJO/Monsoon

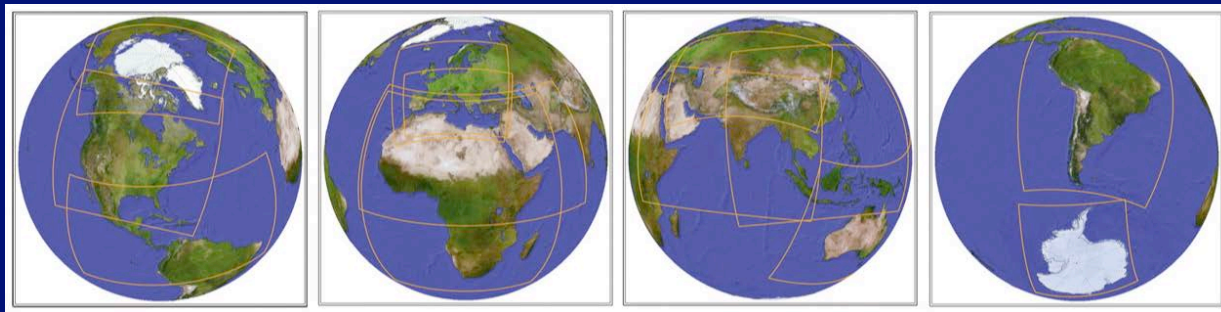
## ✧ Local wind systems

Wind storms; Strong regional winds; Wind energy

# CORDEX – Scientific Challenges

## ✧ Flagship Pilot Studies (FPS)

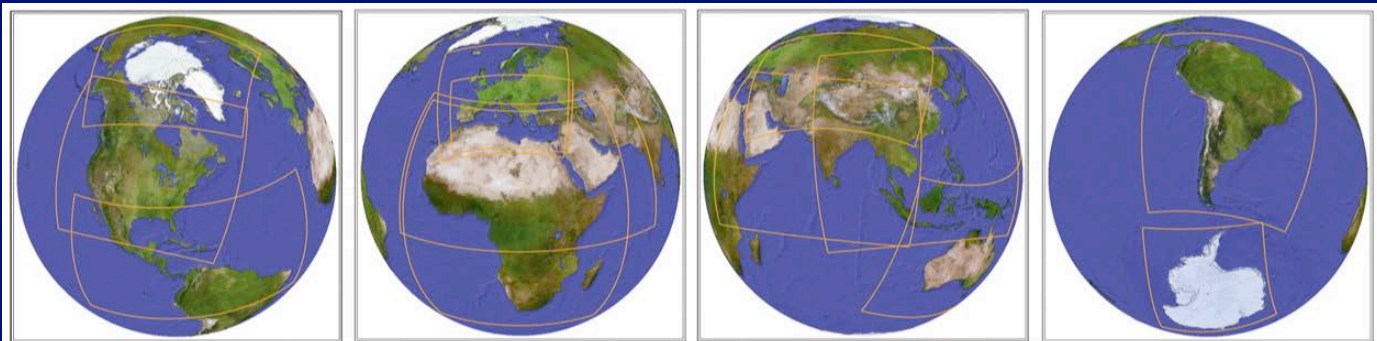
- In development
- Coordinate developments in conv.-permitting climate sim.
- Must have
  - ◆ Fine-scale processes important to region's climate (physical basis)
  - ◆ Observational basis for verification (analysis basis)
  - ◆ User applications (VIA basis)
- Potential connection with other WCRP programs, esp. GEWEX
- Specific FPS to be proposed by regions





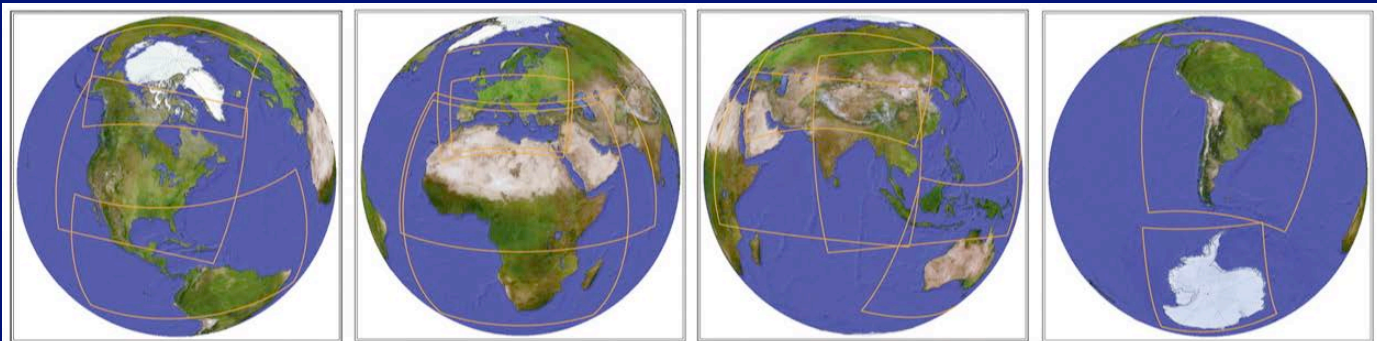
# CORDEX – Regional Downscaling

- Review paper in progress
- Dynamical and Statistical Downscaling:
  - Advancing each for climate information
  - Coordinating comparison of methods: advantages of each?
  - Exploration of hybrid approaches
- Links with VIA communities:
  - WGRC coordination
  - Distillation of climate information
  - Importance of analysis of phenomena
- Links with observational community



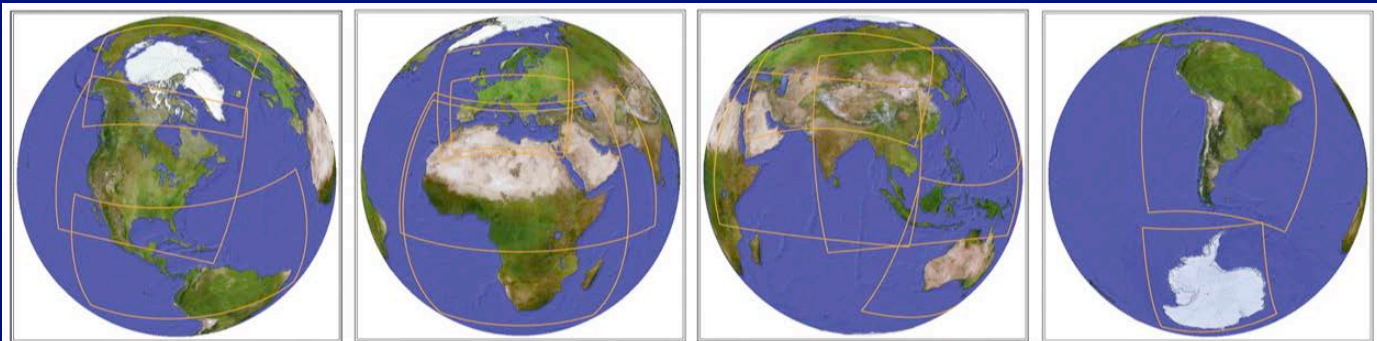
# CORDEX – Coordination

- International Project Office for CORDEX (IPOC)
- Science Advisory Team (SAT) Meeting 2  
(26-28 Feb 2015, SMHI, Norrköping, Sweden)
- ICRC: CORDEX-2016
- CMIP6: ScenarioMIP, ClimservicesMIP, . . .
- Coordination beyond CORDEX:
  - WGRC & Grand Challenges
  - IS-ENES2 (ESGF & data policy)
  - Future Earth (through WCRP and regional office)
  - Obs4MIPS, TGICA, GFCS
  - Funding [e.g., APN, GFCS, EU, World Bank, Asian Dev. Bank . . .]



# CORDEX – Prominent Issues

- **Model development: Cloud-resolving climate dynamics**
  - Flagship Pilot Studies
- **Observational deficiency: Climatological observations at spatial/temporal scales of regional phenomena**
  - Processes resolved by dynamical models
  - Targets for statistical downscaling

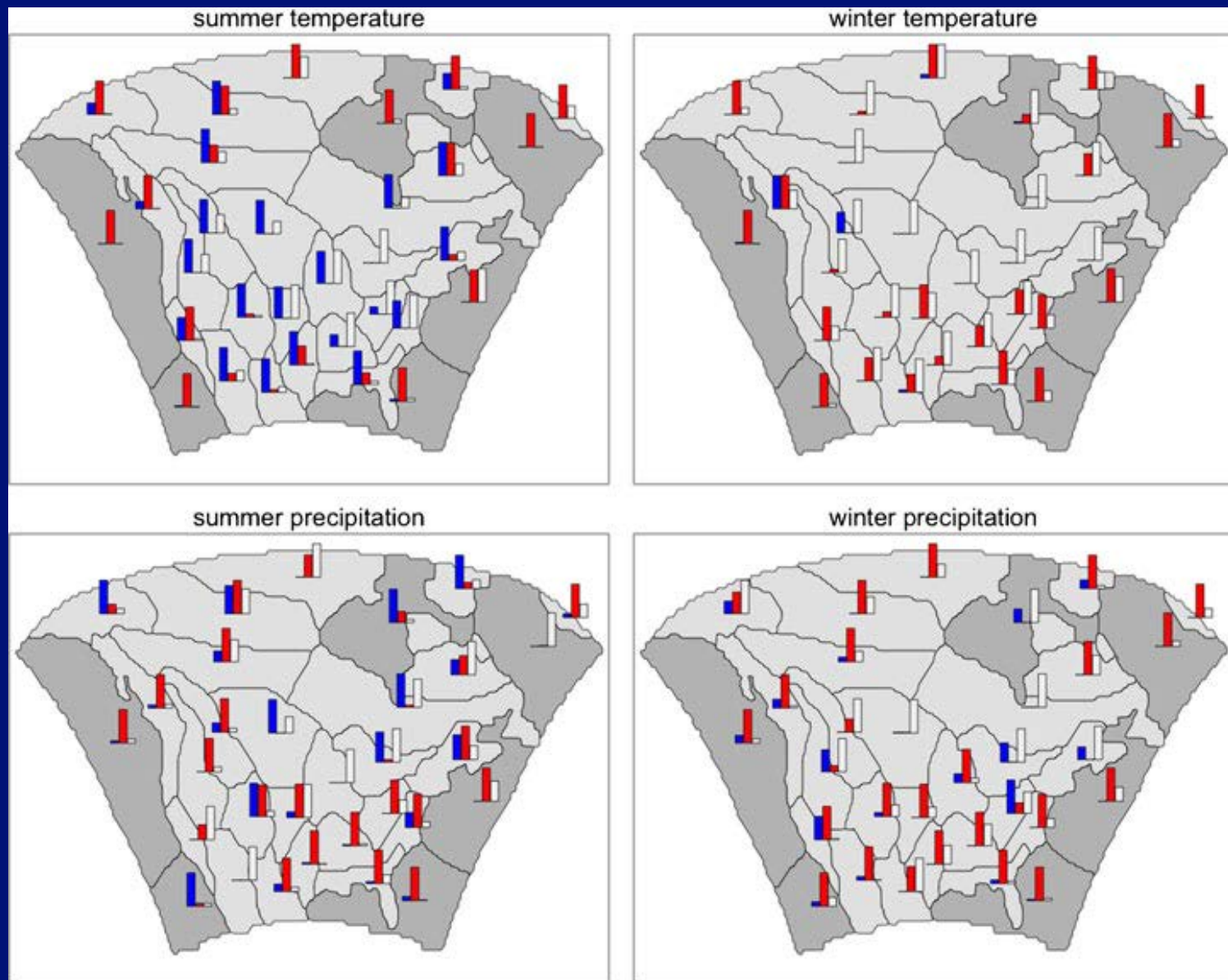


# Thank You





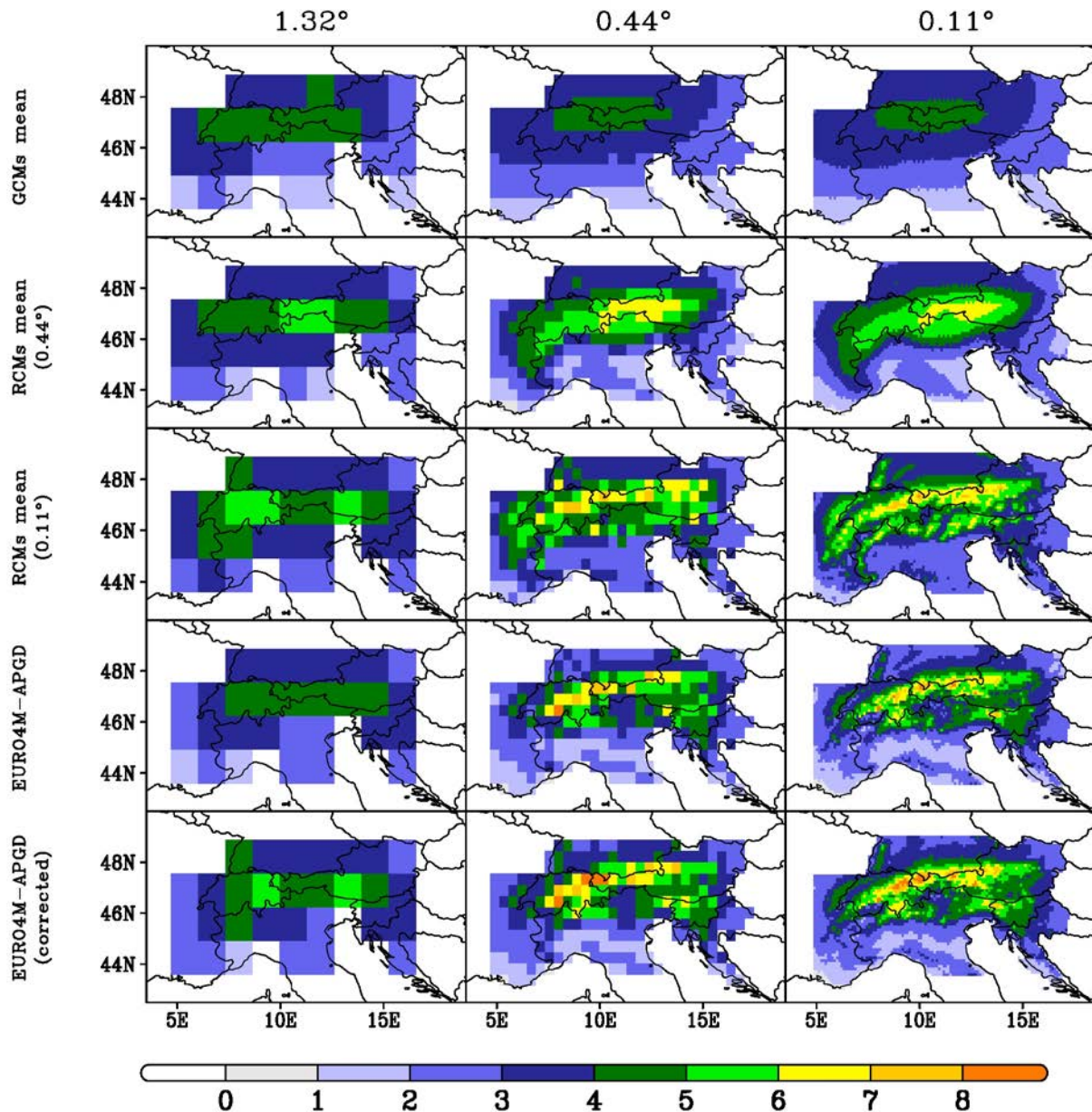




**ANOVA: Blue = RCM, Red = GCM, White = Residual**

(Mearns et al., 2013)

JJA



Higher resolution



Increasing details  
in precipitation  
spatial distribution

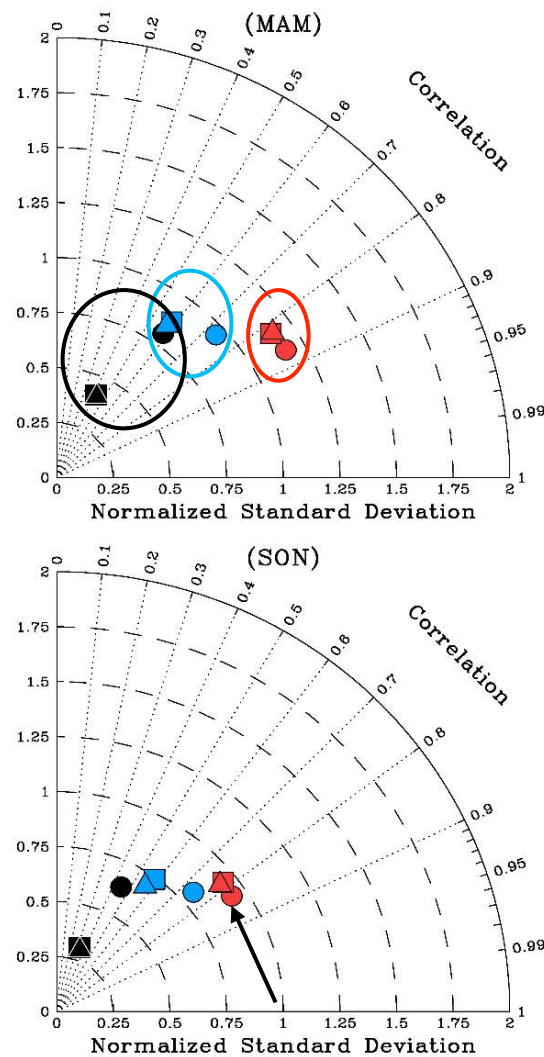
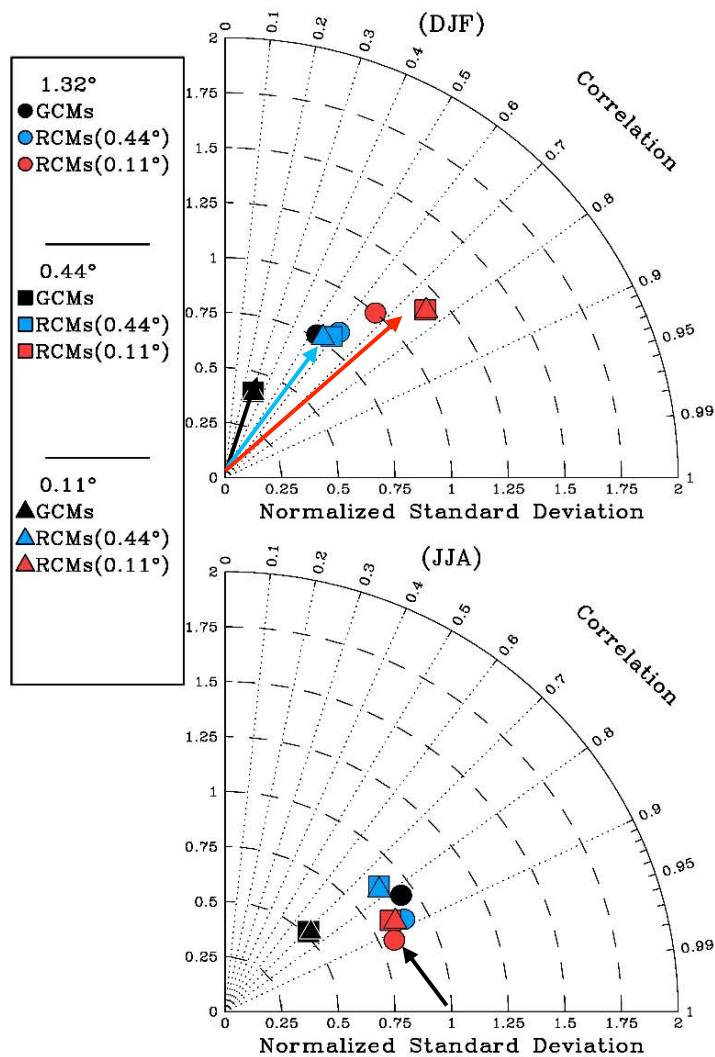


Fine scale AV

(Toma et al., 2015)

Added value of regional climate modeling over areas  
characterized by complex terrain

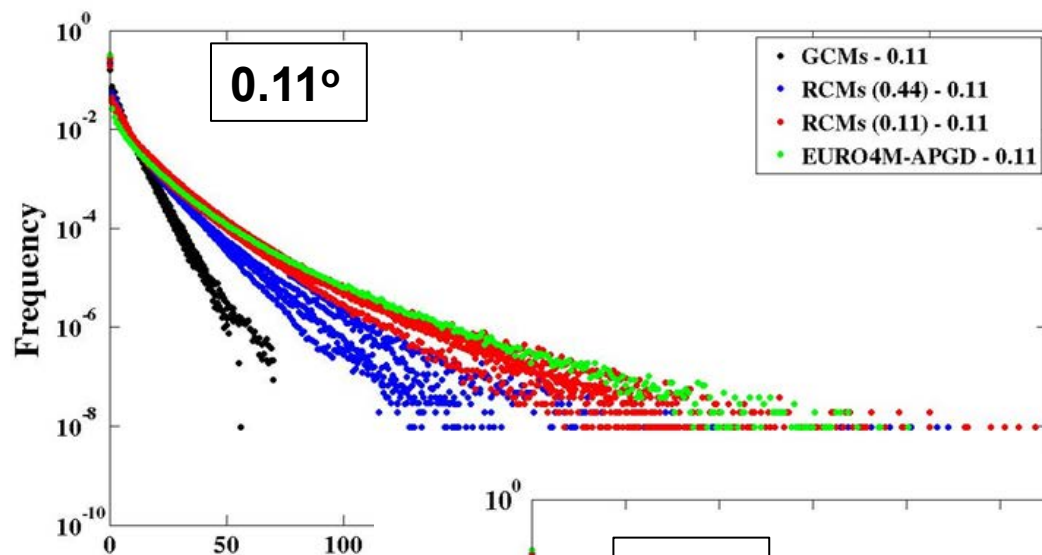
1976-2005



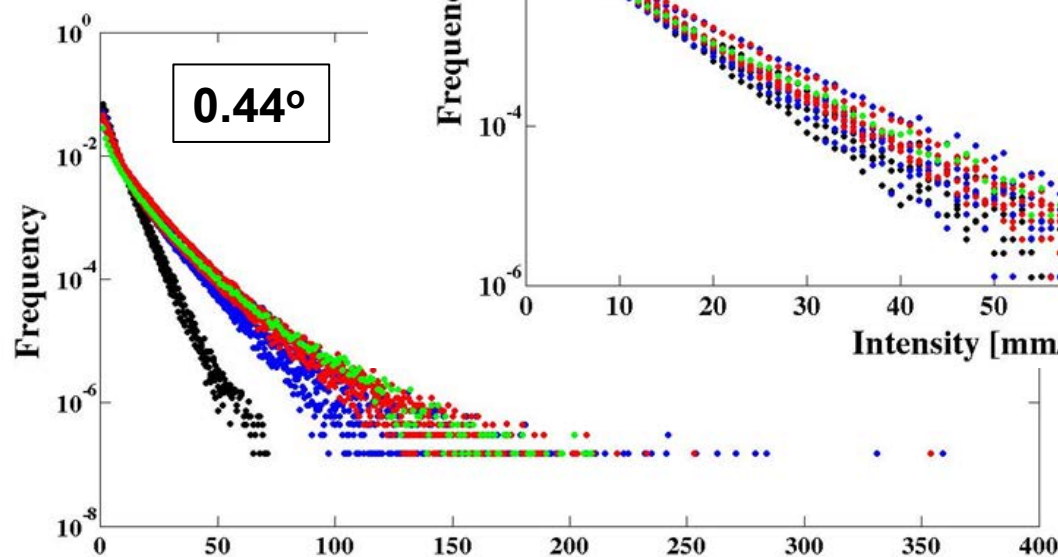
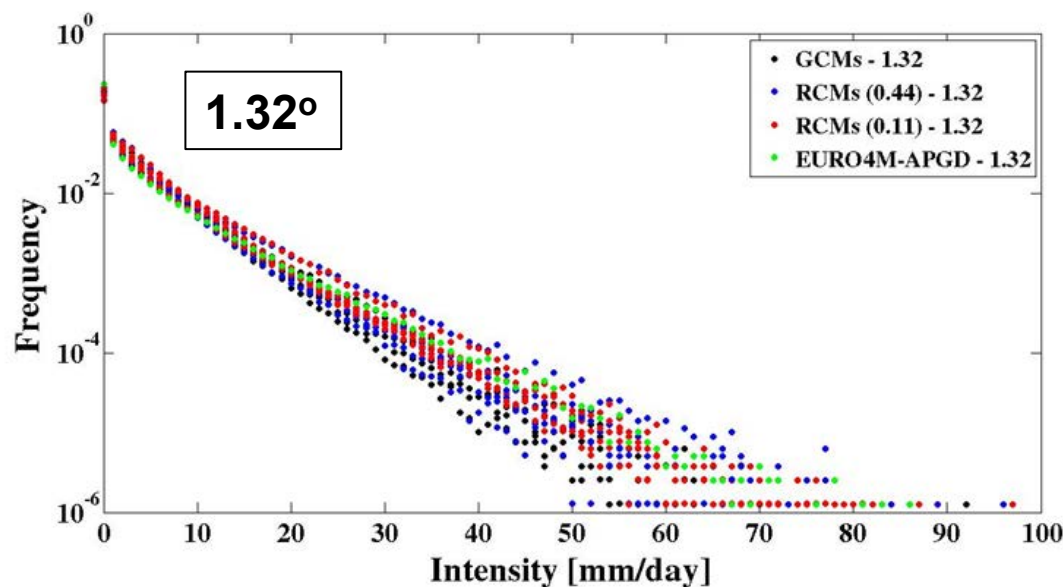
(Toma et al., 2015)



1976-2005



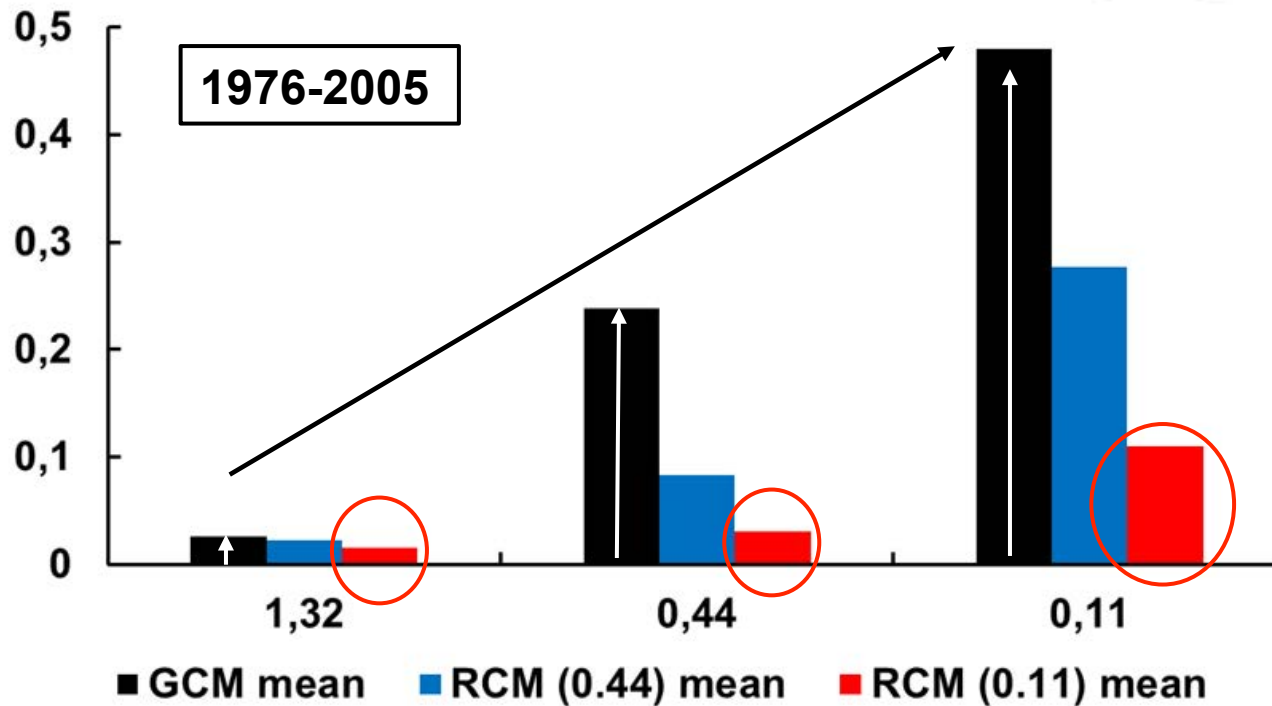
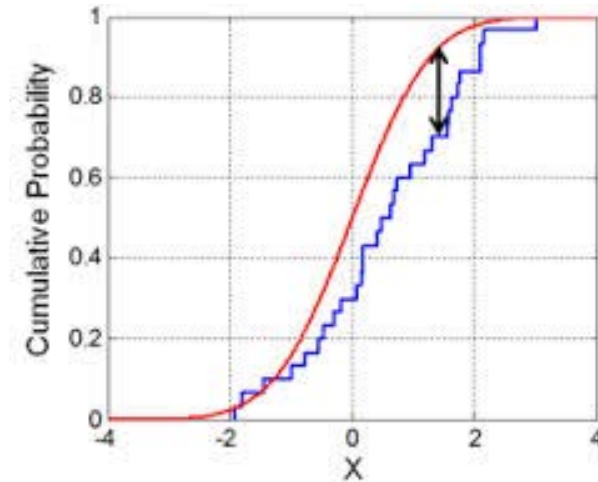
All simulations are represented



RCMs are always closer to OBS  
(Toma et al., 2015)

Kolmogorov-Smirnov distance

$$d_{KS}(F, G) = \sup_{t \in \mathbb{R}} |F(t) - G(t)|$$



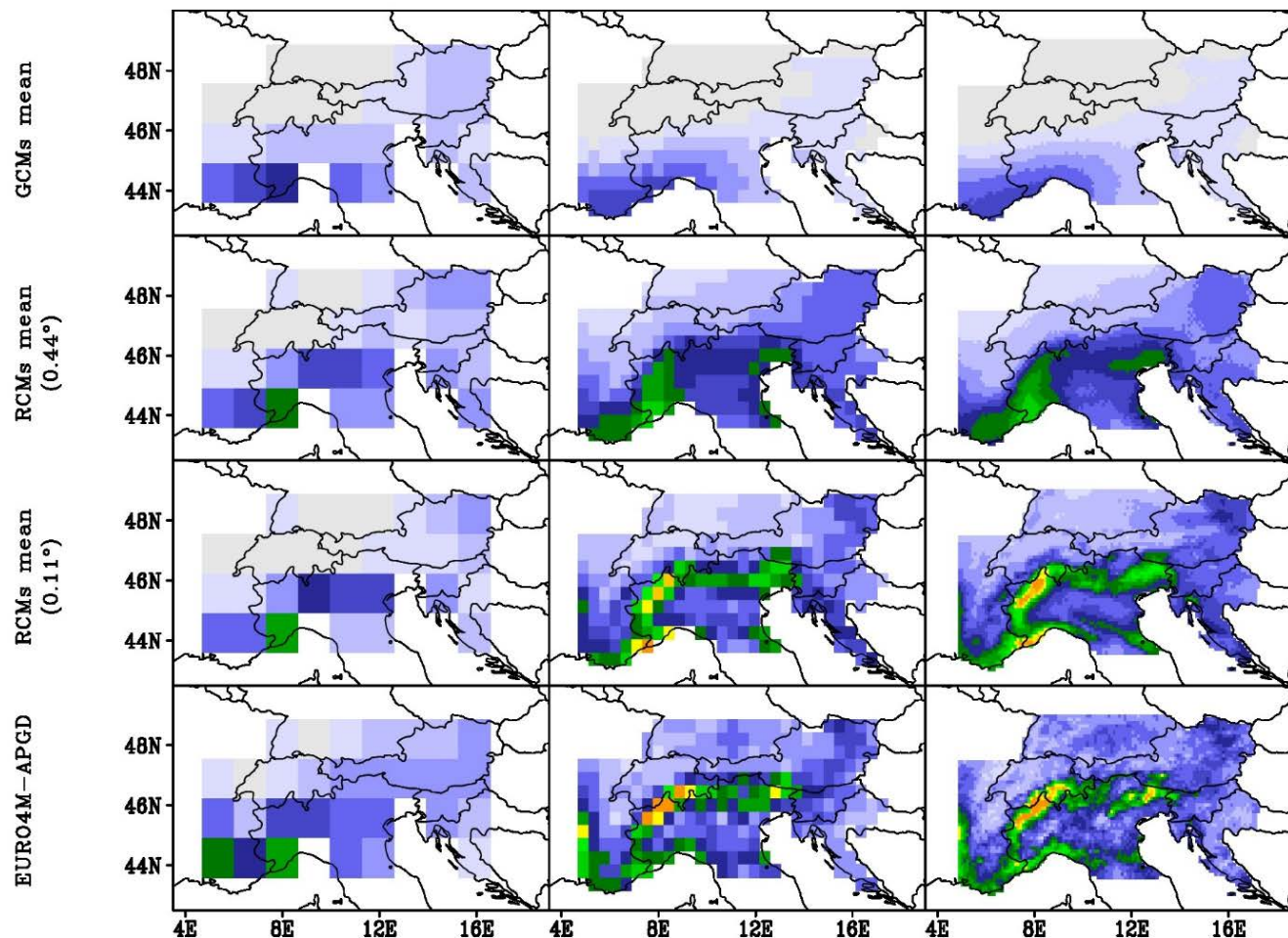
(Toma et al., 2015)

1976-2005

1.32°

0.44°

0.11°

R95


GCM ensemble shows only SW gradient with lower values

RCM11 captures well the magnitude and locations of max, min of R95

Spatial correlations highest for RCM11

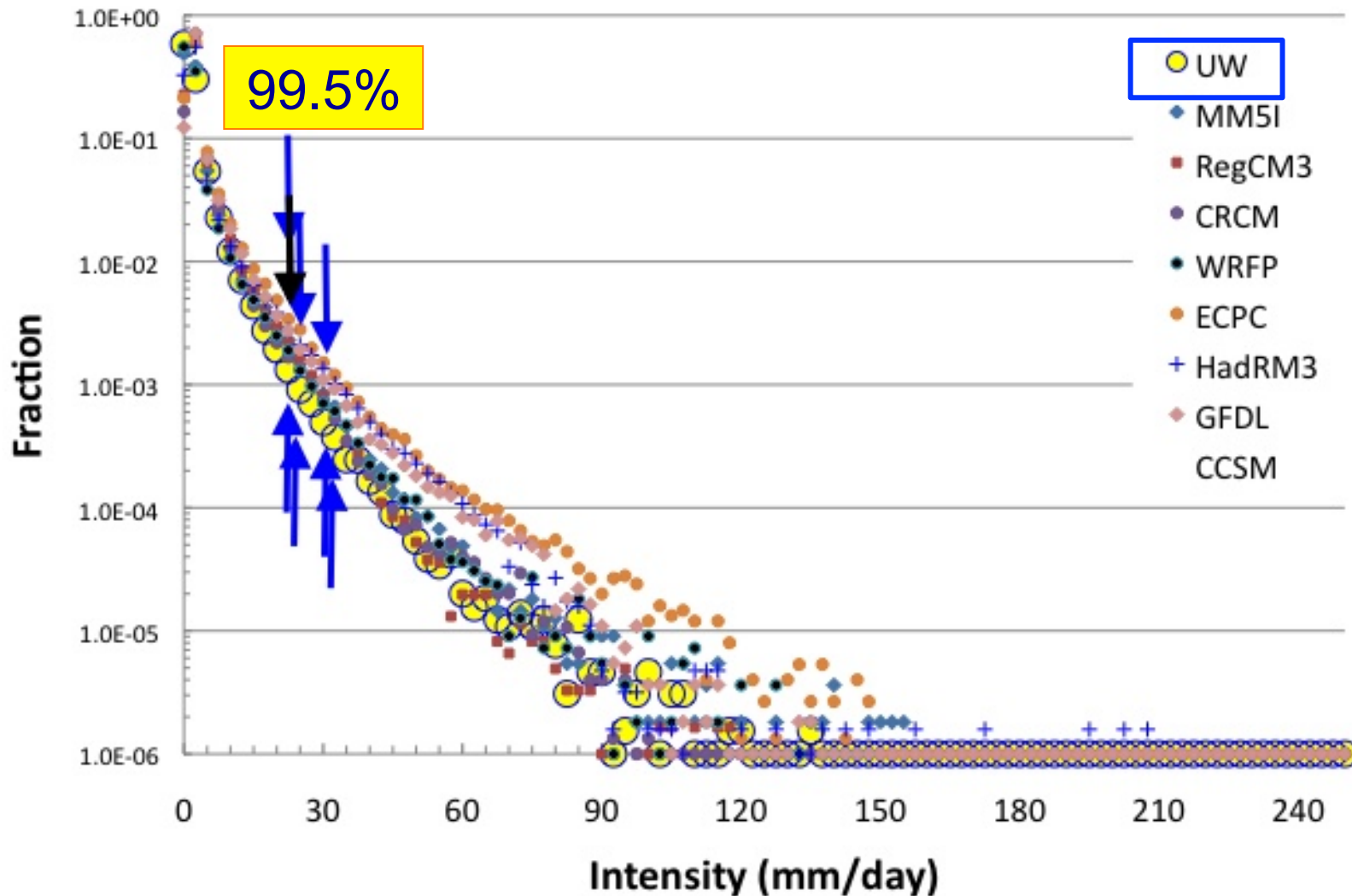
Added value of regional climate modeling over areas characterized by complex terrain

28.01.2015.

(Toma et al., 2015)

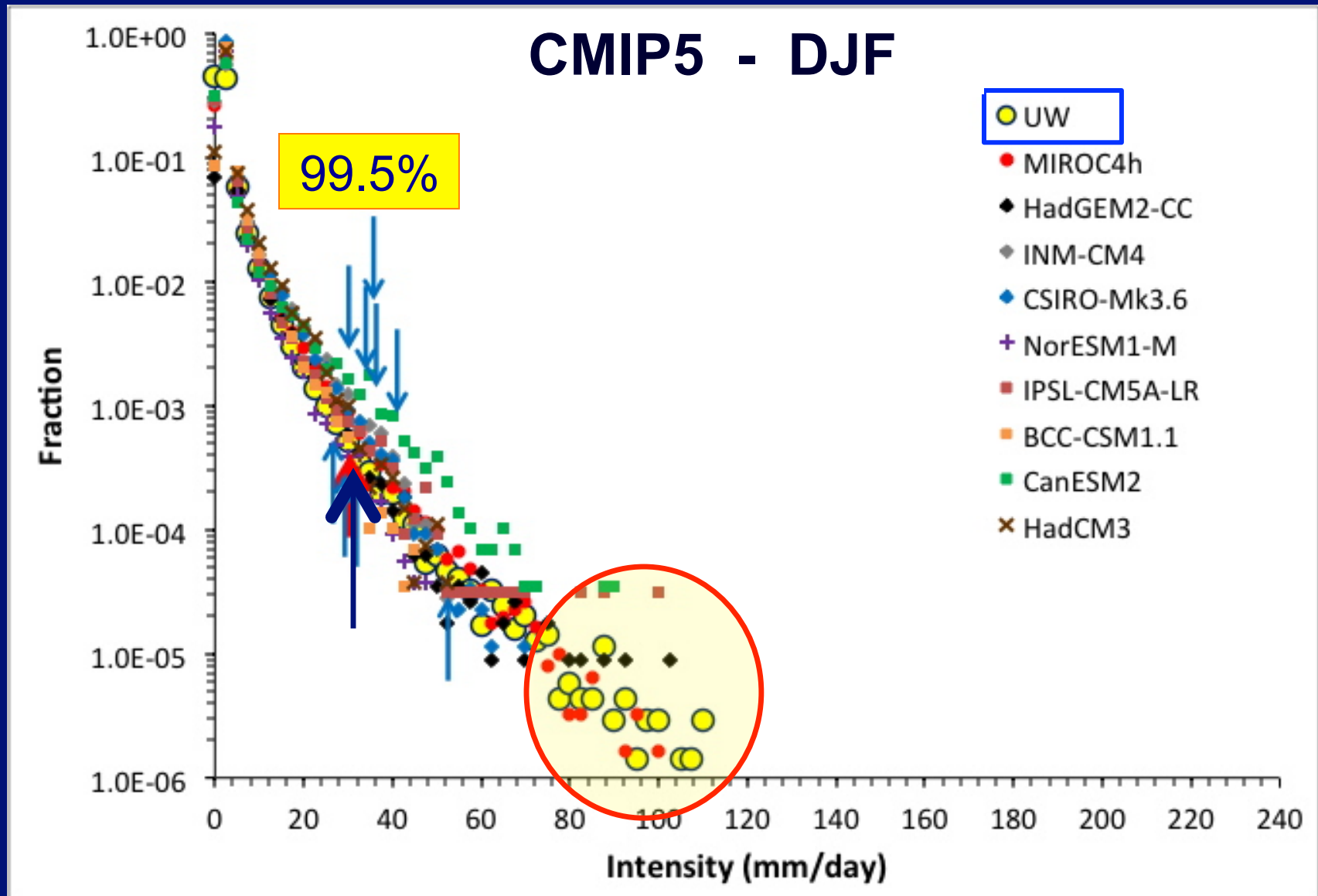
# Precipitation Frequency vs. Intensity

## NARCCAP - DJF

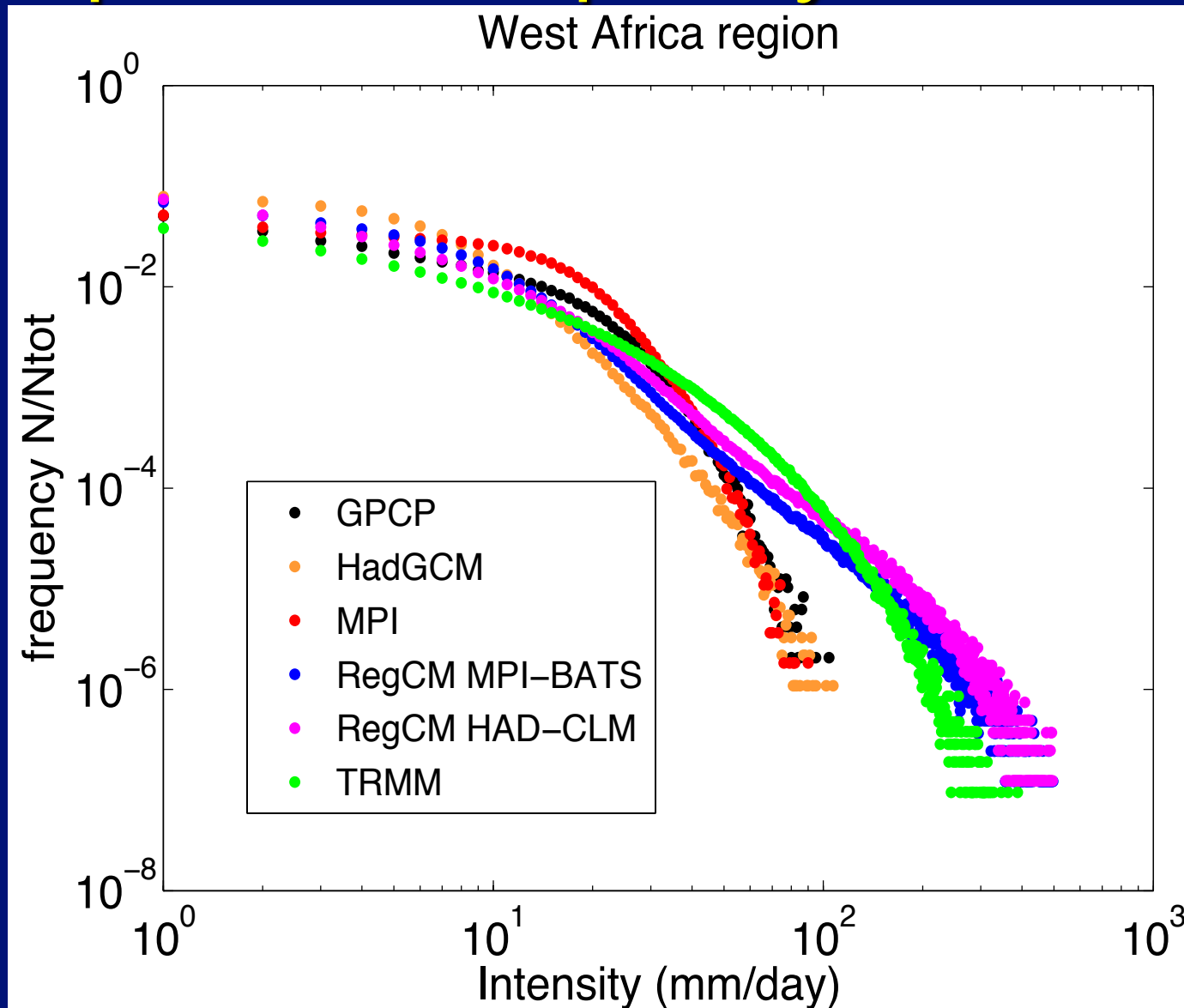




# Precipitation Frequency vs. Intensity

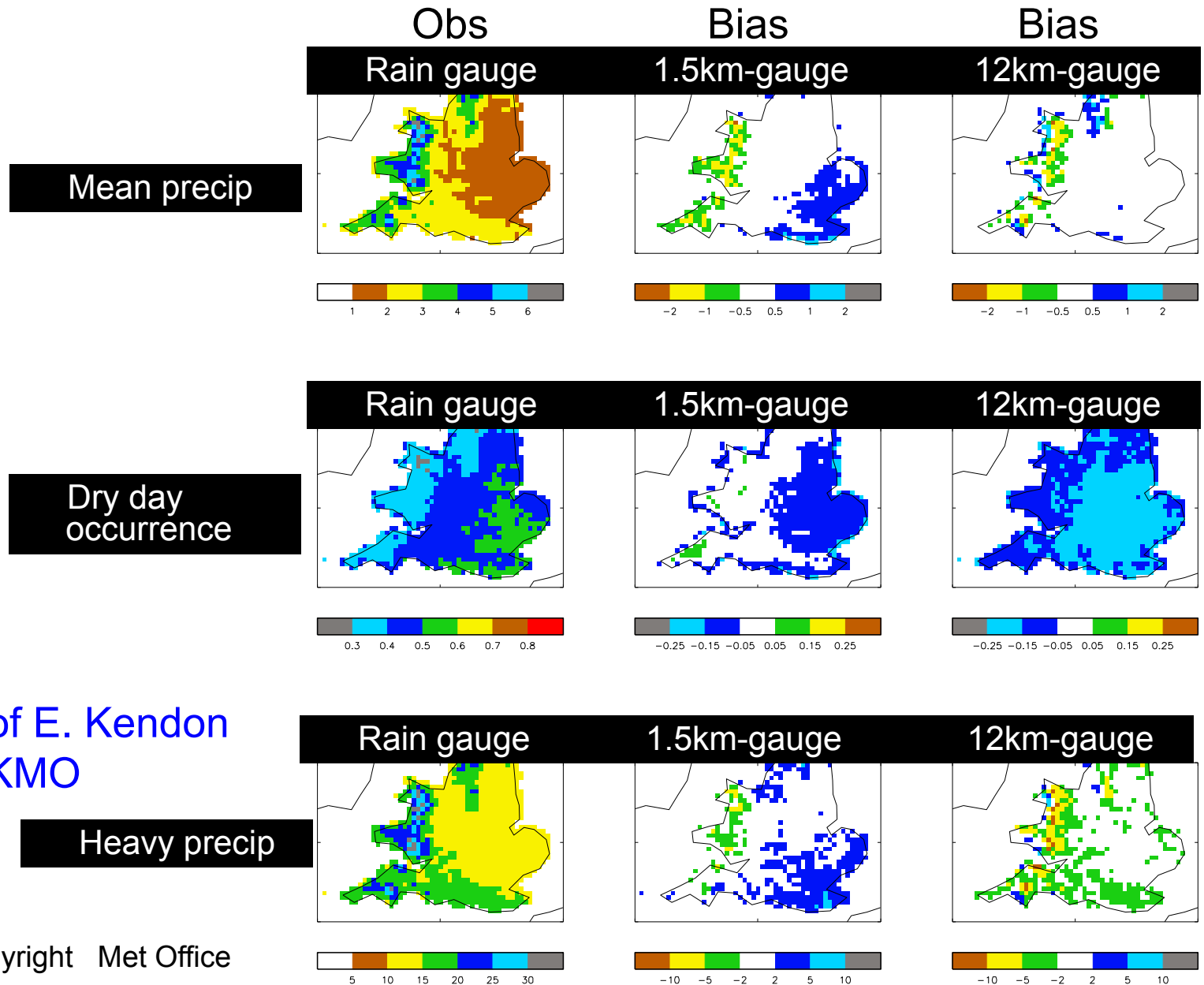


# Precipitation Frequency vs. Intensity



(Giorgi & Gutowski, 2015)

# Daily precipitation (1990-2003)



Courtesy of E. Kendon  
UKMO