

Climate Risks & Early Warning Systems (CREWS)

Using earth observations for early warning - examples from West Africa & the Pacific



WMO OMM

**World Meteorological Organization
Organisation météorologique mondiale**

[Session on frontier ICTs for climate action](#)

Tuesday, 15 October 2019, 14:30 – 17:30

ITU Headquarters Room K

SESSION 3: THE ROLE OF EARTH OBSERVATION AS A
METHOD FOR MONITORING CLIMATE

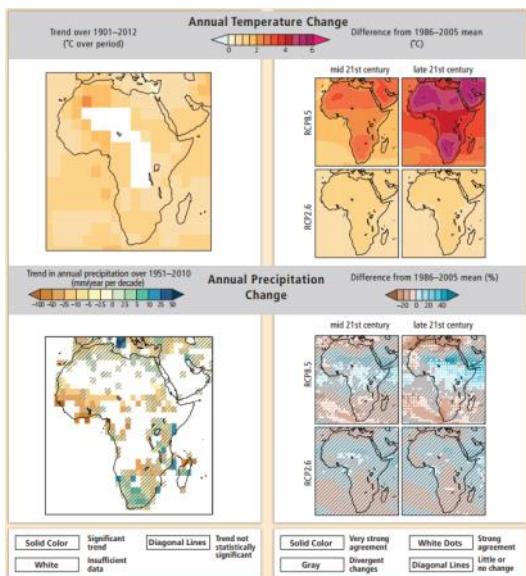


Contact:

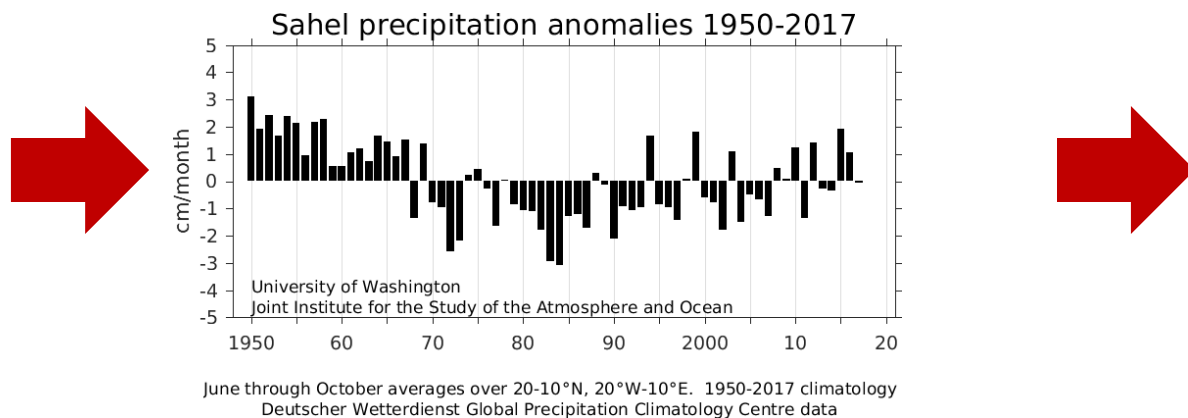
[Jean-Baptiste Migraine](#)

Technical Coordinator, WMO

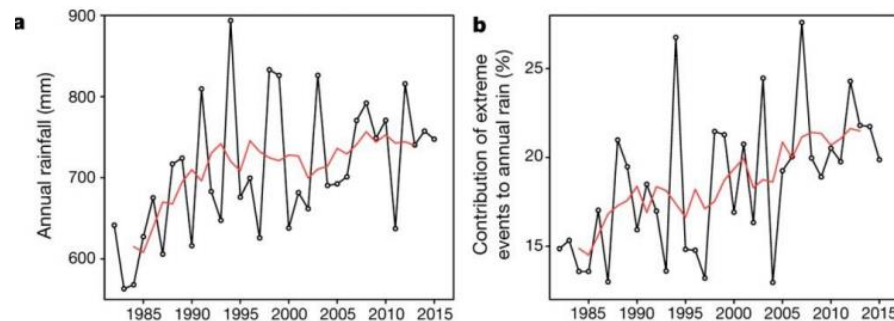
Climate Change & Associated Impacts in West Africa



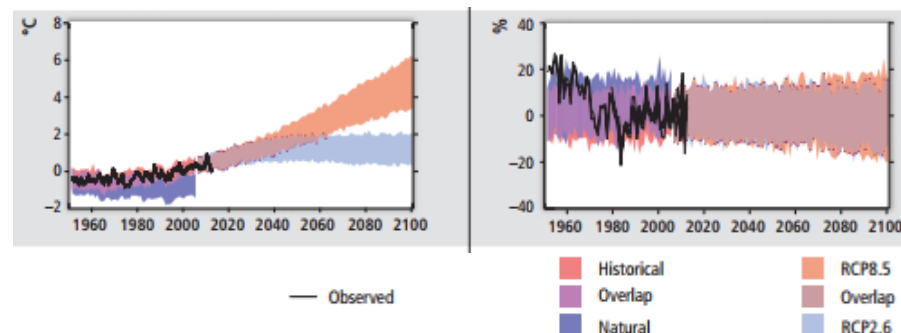
Source: [WGIAR5 chap.22](#), p.1207



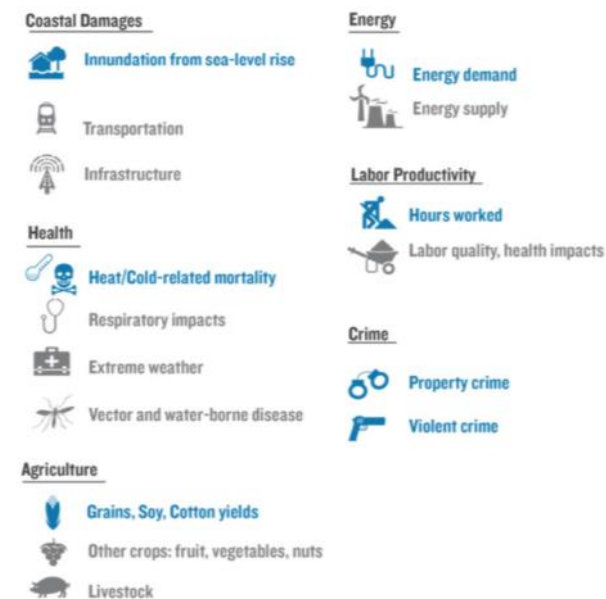
Trends in climatological averages → trends in intensity and frequency of extreme events + impacts in **climate-sensitive sectors**



Source: Panthou et al, I.J.Clim. 2014



Source: [WGIAR5 chap.22](#), p.1208

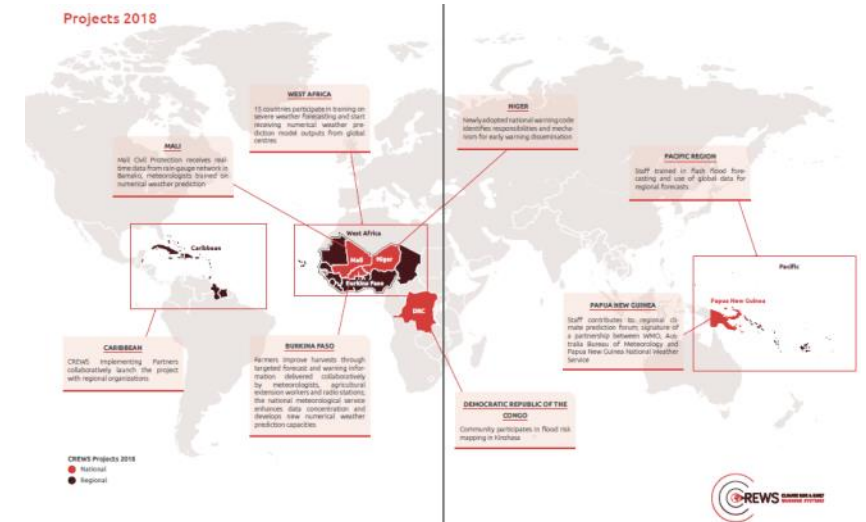
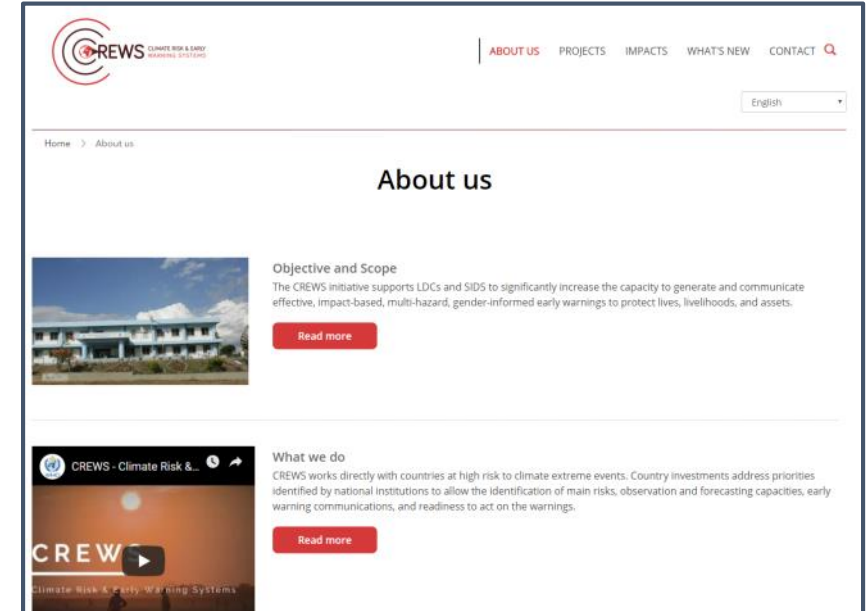


Adapted from: [Maximilian Auffhammer](#), 2014

Climate Risks & Early Warning Systems (CREWS)



The CREWS initiative supports LDCs and SIDS to significantly increase their capacity to generate and communicate effective, impact-based, multi-hazard, gender-informed warnings to protect lives, livelihoods, and assets.

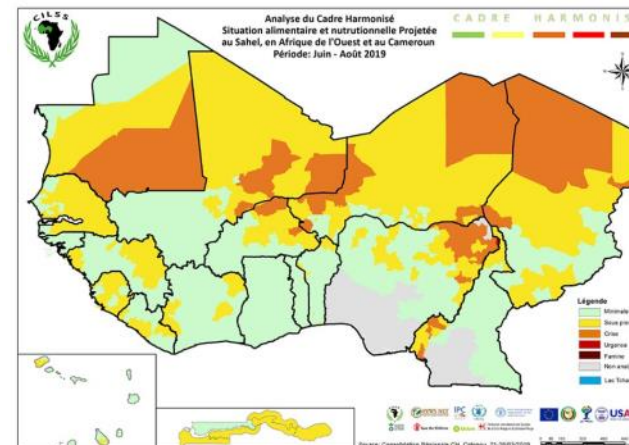


CREWS in West Africa



Strengthening “early” warning for food security and nutrition (in place since early 1970’s)

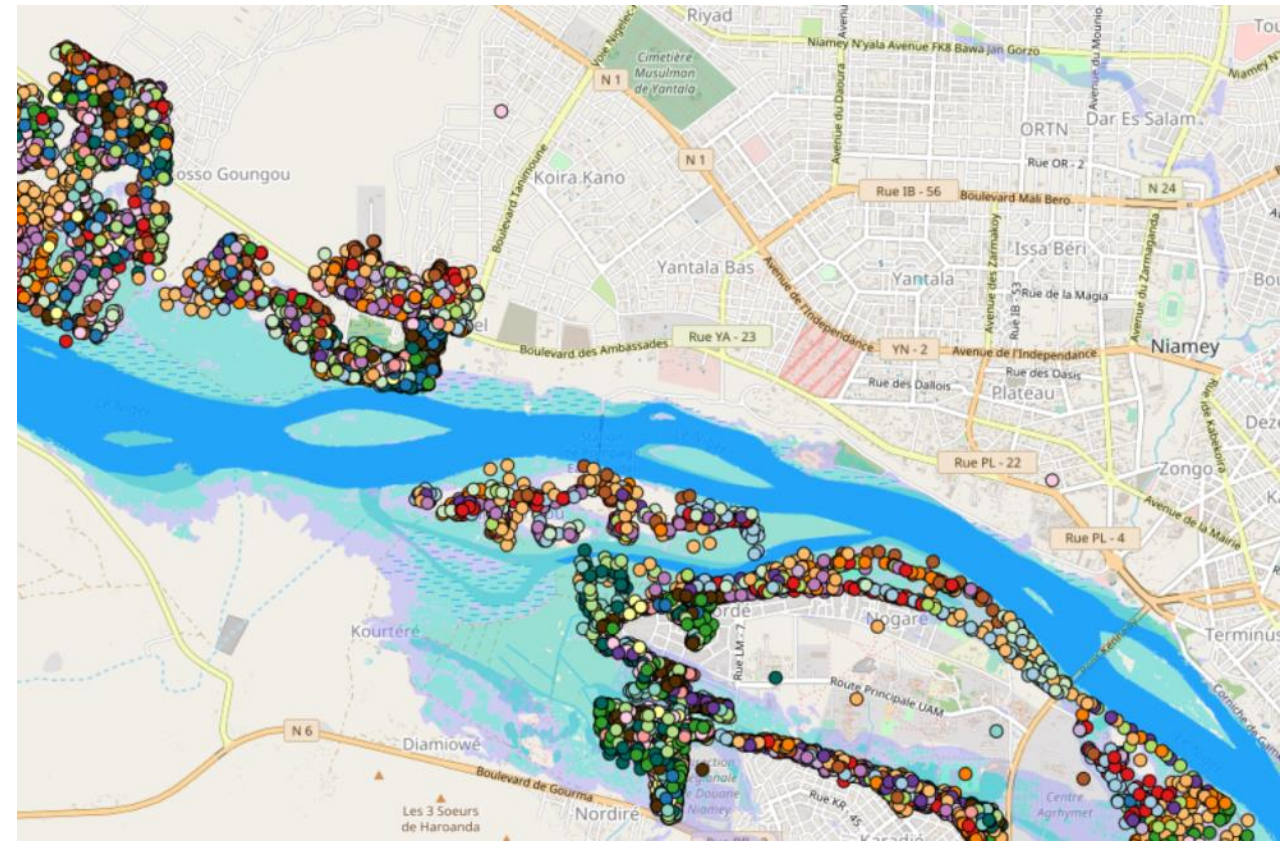
+ setting up “rapid” warning for severe weather events (convective storms, flash flood, sand and dust storms, etc.)



- (i) [AGRHYMET](#) (CILSS) for food security and upcoming [sub-regional climate services](#);
- (ii) [RSMC Dakar](#) (ANACIM) for [severe weather forecasting](#);
- (iii) NMHSs for operational warning + [flash flood guidance](#).



Example 1 - Flood early warning in Niamey

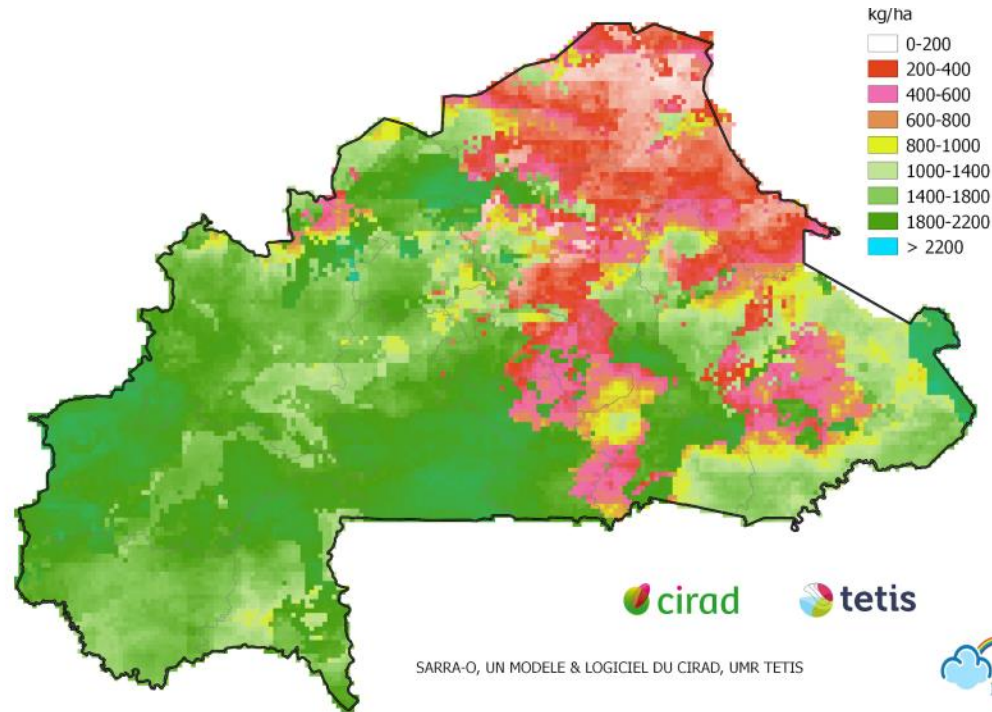


RESULT: A digital elevation model, flood model and database of people and infrastructures' exposure & vulnerability



- 20 young investigators, 15,000 locations surveyed: coordinates, type of building, number of people in the household, type of crops, description of drainage and sewage, etc...
- Combined use of GeoOdk surveys and aerial stereoscopy for DEM
- Open data available on OpenStreetMap

Example 2 - Crop modelling in Burkina Faso (1/2)



Figures : maize yields (top) and millet yield anomalies (bottom).

SARRA-O is used to determine the best time to sow, crop water requirements, or to forecast yields two months before harvesting.

Input remote sensing parameters:

1. NDVI (Normalized Difference Vegetation Index) from the MODIS MOD13Q1 product (16-day, 250m spatial resolution),
2. LST (Land Surface Temperature) from the MODIS MOD11A2 product (8-day, 1 km spatial resolution) and
3. SSM (Soil Surface Moisture) from SMOS (daily, ~40 km spatial resolution)



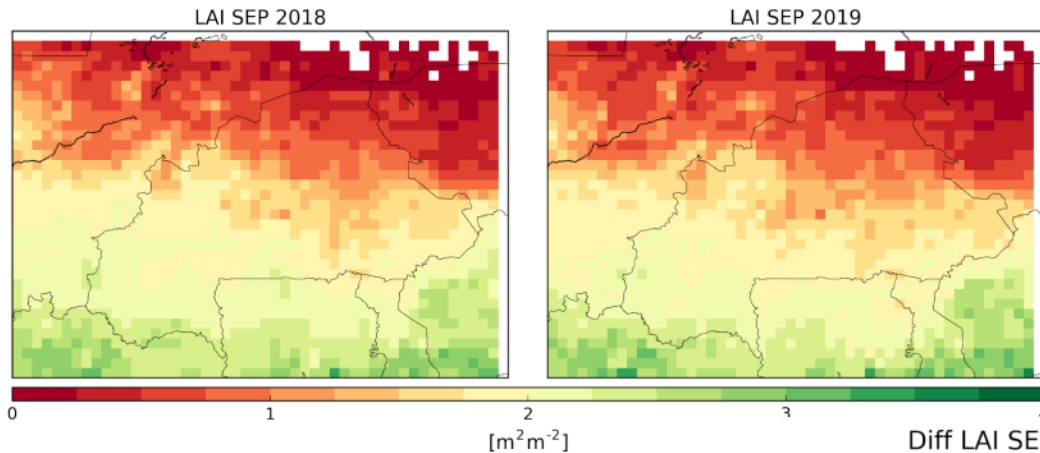
Cf <https://www.cirad.fr/en/news/all-news-items/articles/2019/science/sarra-o-model> et <http://agrhytmet.cilss.int/index.php/bulletins/>

Example 2 - Crop modelling in Burkina Faso (2/2)

Inputs:

Surface Soil Moisture (SSM) from ASCAT
(Copernicus Global Land Service CGLS)

Leaf Area Index (LAI) from GEOV2 (CGLS)

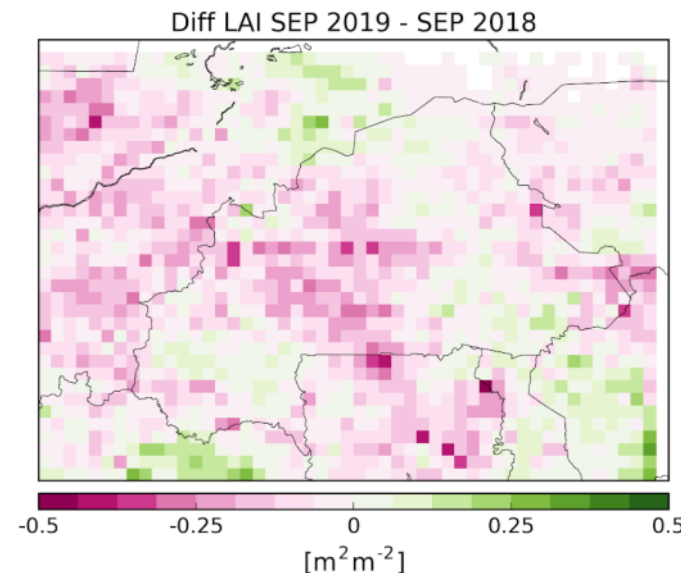


Land

Data

Assimilation

System



Estimated outputs:

Soil Moisture (layers 2 to 7, 1-80 cm)

Leaf Area Index (LAI)

at 0.25° × 0.25° resolution

Processing:

forcing by European Centre for Medium-Range Weather Forecasts (ECMWF)
atmospheric reanalysis ERA5

assimilated with Simplified Extended Kalman Filter (SEKF) using the CO₂-responsive version of the ISBA
(Interactions between Soil, Biosphere, and Atmosphere) land surface model (LSM)

Cf

<https://docs.google.com/presentation/d/1pHd6b19JadwWcGst3eQPczzrHce6GA6LJx3GE6PImuDo/edit?usp=sharing>

Example 3 - Sand and Dust Storm Warning Advisories in Burkina Faso

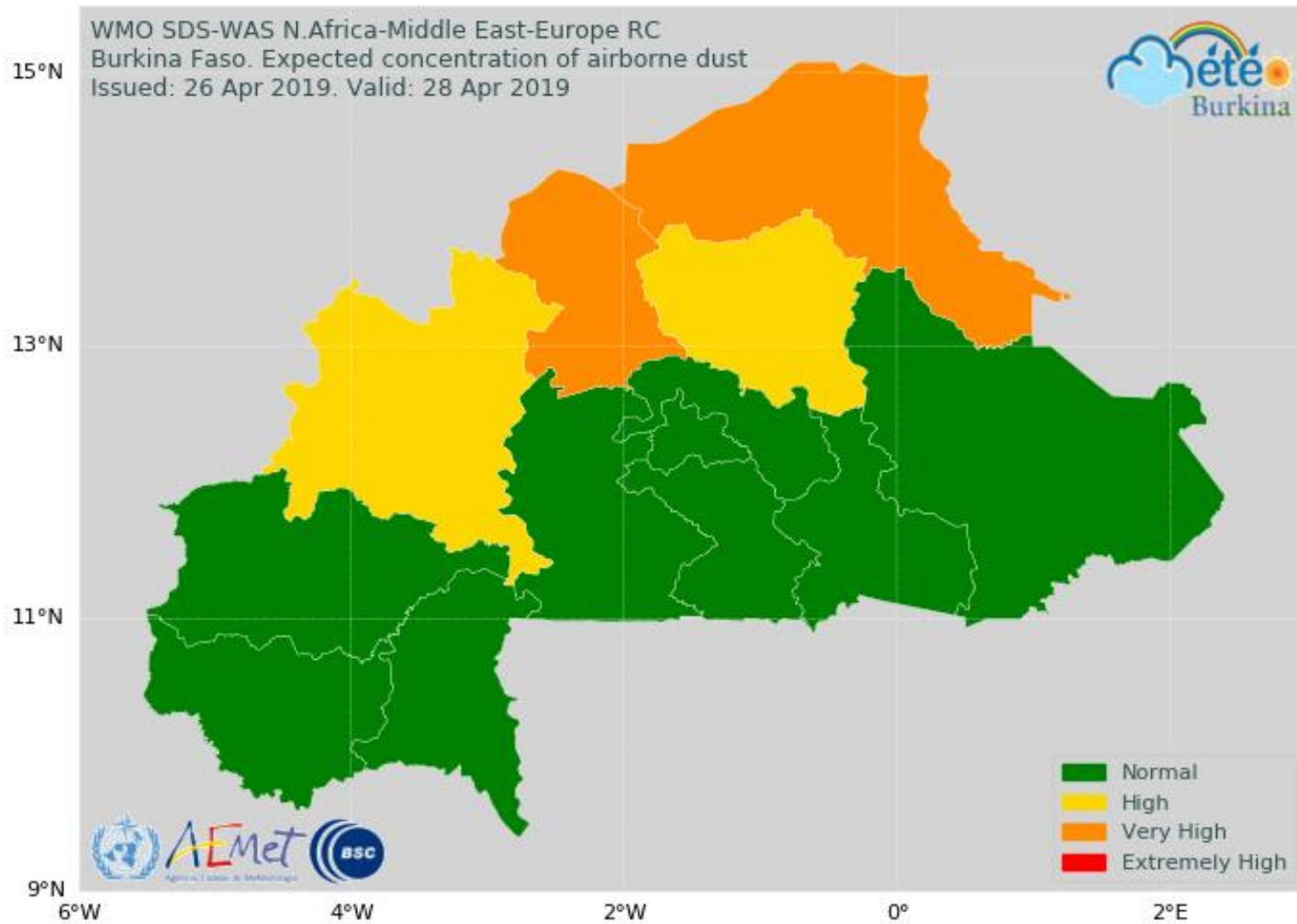


Table 2 Models contributing to the WMO SDS-WAS ensemble prediction

Model	Institution	Domain
BSC-DREAMBb	Barcelona Supercomputing Center	Regional
CAMS	European Center for Medium-range Weather Forecast	Global
DREAMB-NMME-MACC	Republic Hydrometeorological Service of Serbia	Regional
NMMB/BSC-Dust	Barcelona Supercomputing Center	Regional
Met UM	UK Met Office	Global
GEOS-5	US National Aeronautics and space Administration	Global
NGAC	US National Centers for Environmental Prediction	Global
WMA RegCM4	Egyptian Meteorological Authority	Regional
DREAMABOL	Italian National Research Council	Regional
WRF-Chem	National Observatory of Athens	Regional
SILAM	Finnish Meteorological Institute	Regional
LOTOS-EUROS	Netherlands Organisation for Applied scientific Research	Regional

Cf <https://sds-was.aemet.es/forecast-products/burkina-faso-warning-advisory-system>

Example 4 - Severe Weather and Flash Flood Forecasting in Western Africa

Demonstration phase since 1st Jan 2019

Global producing centers:

- Météo-France ([ARPEGE](#), [AROME](#) + MISVA briefings)
- UK Met Office [unified model](#) (4 km)
- DWD ([ICON](#), [COSMO](#))
- ECCC Canada [GPDS](#)
- NOAA NCEP [GFS](#) (28 km)
- AEMET / BSC ([SDS WAS](#))

Regional centers:

- ANACIM (severe weather)
- AGRHYMET (climate & hydrology)
- NiMet (NWP)
- Maroc-Météo (NWP)
- ACMAD (regional coordination)



**METEO
FRANCE**

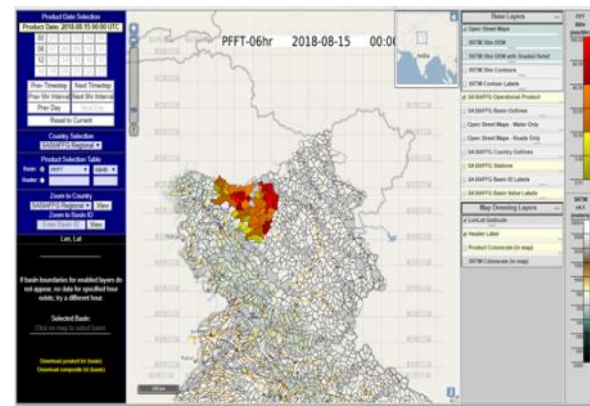
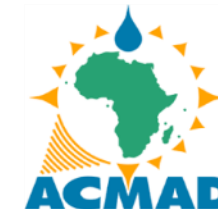
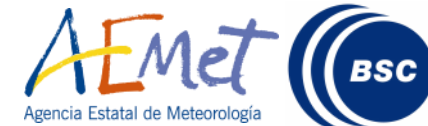


Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Environnement Canada / Environment Canada

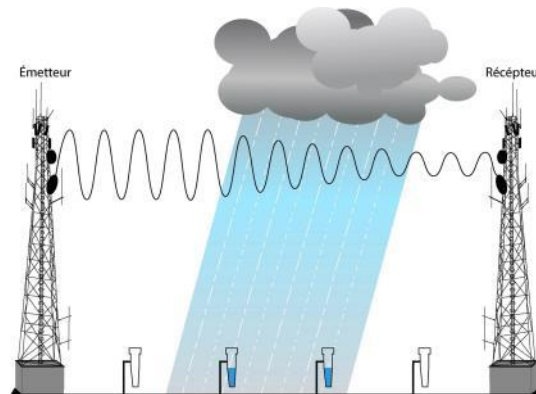
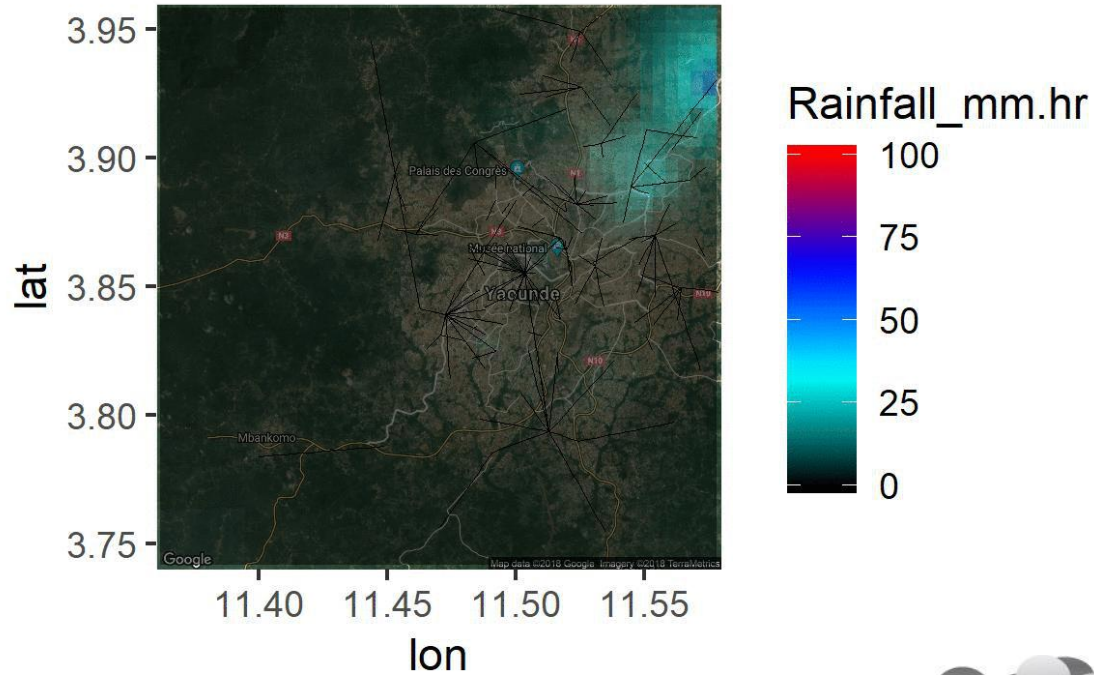
Canada



see [SWFDP](#) and [FFGS](#)
components of the CREWS
West Africa project

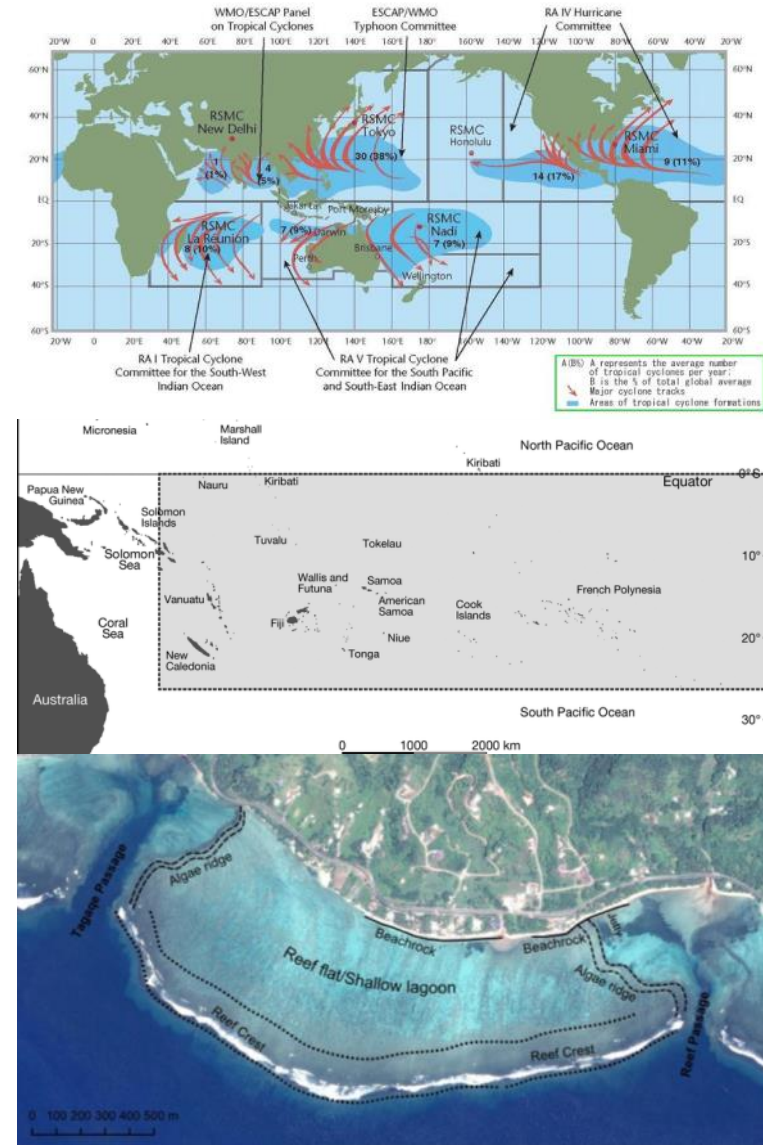
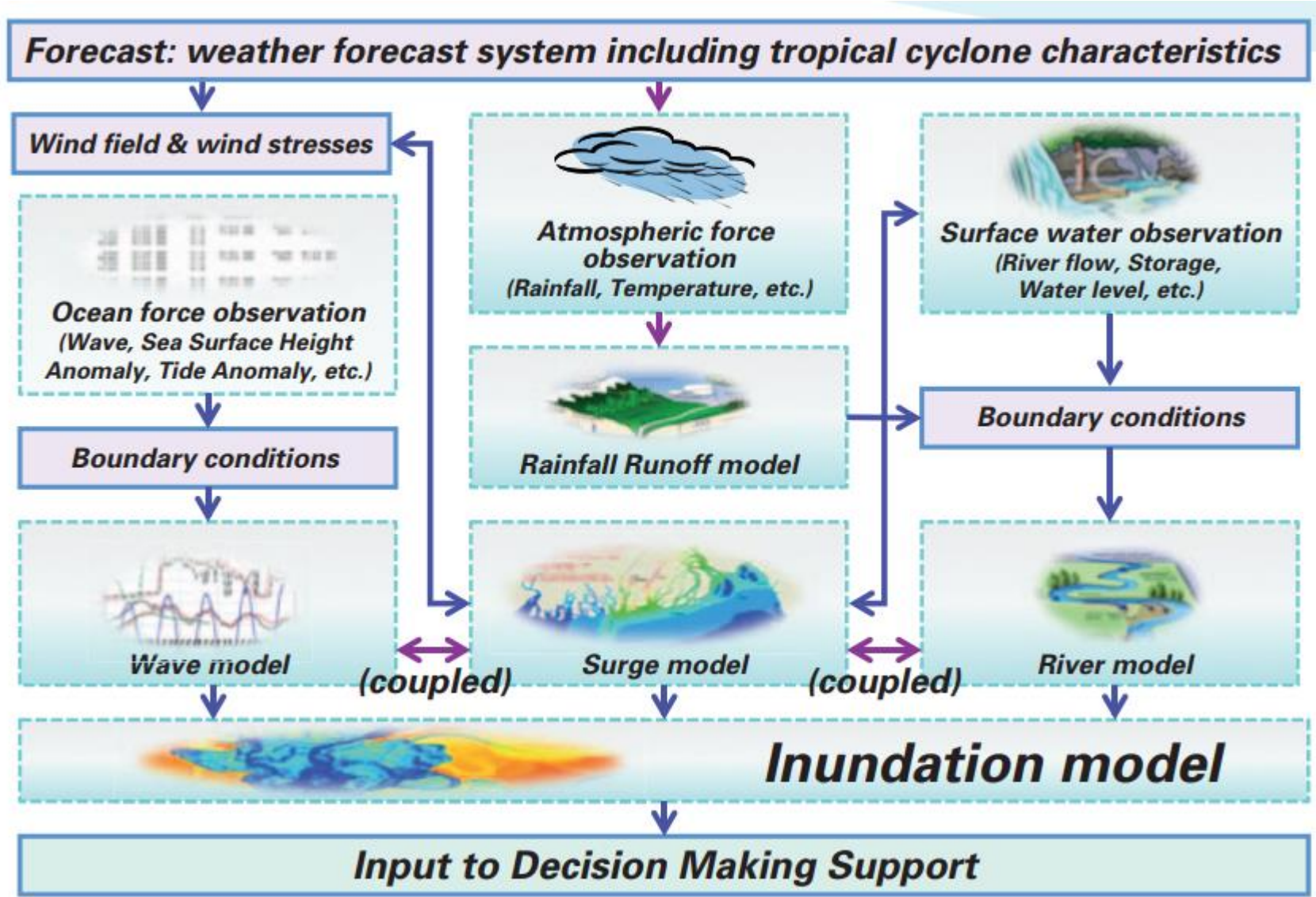
Example 5 - Cell phone signal attenuation as a proxy for rainfall (Cameroon)

Rainfall rate at 2018-09-27 16:00:00 GMT



Cf [raincell presentation](#)

Example 6 - Flash Flood & Coastal Inundation forecasting in Nadi, Fiji





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Thank You !