CREWS Project Presentation Note to the Steering Committee

Project title	Seamless operational forecast systems and technical assistance for capacity building in west Africa	
Project reference	CREWS/RProj/02/Western Africa	
Geographic coverage	West Africa: with particular focus on enhanced delivery of risk information and early warning services in Burkina Faso, Mali, and Niger	
Timeframe	2018-2020	
Implementing Partner	World Meteorological Organization	
Summary of overall cost of the project	a. Project/Programme Amount:	*1,623,500 USD*
	b. Implementing Partner fees (13%):	*211,055 USD*
	c. Total:	*1,834,555 USD*
	d. Other resources	
Additional Implementing Partners	KNMI, DWD, Hydrologic Research Centre (HRC), University of Reading, International Research Institute for Climate and Society (IRI)	
Other partners	Météo-France (through the CREWS work plan for Burkina Faso), RSMC Toulouse, ACMAD, RSMC Dakar, AGRHYMET, NMHSs in Burkina Faso, Mali, Niger	
Main objective	An operational severe weather, flood and climate forecast system, underpinned by on-going observations and continuously updated historical data, that provides monitoring and forecast outputs and products, as well as related knowledge, in support of CREWS-related activities in Burkina Faso, Mali, Niger, and other countries in the region, through enhanced capacity by regional centers to support national level provision of risk information and end-to-end early warning services.	
Initial state of play - project rationale	a. Hazard exposure, vulnerability, risks, and impacts on people and economy	Africa is one of the most vulnerable continents to climate variability and change. It is both highly exposed to climate shocks and stresses and has relatively low adaptive capacities (IPCC Fifth Assessment Report, 2014). Hydrometeorological hazards, including flash floods, landslides, and urban flash flooding, are major causes of the human losses and property damages in Burkina Faso, Mali, and Niger. It is anticipated that the intensity and frequency of extreme events across the globe and in the region may increase due to climate variability and change. For these reasons, the above three countries have all been approved for CREWS projects. These same risk factors are also shared by other countries in the region.
	b. Status of the EWS, DRM agencies and NHMSs, actors / players present	Delivery of priority risk information and early warning products at national level is being addressed through CREWS, and other projects, in Burkina Faso, Mali and Niger. The National Meteorological and Hydrological Services (NMHSs) in these countries are not fully capable of providing and sustaining all meteorological services required to successfully respond to weather, climate, and hydrological extremes, however.

		Forecast provision worldwide depends on cascading operational systems, in which data and observations exchanged internationally by NMHSs are ingested in global and regional numerical weather prediction models. Outputs from these models, which can be enhanced by satellite data, are subsequently downscaled into national and local level forecasts by NMHSs as inputs to early warning systems (for riverine forecasting discharge measurements and operations of control structures (e.g., dams) at basin level also are needed to achieve accurate flood forecasts). Countries in West Africa are supported in this regard by WMO regional centers including the African Center for Meteorological Applications for Development (ACMAD) in Niamey and the Regional Specialized Meteorological Center (RSMC) for West Africa in Dakar, and the Agriculture, Hydrology, and Meteorology (AGRHYMET) research center in Niamey. These regional centers also require strengthening, however, to better enable them to meet the needs of their member countries. And capacities at both regional and national levels need to be strengthened to achieve the relevant operational connections required to for a national-regional-global cascading system. Many elements of such a system are already in place in West Africa. What is needed is to establish or strengthen the operational exchange of data and products between the national and regional levels, with global support, to improve its functioning. ACMAD (a WMO Regional Climate Center, RCC) requires strengthening in areas such as on-going collection, updating and processing of data at the regional level (achieved through the establishment of sub-regional data-base), in the delivery of reanalyses and forecast model outputs to countries, and in providing technical assistance in downscaling model outputs and developing tailored products for country-level decision support. The RSMC Dakar also has a limited capacity to provide guidance for severe weather events that occur in West African countries. There is a need to run a higher resolution Regional Numerical Weather Prediction (NWP) model over the sub-region for the provision of guidance on potential severe weather and of boundary conditions required to run high resolution Limited Area Models (LAM). Adequate communication and computing capability, as well as relevant technical and scientific capacity are needed for effective support to the sub-region. There is also a need to (a) clarify roles and responsibilities between these centers and AGRHYMET, another important West African Regional center, with respect to systems operations across timescales – from severe weather and flooding, nowcasting and monitoring, to sub-seasonal and seasonal forecasts; and (b) strengthen the collaboration between these centers for an improved seamless and integrated forecasting system.
	c. Projects and programmes dealing with EWS and hydro-met under implement-tation or preparation	A large number of projects are on-going and planned in the West Africa region (Annex 1). In addition to the linkages the current project will make with those funded by CREWS in Burkina Faso, Niger and Mali, further described below, on-going and planned projects by the Global Framework for Climate Services, WMO and the World Bank in particular provide the potential for realizing significant further improvements to the systems and capacities which will be established/strengthened through CREWS.
	d. Positioning of CREWS support: complementar ity and	In addition to providing direct, critical support to complement the CREWS national projects in Burkina Faso, Mali and Niger, the current project capitalizes on, and leverages, a significant investment from non-CREWs sources. The current project will draw upon, and benefit from, these other investments being made in country-level infrastructure and capacity

	synergies with existing programmes	development, and fills a specific gap: the integration of the national, regional and global systems, data and products into a cascading system needed to complete the service delivery value chain at country level.
Project design	a. Project outputs	This project will support and strengthen ACMAD, RSMC Dakar, AGRHYMET and other regional entities to achieve a greater potential of the cascading operational system, and to engage with NMHSs in the region to improve risk information and early warning services at national level. This will include not just providing raw forecast system outputs but also capacity development assistance for developing and delivering tailored products for early warning and risk management. This will be achieved through twinning between these centers and developed country NMHSs, including RSMC Toulouse and those designated as part of the WMO European Regional Climate Center (RCC) network. The latter will share their products, methods, technologies and knowledge as necessary to put the operational systems in place, and develop the necessary capacities for their continued operation and delivery of associated services. The programme consists of six components. A first component, focused on data preparation and data and products exchange, is the foundation of the operational cascading system, and supports the other technical components comprising segments of the monitoring and forecasting timescale continuum (Figure 1). Component 1 provides the interface for a coupled regional-national data processing and forecast system. It focuses on promoting data coherence and improved country-level access to enhanced forecast system outputs. It also provides access to basic historical observational data, indices of climate extremes and other derived products, serving assessments of regional and national trends of climate extremes as well as verification and calibration of forecast systems used for early warnings. Component 1 is integrally linked with comparable elements of Components 2-5. Component 1 is partly funded from the current work plan, but leverages WMO-led components of the three CREWS Sahel country projects. (The balance of the WMO-led CREWS country projects will focus on provision of technical advisory and capacity development services for the hydro-met elements of the GFDRR-led activities, World Bank projects in the countries, as well as other hydro-met-related projects on-going in the countries.) Components 2-5 are focused on strengthening regional monitoring and forecast systems on multiple timescales, prioritizing those relevant for severe weather and flood early warning and for reducing agriculture and food security-related risk. These components include forecasting system strengthening and verification using country, regional and global datasets, and on provision of forecast model outputs and related products. These in turn are accessed by the countries, which add value with local data, systems and knowledge, and use the products to provide risk information and early warning services, with support from the CREWS and other relevant country programmes. Component 6, management, further strengthens the broad base of support offered by the regional centres through twinning arrangements with the European RCC network. European RCC network node NMHSs will share their methods, technologies and knowledge with the regional institutions and national NMHSs.

		Component 1. Data, products, and exchange 1.1 Assessment of observation network processes and needs (led by KNMI) KNMI will conduct an assessment of observational network processes and needs drawing on the results of similar assessments conducted in the CREWS project countries. The review will include details on the availability of basic meteorological variables and climate database management system (CDMS, such as Climsoft), network performance, observation practices, data collection and integration systems for manual and automated networks, metadata reporting, data sharing policies, QC/QA procedures, standards, and data archiving and dissemination activities. The assessment will include the entire Niger Basin weather and hydrometric network (including conventional and real time stream and rainfall gauges, control structures and reservoirs). Discussions and a workshop will be held with senior officials at regional centres, NMHSs in the CREWS country projects as well as the regional centres to discuss the results of the review and their implications for data exchange collaboration. The main outputs of the subcomponent will be: a) an assessment of the current observation networks in use in West Africa; b) data exchange collaboration framework/agreement outlining stations metadata and inventory to be included in the regional dataset; and c) a plan to make existing observations available and inter-operable for the region, including recommendations for incorporating missing or new stations into the WMO WIGOS and WIS systems (OSCAR/Surface, WDQMS, GTS and WIS/GISCs). 1.2 Data base improvement (led by KNMI) This sub-component focuses on strengthening the regional historical climate database and associated analyses. The specific implementation plans will depend on the initial assessment (subcomponent 1.1) KNMI will review existing databases and assess the potential for installing the West African International Climate Assessment & Dataset (WAICA&D) at ACMAD or AGRHYMET, building on software developed for the European Climate Assessment & Dataset (ECA&D), a web portal for daily station data and derived indices brought together under regional cooperation. ICA&D combines the climate monitoring and assessment activities developed in ECA&D with WMO's Data Rescue DARE activities. The WAICA&D would improve the historical rainfall time series needed to identify historical hydrological drivers of floods and droughts, validate forecasts, and develop improved seamless forecast products under project components 2-5 below. There will be an exchange of technical staff from regional centers, the NMHSs and KNMI assess the current climate data management systems, their capabilities and inter-operability. This will provide a basis for a stakeholder-driven plan to strengthen these systems, their capabilities, and interoperability, drawing on the capabilities of the WAICA&D system, as appropriate, and providing training and other capacity development on how to prepare and disseminate observational data to the system, and at the same time learn to interpret the WAICA&D and other products for national and local EWS. In this component there will be an update of the Climate Data Management System, Climsoft, already installed at ACMAD to improve system functionality. Outputs from this sub-component include: a) enhanced exchange of historical climate data among NMHSs and regional centers, b) enhanced availability of derived risk information products at regional and national levels,

		and c) enhanced availability of data for improving forecasting systems and forecasts. 1.3 Set-up of a data base on impacts of extreme events for Western Africa (similar to the Knowledge Database on European Climate Extremes (KRONER) (led by DWD) This sub-component includes an assessment hydro-meteorological events as reflected in existing disaster impacts databases, including national Desinventar databases supported by UNISDR, and other national databases, and the EM-DAT International Disaster Database (http://www.emdat.be). The assessment will provide a basis for development of a stakeholder-led common approach to developing and maintaining historical hydro-meteorological extreme event catalogues, drawing on the methodology employed in the KRONER database, which includes a catalogue of extreme events in WMO RA VI. Access to information in KRONER will be through a protected web service operated by DWD. Outputs of this subcomponent include: a) an inter-operable regional/national catalogue of high impact weather events in West Africa, identifying their daily characteristics in terms of intensity, frequency, duration, and areal extent, b) arrangements for sustained operations and maintenance, and c) products, such as Climate Watch Advisories and other risk and early warning information. 1.4 System integration and seamless service delivery Under this sub-component, the consortium partners will develop procedures and systems for downscaling and tailoring sub-seasonal to seasonal forecast at national scales for Burkina Faso, Mali, and Niger, and other countries in Western Africa. This sub-component will integrate outputs from the risk information and forecast systems enhanced through the project and evaluate and optimize the user interface for seamless service delivery. Workshops with the user community will sensitize stakeholders on the program and engage them, through co-design sessions, to define their preferences in early warning content, format, and dissemination. This will enable customization of early warning systems to ensure effective targeting and impact. Sex disaggregated information will be gathered to distinguish user preferences by gender in early warning content, formats, and mediums. Following user engagement forums, training will be provided to support NMHSs in the CREWS country projects to a) use and prepare (sub-)seasonal forecasts for the region; b) use and prepare historical datasets and derived indices of extremes related to droughts, floods, health; c) transform products into operational services and stimulate and contribute to downstream applications. **Component 2. Analysis and climate watch tools** (led by DWD) This component and support ACMAD's collaboration with the NMHSs in the CREWS country project portfolio in operationalizing climate analysis and climate watch tools for enhanced early warning at national level, based on DWD experience gained in operating the WMO RA VI RCC Network Node on Climate Monitoring. The climate watch system will enhance continued monitoring and assessment of the state of the climate, evaluate available long range forecasts, and where conditions warrant provide users concise and understandable climate early warning information at weekly, 10-day,

		monthly, and (sub) seasonal time scales. Climate monitoring products/reports for the region will be based on available satellite and in-situ data products and opportunities to link with Copernicus re-analyses and satellite products will be explored. Outputs from this sub-component include: a) climate monitoring products based on existing global data sets, e.g. from GPCC and CM SAF, adapted to the West African region, and b) climate monitoring products for precipitation, drought, cloud fractional coverage, number of sunny and cloudy days, total precipitable water, global and direct radiation, and surface albedo. Depending on the availability and accessibility of present time and historical observation data (see sub-component 1.2, led by KNMI), climate monitoring products based on in situ observation data will be also be developed, for near-surface air-temperature and sunshine duration. **Component 3. Improved short-to medium-range forecasting capabilities focusing on severe weather** (led by WMO) This component will improve accessibility of RSMC Dakar and ACMAD to NWP/EPS products from advanced centres (e.g. Météo-France, ECMWF, DWD, KNMI etc.) and develop capacity of NMHSs in interpretation of NWP/EPS products to make the best use of this high value information in improving severe weather forecasting and delivery of early warning services. The sub-component will also support capacity development in the application of these products for drought, heat waves, extreme precipitation and flood monitoring through specialized training workshops. Activities be coordinated/facilitated through the WMO's Severe Weather Forecasting Demonstration Project (SWFDP) concept and framework. An initial needs assessment mission to the three countries including capabilities in forecasting, early warnings issuance and dissemination, and Decision Support Systems will be conducted. To implement the cascading forecast process through the SWFDP in West Africa, WMO will facilitate the implementation of WRF high resolution model to be initialized by global model data (e.g. NOAA/NCEP GSF, Météo-France ARPEGE model) at RSMC Dakar following the implementation of High Performance Computer (HPC) system funded through the African Development Bank. WMO will also provide guidance products for severe weather based on agreed thresholds for various severe weather phenomena such as extreme Temperatures (hot/cold conditions), strong winds, heavy precipitations, high ocean waves, etc. The overall framework for the SWFDP in West Africa, including a plan for Implementation, is being developed following a technical planning meeting of participating countries from West Africa and potential global and regional centres in Abidjan, Ivory Coast (4-8 Sept 2017). CREWS activities will be harmonized with SWFDP work plan as outlined in Table 1. **Component 4. Flood forecasting** (led by WMO) This component will oversee the development and implementation of regional flash flood guidance and early warning systems in West Africa, with technical support from the Hydrologic Research Centre (HRC), San Diego, USA. The approach will build from experience in advancing similar operational systems in other parts of the world and contribute towards reducing the vulnerability of the region to hydrometeorological hazards, specifically flash floods, by developing and implementing a flash flood guidance system to strengthen regional and national capacity to develop timely and accurate flash flood warnings.

		In cooperation with a designated regional centre, to be identified in an initial scoping mission, the project will be executed by the participating NMHSs with the HRC providing technical assistance in cooperation with NOAA/National Weather Service for the system implementation; and WMO providing technical backstopping and supervision. Based on estimation of rainfall from satellite imagery and available gauges, the system will provide the NMHS of each participating country with an estimate of the precipitation amount and an indication (guidance), based on hydrological modelling, as whether it would generate a bankfull discharge (e.g., minor flooding) at the outlets of small, flash flood prone basins throughout each country. The NMHSs will integrate local knowledge from other sources (their national networks, observers report, etc.) to validate the guidance and issue as required a warning through channels proper to each country. Technical assistance includes the development and implementation of the flash flood guidance and warning system as well as research and development into system enhancements, including inclusion of infrared and microwave technology for satellite rainfall estimates, as needed for the different implementations, and training and capacity building on system operations and applications to disaster risk reduction (i.e., an end-to-end system approach). The approach will provide a tool for each country within the specified region to access the data and information needed to develop alerts and warnings for flash floods. Finally, the Severe Weather Forecasting Demonstration Project-West Africa (SWFDP-West Africa) and West Africa Flash Flood Guidance System (WAFFGS) will be linked. High resolution mesoscale Numerical Weather Prediction (NWP) Quantitative Precipitation Forecast (QPF) that will be produced within the scope of SWFDP-West Africa will be ingested into WAFFGS to improve the accuracy of forecast flash flood threats. **Component 5. Sub-seasonal to seasonal forecasts** The sub-seasonal to seasonal timescale (2 weeks to a season in advance) is an important one for many management decisions, including for the agriculture and food security, water resources management, health and disaster risk reduction. Sub-components of component 5 focus on strengthening operational systems, and research-to-operations transferability, for seamless provision of improved weather-to-climate forecasts, from climate to weather time scales, tailored for climate-sensitive decision in priority socio-economic sectors in the region (see sub-component 1.4). They identify windows of opportunity for increasing forecast skill (see sub-component 1.2) and improving communication of forecasts, including reliable estimates of the associated uncertainties, for incorporation into the risk management strategies (sub-component 1.2). Specific attention is to be paid to the risks of extreme weather and climate events, including tropical cyclones, droughts, floods, heatwaves and the waxing and waning of monsoon precipitation (links to sub-component 1.3). 5.1 Developing and inter-comparing methodologies for forecast calibration, regionally optimized multi-model combination, verification, and digital hindcast and forecast formats data preparation and packaging for Western Africa as a whole, including support to the RCOF process; IRI and ECMWF in collaboration with WMO GPCs-LRF, including ECMWF and WMO LC-LRFMME, as well as IRI, ACMAD, and/or AGRHYMET, will collaborate to

		develop and inter-compare different methodologies for forecast calibration, multi-model combination, verification, and digital hindcast/forecast formats data preparation and packaging [(e.g., probability of threshold exceedance of week 2–3 and week 3–4 fortnight averages of precipitation and temperature (i.e. days 8–21 and 15–28 in advance respectively), issued weekly]) with a specific focus on West African Monsoon. This will build on the work of the current S2S Verification and Products Sub-project, regression and forecast presentation methods developed at IRI for sub-seasonal and seasonal forecasts, including the Climate Predictability Tool, as well as the operational products of the GPCs-LRF including the available experimental sub-seasonal forecast products. This activity will also leverage the S2S and NOAA SubX databases available through IRI data library. The output will be recommendations for operational centres to harmonize their real-time and re-forecast set-ups to facilitate S2S forecast calibration, multi-model combination, verification; real-time products from the GPCs-LRF and LC-LRFMME including facilitation through the RCC operations and the RCOF process. <u>5.2 Sub-seasonal and Seasonal prediction, skill assessment and systematic bias correction and calibration of the forecasts and production of tailored forecast products for the Burkina Faso, Mali, and Niger, and other countries in Western Africa</u> Under this sub-component, the consortium partners listed above will develop procedures and systems for downscaling and tailoring sub-seasonal to seasonal forecast at national scales. The ANAM-BF CREWS project results will be upscaled into a design generalized approach for a national applications of objective regional seasonal forecast system encompassing Burkina Faso, Mali, and Niger, and other countries in Western Africa. Historical data from WAICA&D (see component 1) will be used for skill assessment and systematic bias correction as well as calibration of the forecasts. Tailoring of forecast products will be done through national project funding or future projects, as will full operationalization of the system. <u>5.3. Pilot services on early warnings for agricultural severe drought tested in one or two countries</u> UK Reading University will pilot services for early warning on early warning for drought in one or two countries, using the TAMSAT-ALERT (TAMSAT-AgricuLtural EaRly warning sysTem). TAMSAT-ALERT produces risk assessments based on impact models driven with meteorological observations. TAMSAT-ALERT was co-developed with the Ghana Meteorological Agency (GMet) and has been piloted with GMet in Ghana for two years using the land surface model JULES to predict various metrics of risk, including deficit root zone soil moisture. Other implementations of TAMSAT-ALERT use crop models (WRSI and GLAM). TAMSAT-ALERT is now at a stage where it could be piloted widely across West Africa, following limited technical development, and co-design with selected NHMSs. The co-design would aim to develop a system that adds value to systems already in operation (for example extending the use of NMHS observational data and facilitating interpretation of meteorological subseasonal and seasonal forecast information).

		Component 6. Management Specific activities will be implemented by WMO, ACMAD and RSMC, NMHSs in Burkina Faso, Mali, and Niger, and DWD, and KNMI. Monitoring and Evaluation (by WMO, compiled from regular reporting from all implementing partners). Project management P2/3 level @ 50%, with 50% to be covered from WMO project support costs.
	b. Implementing time frame	See Table 1 below.
	c. Contribution to CREWS Programming Framework	2.1 Climate monitoring and prediction products with facilitated access for CREWS Project Countries. 2.3 Regional monitoring, forecasting and warning products for extreme events (flood, drought, extreme heat, other weather events). 2.4 Regional, gender-disaggregated, risk analysis products and monitoring of high risk countries, cities and vulnerable populations. 2.5 Regional inter-governmental organizations strengthened to support NMHSs and early warning capacities. 3.1 Standards and systems in place to monitor early warning trends, needs, gaps and capacity to drive investments and measure progress against the 2030 Sustainable Development Agenda, the Sendai Framework and the UNFCCC agenda. 3.2 Donor investments are increased to address the service delivery gap in LDCs and SIDS and are better coordinated through common programming and reporting protocols. 3.3 Demand-driven knowledge products are compiled and applied for technical guidance for early warning service delivery in countries and cities. 3.4 Networks of early warning system practitioners strengthened and broadened.
	d. Logical framework with indicators	Outputs are identified in project design, see also Table 1 below.
Organization and operating procedure	a. Institutional framework	A Regional Programme Steering Committee (RPSC) will be established to coordinate project activities in relation to the Burkina Faso, Mali, and Niger CREWS country projects and ensure CREWS portfolio harmonization with other ongoing and planned regional initiatives (including WB and GCF investment portfolios). The role of the RPSC is to guide the implementation of the programme activities and provide overall policy direction on implementation resolving any policy challenges, inter-ministerial barriers or policy conflicts. The RPSC will be responsible to approve overall implementation plan and annual project budget, and will meet as often as needed but at least every quarter to review and follow-up on the project progress. WMO will chair the RPSC, which will include the following members: KNMI, DWD, ACMAD, RSMC Dakar, AGRHYMET and NMHSs Burkina Faso, Mali, and Niger. This arrangement will contribute directly to the implementation of the CREWS national work plans and promote programme alignment and coordination in the CREWS West Africa project portfolio. The project will be carried out in alignment with the WMO policy on gender mainstreaming. The implementing entities will strive for gender balance in all training activities and in the RPSC. Sex-disaggregated data will be collected in the development early warning information and also in the end

		user preference scoping workshops to understand how gender disparities affect the way poor men and women access and respond to early warning information. Early warning information will be tailored to meet the needs of both women and men and feedback on the early warning will also be sex-disaggregated. The project will be implemented in line with WMO Project Management and Administration Procedures. Funds will be transferred to implementing partners through standard WMO Letters of Agreement.
	b. Monitoring and evaluation system	The Project will make use of the established Monitoring and Evaluation Process used at WMO, taking into account the CREWS M&E framework. The RPSC will be meet every six months to evaluate the progress made on the Project as outlined in the workplan (Table 1). Evaluation reports will be made available to all Project Stakeholders, including development partners. An independent consultant budgeted under supporting component Monitoring & Evaluation, will conduct a project impact assessment through identify relevant process on the information flow from observation to final decision making at user level using few tests. That assessment would be conducted in the second half of 2018 and would help to validate project approaches and to suggest improvements for the last year of implementation.
Project viability and sustainability	a. Main identified risks	The risks identified below include key policy, institutional, and implementation risks; which include (1) programme scope and ambition in relation to available resources; (2) lack of adequate institutional capacity for implementation; (3) constraints in financial management capabilities; (4) limited procurement experience and (5) security and vandalism. Risks (1)-(4) will be mitigated through close association between the current work plan an on-going CREWS and other related projects in the region (see Annex 1). The overall risk rating for the project is moderate, based on the nature of the proposed activities, the capacity of the implementing entity and the available support through the partners during implementation. Mitigation measures will be established to ensure that risks do not compromise the successful implementation of the project or long-term sustainability of results. Ongoing dialogue with the government and intermittent workshops as well as training will also be arranged in order to make sure that the project is implemented in a risk-informed manner.
	b. Critical assumptions	The project was prepared under the assumption that NMHSs will support operationalization of Resolution 60 (Cg-17), on the international exchange of climate data and products. The project also assumes that there is collaboration between ACMAD, RSMC Dakar, and AGRHYMET in the CREWS countries and this collaboration will be strengthen under the programme to enhance quality and effectiveness of end-to-end early warning systems.
	c. Judgement on the project's sustainability	The investment is economically viable and technically feasible and has strong social, environmental, and economic co-benefits. The administrative capacity of ACMAD is tenuous, WMO and technical partners will provide capacity building support to improve administrative procedures and their technical capability to better support ACMAD's capacity to fulfill its mandate as a WMO CC. The programme engages a broad regional network of support, with institutions such as AGRHYMET and RSMC Dakar underpinning activities. The participating NMHSs are standing entities within their national governments.

Table 1: Workplan

	2018				2019				2020			
ACTIVITIES	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Component 1 - Data, products and exchange												
Activity 1.1.1: Contacting observation network owners (mostly NMHSs) of the region to gather information on the status and performance of the observation network and data archives												
Activity 1.1.2: Initial two-day stakeholder workshop												
Activity 1.1.3: Preparation of a plan to make observations available and inter-operable for the region												
Activity 1.2.1: Setting-up the WACA&D system for West Africa (specific implementation plan developed in regional consultations)												
Activity 1.2.2: Organisation of two local workshops bringing together national providers of observational data and users involved in (the development of) Early Warning Systems, and preparation of an e-learning module.												
Activity 1.2.3: Climsoft update for implementation at observation sites in the region.												
Activity 1.3.1: identify priorities and needs of stakeholders for enhancing Climate Watch Advisories (CWAs)												
Activity 1.3.2: Identify existing initiatives for collecting and sources of information on impacts of extreme events and options for inclusion into hydro-met extreme database (e.g KRONER)												
Activity 1.3.3: Identify, and develop standards for information collection and description												
Activity 1.3.4: Develop and implement process for operational inclusion of impact information into the hydro-met extreme database (e.g KRONER)												
Activity 1.3.5: Evaluate and optimize user interface for analysing information contained in the hydro-met extreme database (e.g KRONER) together with users in the region												
Activity 1.4.1 One user forum in each CREWS country												
Activity 1.4.2 One training in each CREWS country to build capacity on service delivery												
Component 2 - Analysis and climate watch tools												
Activity 2.1: Identify priorities of stakeholder												
Activity 2.2: Development of CM SAF satellite- and GPCC-based monitoring products for West Africa based on process established and applied for WMO RA VI												
Activity 2.3: Identifying optimal procedure(s) for generating gridded climate monitoring products for each variable (CM products)												
Activity 2.4: Developing processes for generating the CM products												

Activity 2.5: Evaluating and improving performance and quality of CM products												
Activity 2.6: Operationalizing the procedures												
Activity 2.7: CWS workshop with regional stakeholders												
Activity 2.8: Designing and setting up a CWS decision making process to regularly assess and analyse the meteorological situation												
Component 3 Improved short term and severe weather forecasts capabilities tentative activity plan												
Activity 3.1: Meetings of RSMT of CREWS Western Africa to review the project progress and update Regional Subproject Implementation Plan (RSIP) including preparation, execution and evaluation of demonstration phase												
Activity 3.2: Preparation by the Centres and development of project website (RSMC Dakar web portal) before starting demonstration												
Activity 3.*3: Two-week CREWS / SWFDP Training Workshop on Severe Weather Forecasting and Delivery of Warning Services*												
Activity 3.4: *Two-week RSMC Dakar Training Desk (for 2 forecasters/PWS staff from the NMHSs of identified countries in Western Africa and 1 expert from a regional technical support centre)*												
Activity 3.5: In-country visits (2 countries per year) to gather information on operational weather forecasting and delivery of services; and negotiations with national project leaders												
Activity 3.6: Based on mission assessment reports, develop national implementation plans (IPs) for visited countries and reach agreement with the PRs.												
Activity 3.7: Support participants from SWFDP countries at the ECMWF (UK) annual training												
Activity 3.8: Support participants from SWFDP countries at the DWD (Germany) annual training												
Activity 3.9: Continuous monitoring and tracking of the project (including overall review of progress through RSMT meetings as mentioned above)												

Component 4 Flood forecasting: West Africa FFGS implementation in Burkina Faso, Mali, and Niger tentative activity plan	**2018**	**2019**				**2020**				**2021**
	Q4	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**
Activity 4.1: Initial planning meeting										
Activity 4.2: Development of Geomorphological relations										

Activity 4.3: Verification of Basin delineations												
Activity 4.4: Initial development and implementation of West Africa FFGS System												
Activity 4.5: Steering Committee Meeting 1												
Activity 4.5.1:On line FFGS training (Step 2)												
Activity 4.5.2: Operational Training at HRC (Step 3)												
Activity 4.5.3: Regional Operations Training (Step 4)												
Activity 4.5.4: Sustainability training (Step 5)												
Activity 4.6: Purchase of FFGS servers and shipment to DR Niger/Mali												
Activity 4.7: Maintain the system at HRC												
Activity 4.8: Onsite installation of FFGS servers and It training												
Activity 4.9: Operations Supports												
Activity 4.10: Preparation of West Africa FFGS user guide												

	2018				2019				2020			
ACTIVITIES	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Component 5. Sub-seasonal to seasonal forecasts												
Activity 5.1: Sub-seasonal to seasonal prediction and regional optimization												
Activity 5.2: Sub-seasonal to seasonal forecast tailoring to national scales												
Activity 5.3: Pilot services on severe drought tested in one or two countries.												
Component 6. Management												
Activity 6.1 RPSC meetings												
Activity 6.2 Reporting												
Activity 6.3 Final evaluation												

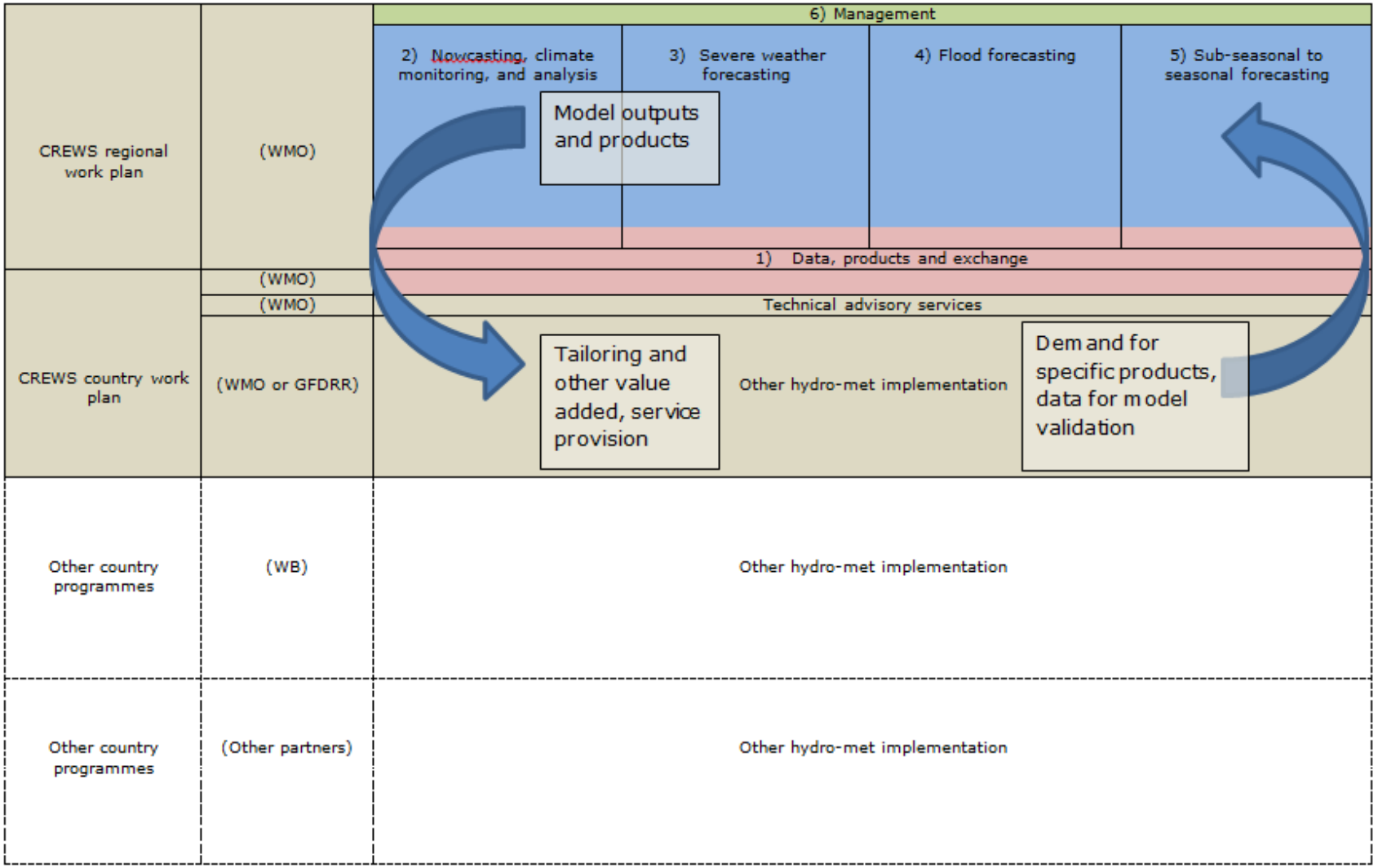

Figure 1 CREWS West Africa Regional Programme in CREWS and other country programme context

Annex 1 - Selected hydro-met-related projects in West Africa

WB/GFDRR

- Niger: Projet de Gestion des Risques de Catastrophes et de Développement Urbain (20 million USD, under implementation)
- Mali: Strengthening Climate Resilience in Sub-Saharan Africa (29.5 million USD, approved, implementation pending World Bank GCF accreditation)
- Burkina Faso: Hydromet country programme (22 million USD, submission to GCF 4th Q 2017)

WMO

- Climate Services for Increased Resilience in the Sahel (1 million USD, funded by USAID)
- Global Framework for Climate Services (GFCS) – Africa, Caribbean and Pacific states (85 million EUR, funded, award TBC, implementation to begin 2018)
- Linking Climate Knowledge to Action for Resilience in the Sahel (50 million USD, in preparation by GFCS for WMO submission to GCF)

Niger (other)

- UNDP, UNCDF: Regionalization of Community-Based Adaptation (CBA) in Niger (19 million USD) GEF/LDCF funding
- FAO: Integrating climate resilience into agricultural and pastoral production for food security in vulnerable rural areas through the Farmers Field School approach (3 million USD) GEF/LDCF funding
- AfDB: Climate Information Development and Forecasting Project (PDIPC) (13.8 million USD)
- European Union: Support Project for Climate Resilience for Sustainable Agricultural Development (PARC-DAD) (12 million USD)
- Word Bank: Climate Smart Agriculture Support Project (111 million USD)
- Word Bank/EU: Community-based Disaster risk reduction project in Niger (1 million USD)

Mali (other)

- USAID: Mali Climate Change Adaptation project for institutional capacities strengthening of Mali Meteo, technical assistance to improve climate data and development of a decision making tool for farmers (23.3 million USD)
- UNDP: support to the prevention and preparation for major risks (mainly floods) in communes of Bamako, Mopti, in Kayes (10.3 million USD)

Burkina Faso (other)

- UNDP: SAP-IC project- Strengthening climate information and early warning systems (EWS) for climate resilient development and adaptation to climate change (3.6 million USD)
- FAO: Integrating CC Resilience into Agricultural and Pastoral production for food security in the vulnerable rural areas through the farmer school approach (3.8 million USD)
- DfID: Building Resilience and Adaptation to Climate Extremes and Disasters (BRACED) (678,000 USD)
- CCAFS: Capacitating African Smallholders with Climate Advisories and Insurance Development (CASCAID) (funding unknown)