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OKACOM 33rd OBC Meeting

Climate Index: Update and Discussion

Based on discussions with and a specific paper prepared by Prof Jasper Knight

Gaborone, Botswana
28th November to 2nd December 2016

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In this presentation:

- Climate context: Analysis of (published but not focussed) projections.
- MSIOA development scenarios, associated vulnerabilities.
- Climate impacts – the key impact areas (related to the infrastructure options in the development scenarios).
- Visualisation for scenario spread – the ‘likelihood’ (of the impact occurring) and the ‘severity’ (if it does occur).
- Beyond Okavango – CRDP at a SADC scale – CRIDF1 and follow-up under CRIDF2.

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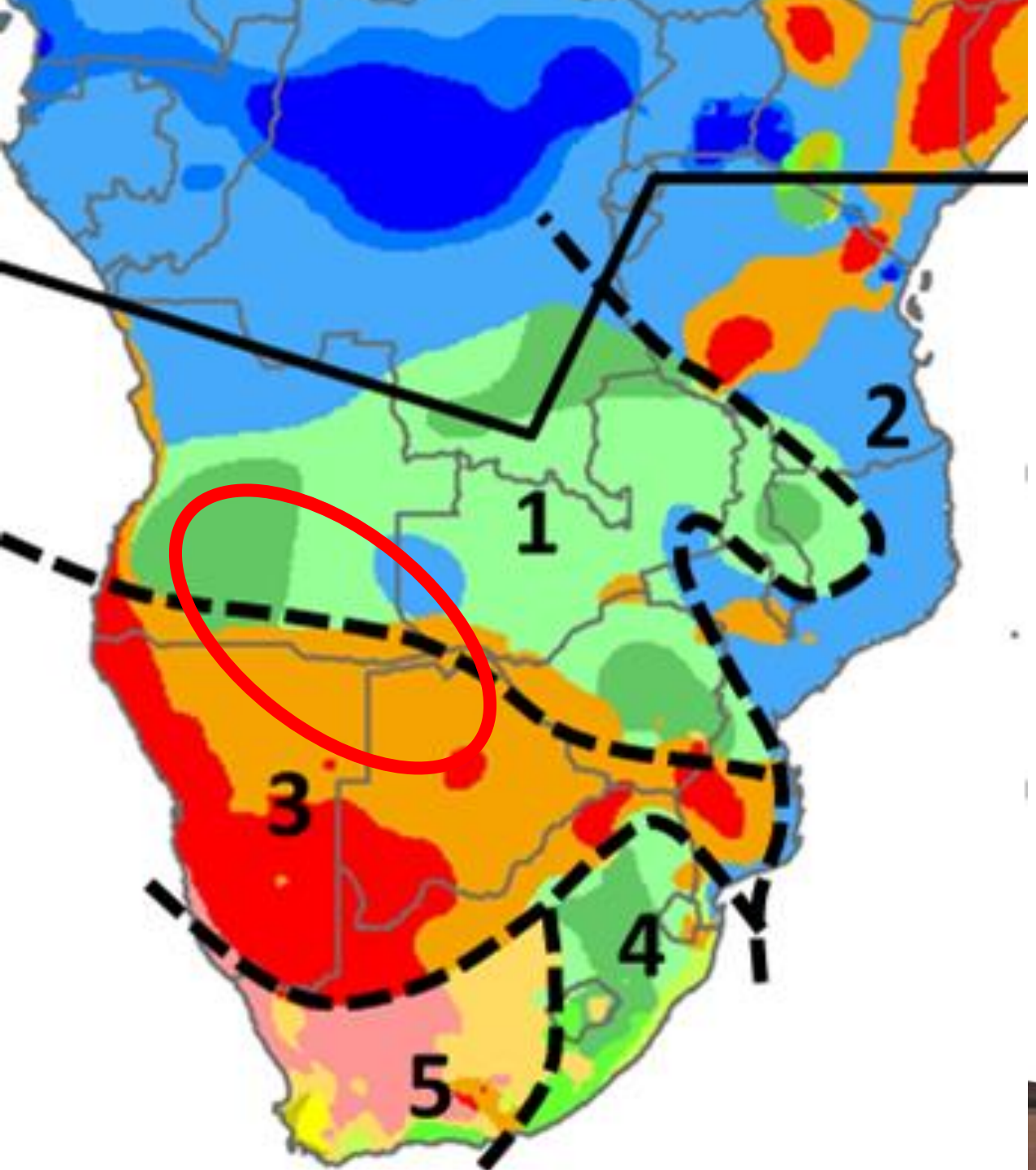
First, the ‘reality check’…..

- The expectation of current and increasing precision vs the reality of dealing with more uncertainty.
- Proportionality – the climate signal in relation to other drivers of change.
- The science is good at alerting us about the problem. It is not so good at informing us what to do. We have to make the best decisions we can with the best available current information…..
- Start right now on the things that reduce vulnerable people’s exposure to climate change – it’s the only foundation on which to build any sustainable economic growth in the future.



- **Region 1**, Summer ITCZ (Intertropical Convergence Zone)
- **Region 3**, Arid descending arm of Hadley cell.

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The future - climate by the middle of the century

- Li et al. 2015, Journal of Hydrology.
- Temperatures to 2029 (relative to 1990 values): increased winter T by 0.2-0.6ºC, increased summer T by 0.4-1.0ºC. Net annual increase of 0.4-0.8ºC
- Precipitation to 2029: no change in winter P, decreased summer P over Angola by -10 to -20%, increased summer P over Botswana by +5%
- Decrease in runoff by -25% in Angola and Namibia, and increase by +50->75% in Botswana (from low base)

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The future - climate by 2050 and 2100

- Niang et al. IPCC AR5 2014
- Increased T by +0.5-1.5ºC over period 1901-2012, decreased P by -5 to -10 mm/yr/decade over period 1951-2010
- Future trends: by 2050 - increased T by +1/5ºC (RCP2.6), +2.5ºC (RCP8.5), decreased P by -10% under both RCP scenarios. By 2100, increased T by +1/5ºC (RCP2.6), +>4.0ºC (RCP8.5), decreased P by -10% (RCP2.6), -20% (RCP8.5) (strong agreement)

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The future - climate by 2100

- Dike et al. 2015, International Journal of Climatology
- Period 2073-2098, summer and winter T increases of 1-2ºC (RCP2.6) to 5-6ºC (winter, RCP8.5) and 5-7ºC (summer, RCP8.5)
- For the same period, P changes of: -0.2 to -0.5 mm/day for Angola, Namibia and +0.5-1.0 mm/day for northern Botswana (summer, RCP2.6), to no change (winter, RCP2.6). For RCP8.5, decrease in P of -0.2 to -0.5 mm/day across the region (summer), no change (winter)

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Other sources – Kwanza 2016

Byman H. Hamududu [1,]* and Ånund Killingtveit [2]

Norwegian Water Resources and Energy Directorate (NVE), Department of Hydrology,

[2] Norwegian University of Science and Technology (NTNU), Department of Hydraulic and Environmental Engineering;

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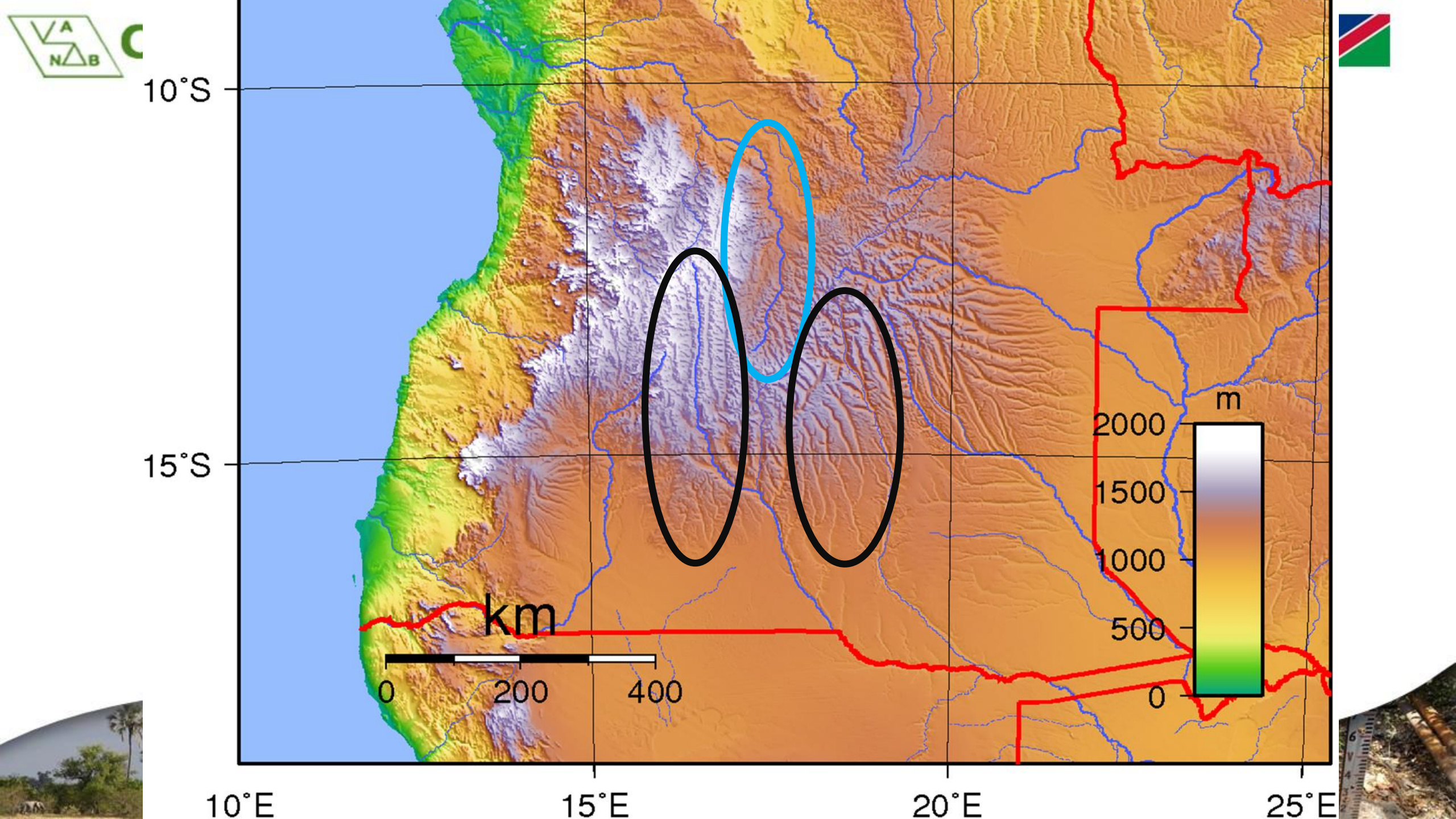
10°S
15°S
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15°E
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km
0
200
400
m
2000
1500
1000
500
0

Other sources – Kwanza 2016

- This study is an evaluation of the possible impacts of climate change on water resources and hydropower production potential in Kwanza River Basin, Angola. The regional climate data, the basis for future climate scenarios, is used in the hydrological model HBV to assess climate change impacts on water resources in the Kwanza River Basin. Evaluation of changes in hydropower production potential is carried out using an energy model. The simulations show that **annual rainfall in 2080 would increase by approximately 16% with increasing inter-annual variability of rainfall and dry season river flow and later onset of the rainy season.** The simulation results show that for the Kwanza River Basin the effects as a result of changes in the future climate, in general, will be positive. Consequently, **the increase in water resources will lead to increased hydropower production potential in the basin by up to 10%.**

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Summary – some narrative

- Increased T, decreased P (upper) increased P (delta).
- Spatial differences are not well resolved, but variations in the position / dynamic of the ITCZ summer rains is critical.
- Projections don’t model the ITCZ precipitation well, this uncertainty may be amplified by orographic / convective patterns over Angola headwater areas (further CRIDF work in next 2 months).
- Under higher RCP values, the ITCZ may extend farther south.

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Summary – some narrative

- Suggests greater seasonality at the southward extent of the ITCZ, with seasonal migration over a greater distance thus greater atmospheric instability?
- Winters, which are already dry, exhibit least change, wet summers are likely to become more variable.
- Northern parts of Botswana are likely to be somewhat wetter, linked to penetration of Indian Ocean cyclones.
- Namibia in particular undergoes greater summer aridity (likely linked to decreased upwelling of Benguela Current).

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Development scenario effects: significant abstractions

- High evaporation, salinization of surface soils
- Reduced groundwater table, reducing potable water availability and increasing the cost/effort of water abstraction especially rural areas or with shallow wells
- Decreased vegetation cover, increased likelihood of wind and water erosion, land degradation
- Increased surface water temperatures and salinity, with implications for ecosystems and biodiversity, fisheries / aquaculture, hydropower production

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Development scenario effects from water abstraction

- Decreased water quality, with implications for risk of waterborne diseases and environmental effects
- Deteriorating conditions for smallholder/subsistence farmers at the expense of capitalised commercial farming

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Impacts – manifestation of climate change

- Based on professional opinion – to be verified by National stakeholders and confirmed by technical experts

- Extreme climatic events
- Hydrological systems and processes
- Agriculture (embedded within ecosystems)
- Human health impacts of climate change
- Environmental sustainability

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Two parameters of assessment

Values cited in the table are made up of two parts:

- First, an evaluation of the likelihood of this factor being a significant variable to consider with respect to the specific development scenario.
- Second, an evaluation of the severity of impact of this factor on the sustainability of maintaining or achieving that development scenario.

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Climate Index by country

Climate Zone	Climate zone 1: ITCZ region						Climate zone 3: semiarid environment											
	Angola						Namibia						Botswana					
Scenario	LS01		LS05/06		LS08		LS01		LS05/06		LS08		LS01		LS05/06		LS08	
Likelihood (L) Severity (S)	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S
Extreme climatic events		High																
Hydrological systems and processes		Medium																
Agriculture and ecosystems		Low																
Health impacts of climate change																		
Environmental sustainability																		
Summary of RISK																		
Summary of VULNERABILITY																		

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Likelihood (L) Severity (S)	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S	L	S
Extreme climatic events																		
Hydrological systems and processes																		
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Extreme climatic events																		
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Now the real discussion starts……

- Are there any other options that have not been assessed (e.g. Regional tourism investment programme, rain-fed agriculture improvement in the high rainfall areas, livestock improvement, agri-processing etc.?)
- What happens to the climate vulnerability assessment if the current assumptions related to types of crops and irrigation efficiency are revised to consider high-value, water efficient crops and cutting-edge in-field irrigation systems?

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Now the real discussion starts……

- What trade-offs do these types of technology and management allow (for example could crop selection and improved water efficiency completely ‘offset’ the CAN abstraction?)
- Can different production options lead to i) better opportunities for social justice and inclusive economic growth, ii) added growth opportunity through agri-processing and local value addition, iii) more sustainable green growth and iv) more equitable gender outcomes?

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The next three months

- More tailored projections for the upper and lower basins
- Angolan Highlands water tower – for six major Basins
- Participative exercise in OKACOM - tailored projections
- Feed back of the OKACOM ‘case study’ to wider climate index/CRDP forum in February 2017
- Internal discussions between sectors to refine and improve development options in light of climate analysis
- Take forward promising developments and lines of enquiry under CRIDF2

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