



Niger Basin Authority (NBA)/ Autorite du Bassin du Niger (ABN), Niamey, Niger.



Brief Outline of Regional Groundwater Management in NBA

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Outline of the Presentation

- Overview of River Niger and Niger Basin Authority (NBA)
- Status of Groundwater Management in NBA
- Outline of AGES Project Phases 1 to 3: 2010 – 2022
- Some outputs of AGES Project Phase 1: (Example) Niamey Project site
- Some challenges
- Some achievements of the project
- Lessons learnt
- Conclusion

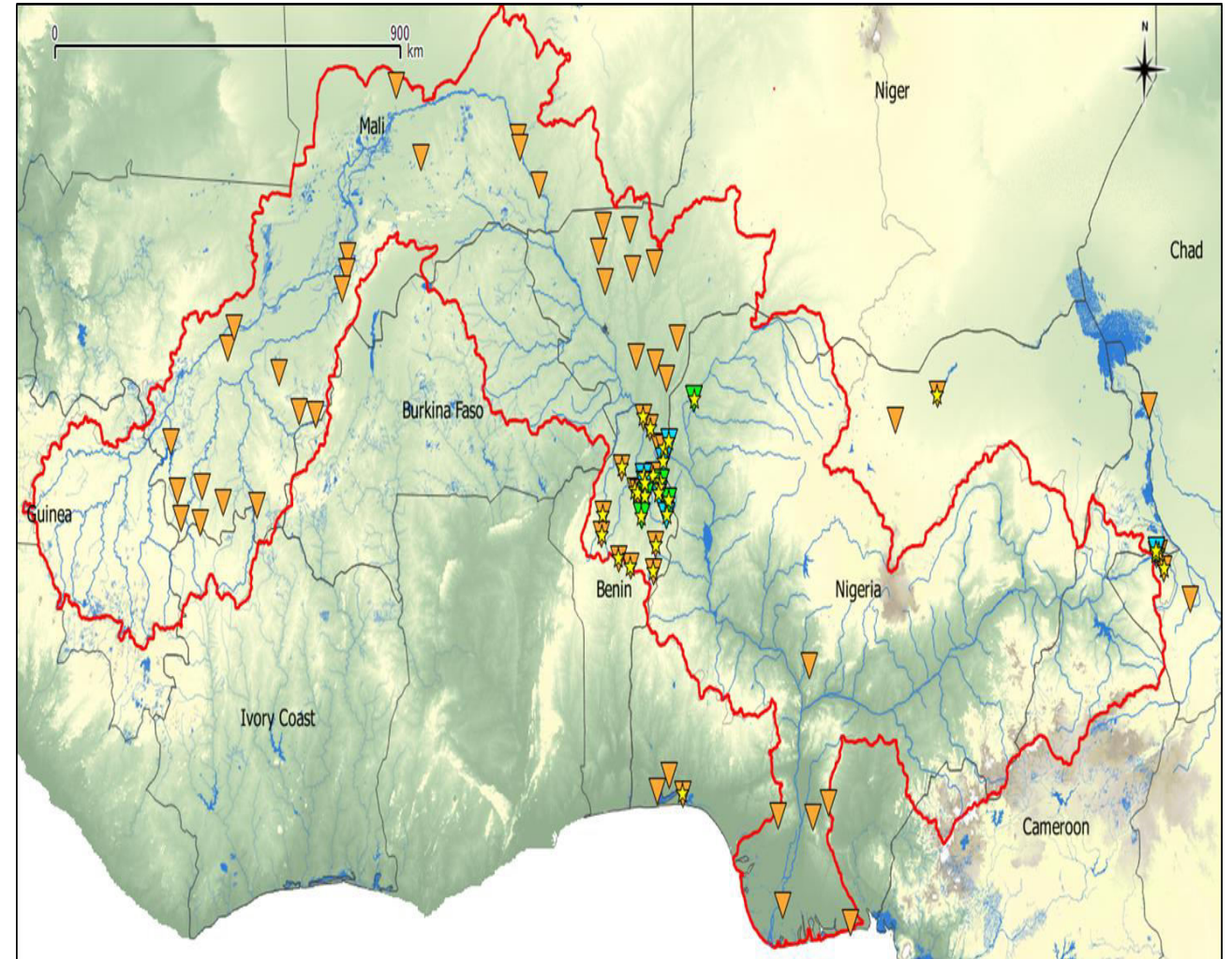
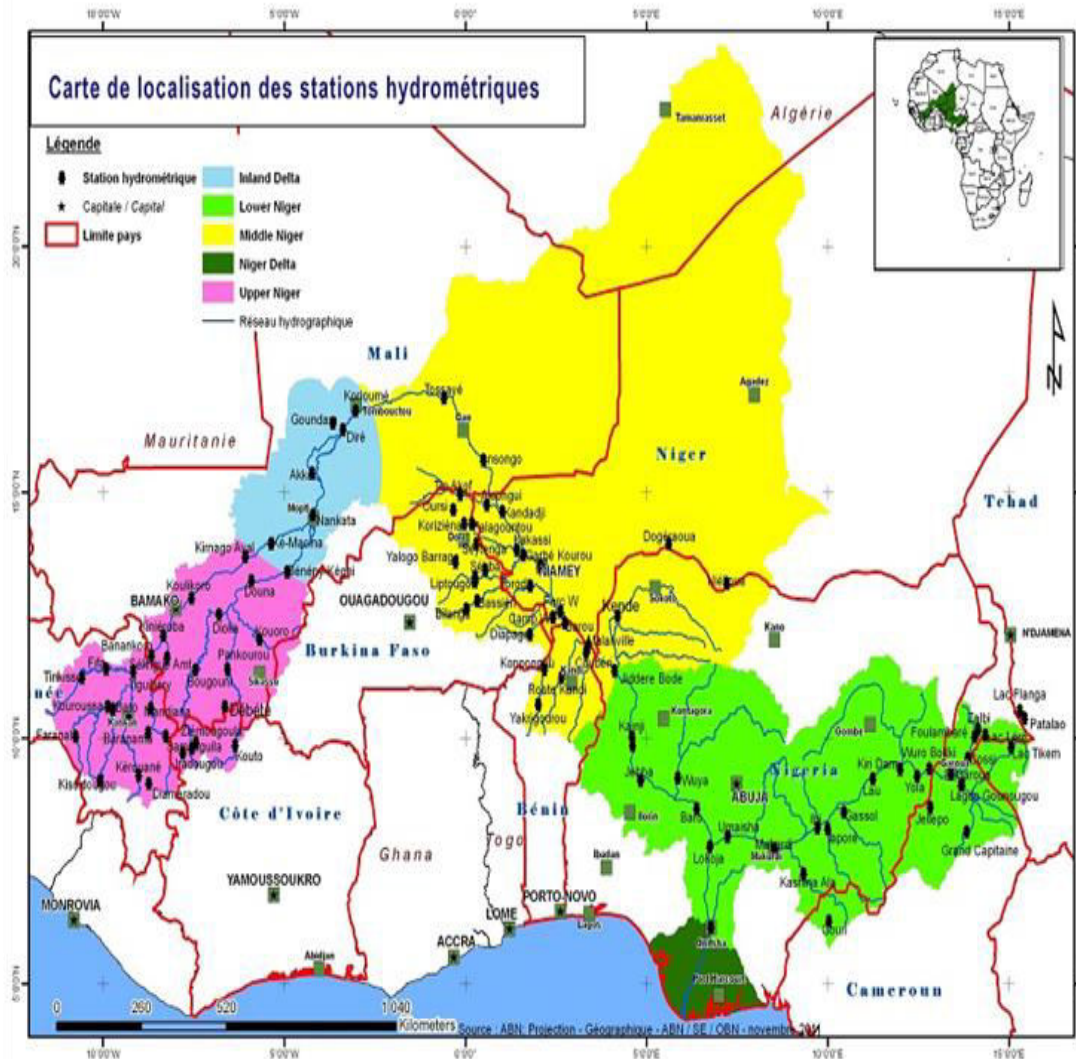


Overview of River Niger & NBA

- Source from the Fouta-Djalon Plateau more than 1000m altitude in Guinea & successively flows through Mali, Niger, Benin and Nigeria where it empties into the Atlantic Ocean after a span of around 4200 km.
- Longest river in Africa (after the Nile and the Congo), the 14th in the world & the 9th by its drainage basin (2,170,500 km²).
- Active watershed covers an area of approximately 1,500,000 km² shared by the nine (9) countries within the Niger Basin Authority catchments with over 120 million population:
- Benin (2%), Burkina Faso (4%), Cameroon (4%), Côte d'Ivoire (1%), Guinea (6%), Mali (26%), Niger (23%), Nigeria (33%) and Chad (1%).
- The River Benue which rises from Adamawa Plateau, Cameroon, to join the main course of River Niger at Lokoja in Nigeria, this is one of its most important tributaries.
- The NBA, created in 1980 is one of the oldest inter-governmental river basin organization with the mandate to promote cooperation among the 9 member countries and to ensure the integrated development of the Niger basin across the domains of energy, water works, agriculture, livestock farming, fisheries and aquaculture, forestry and timber, transport and communication and industry and associated ecosystems
- Groundwater accounts over 90% of safe water sources in the Basin, which is used extensively in particular for households, agriculture and livestock and is forecast to increase substantially to combat growing food insecurity in the Basin
- The NBA is legalise institution with responsibility of coordinated management of transboundary groundwater management in the Basin.



The Networks of flow of River Niger / Groundwater Monitoring Networks from Guinea to Nigeria





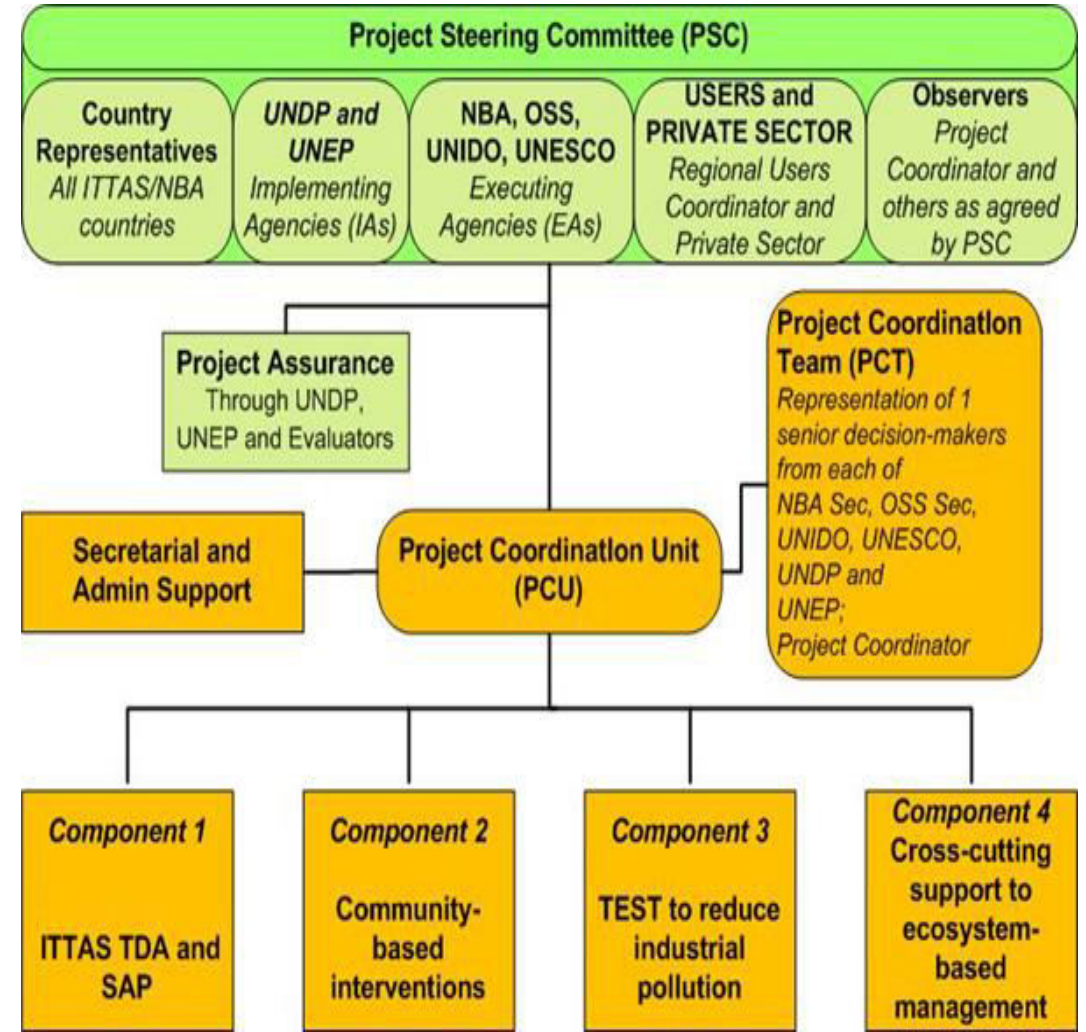
Status of Groundwater Management in the Basin

- Since its inception in 1980, Groundwater activities/ programmes/ projects has been so redundant at the regional level.
- Concentration is on surface water, the River Niger & its tributaries.
- The development and implementation of NBA Water Charter and some activities in the Sustainable Development Action Plan and Investment Plan of NBA, has necessitated the integrated management of both surface and groundwater of the Basin.
- Hence the project for the management of groundwater in the Basin (AGES) was formulated by the support of the Government of Germany in the year 2010, still on-going.
- Also the project for Improving IWRM, knowledge-based management and governance of the Niger Basin and the Iullemeden-Taoudeni/Tanezrouft Aquifer System (ITTAS)” to support integrated water resources management (IWRM) for the benefit of communities and ecosystems’ resilience, 2018 is also on-going. This was with the support of UNDP, GEF, UNIDO, OSS.
- Two Groundwater Management Projects are in line with IWRM principles and NBA institutional sustainable action plan, currently on-going, lets mirror AGES Project!



Brief on ITTAS Project (2018 – 2022)

- Objective: improve knowledge-based management, governance & resource conservation of the River Niger Basin & the Iullemeden - Taoudéni/Tanezrouft Aquifers (ITTAS), to support IWRM for the benefit of communities & the resilience of ecosystem.
- 11 Countries are the beneficiaries (+ Algeria & Mauritania)
- Expected 4 general outcomes:
 - a. IWRM supported by a sound understanding of ground water resources and their linkages with surface water systems
 - b. Niger Basin Users Associations and National NGOs engaged in basin resources management and conservation for better control of flood/drought/pollution, reduction of pressure on land, forest and biodiversity while improving living conditions of households
 - c. Introduce systematic and integrated approach of industrial competitiveness and environmental/social responsibility to reduce wastewater discharges & pollution loads in the River Niger.
 - d. National Policies and Institutions, Civil Society Platforms support River Niger Ecosystem based management





Brief on the AGES Project

The AGES Project:

- As part of the NBA's "Integrated Water Resources Management" program & the German Development Cooperation, this project supports the Niger Basin Authority in the development of **measures for groundwater protection and sustainable use within IWRM perspective**.
- The project activities aim to develop the necessary institutional capacities in groundwater management with the participation of NBA staffs playing an important role. During the project the NBA and its focal structures should be sensitized on groundwater management issues, while the authority should start implementing measures with transboundary effects.

The general project activities include:

- Collection and assessment of groundwater data and maps in the Niger basin in order to develop a groundwater database as well as a basis for the preparation of a hydrogeological modelling, maps for the basin
- Identification of transboundary regions with conflict-ridden groundwater problems
- Support of first measures to improve groundwater management in selected project areas
- Capacity building at all levels (education, training programs, know-how-transfer)



AGES Project Phases 1 to 3

AGES Project Phase 1: Duration: 2010 - 2013	AGES Project Phase 2: 2014 - 2018	AGES Phase 3: 2019 - 2022
Budget: 2.5M Euros Location: transborder between Niger/Benin/Nigeria	Budget: 2.5M Euros Location: (Benin-Niger-Nigeria) and pilot zone 2 (Guinea-Côte -Mali)	Budget: 2.2M Euros Location: same as phase 2
Main activities carried out	Main activities carried out	Main activities carried out
Inventory of groundwater information in the Niger River Basin.	Groundwater monitoring network (piezometry & quality) established in project areas	Establishment of cross-border expert working groups; hydrogeologists, computer scientists, etc.), who will participate in all stages of the work (on-the-job training) in pilot areas
The cross-border study of pilot areas, Identification of priority areas & definition of pilot areas	26 piezometers with all equipment established including 18 in pilot zone 1 and one in pilot zone 2	Development of a strategy for improving monitoring networks in member countries, analysis of networks & quality of existing piezometers
Identification of the institutional structures concerned in the members countries and more data collection.	Production of quality (WHO pollutants), piezometric maps, with reporting of the six-monthly monitoring plus more information (precipitation, etc.)	Continuation of field campaigns in the 2 pilot areas, with MN (Benin, Niger, Mali & Ivory Coast), initiation of field in the pilot areas in Nigeria (1) & Guinea (2), reading the recorders, groundwater sampling (quality & isotopes),pumping, data collection & processing, monitoring etc. with (on-the-job) training of cross-border working groups (MC & SE ABN)

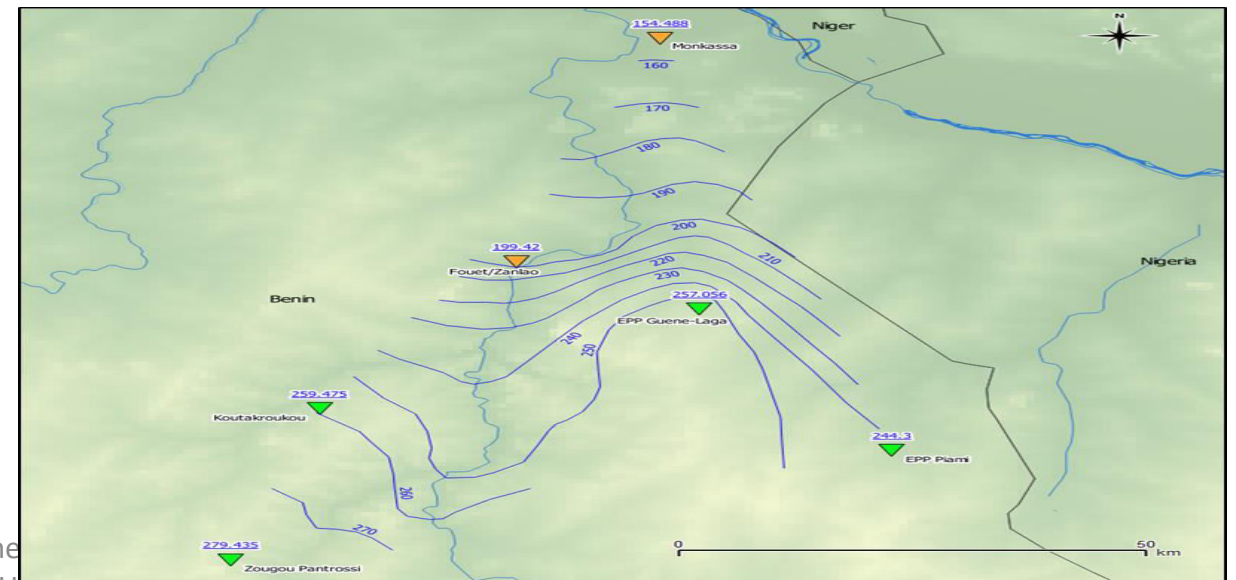
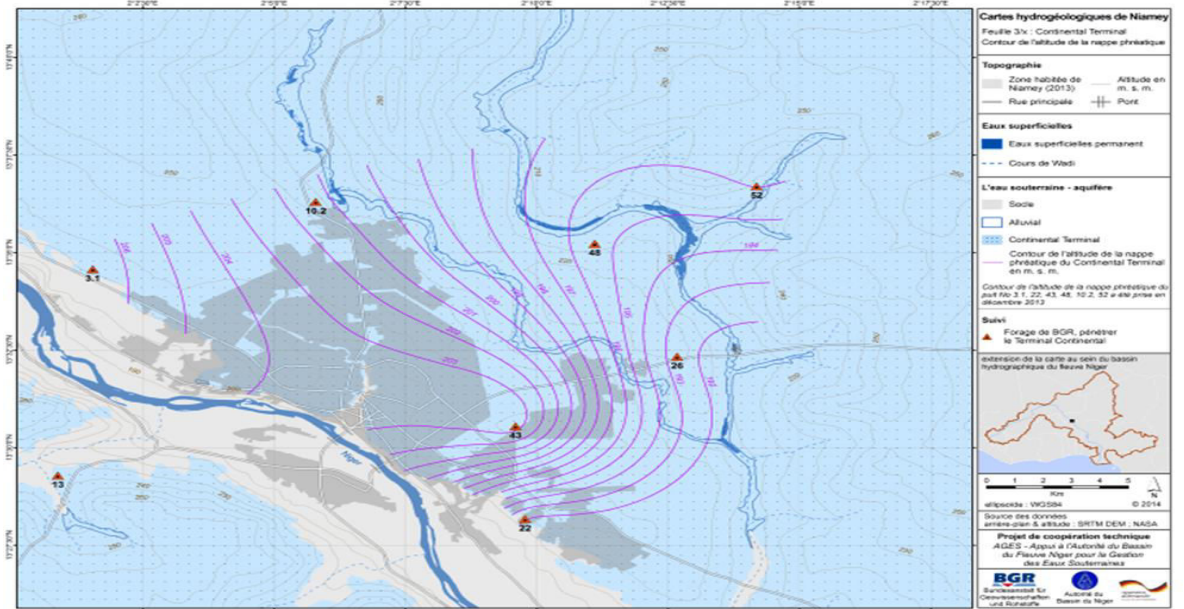


AGES Project Phase 1: 2010 - 2013	AGES Project Phase 2: 2014 - 2018	AGES Phase 3: 2019 - 2022
Capacity building at all levels - parallel program (NBA personnel & members countries)	Field training in pumping tests, hydrogeochemical sampling, programming, installation, reading of automatic recorders for ABN staff (SE and SFN), regional offices, etc	Identification, selection & treatment of concrete hydrogeological problems in the pilot areas (such as natural pollution, vulnerability and natural recharge of groundwater) and development of thematic maps
Development of Regional & National Data Base System, Complement & update additional data, data evaluation, development of a model designed, Digital model & scenario development, Identification and characterization of aquifers	Finalization of thematic maps for pilot zone (1) lithology / geology, (2) productivity of aquifers, (3) seasonal map of surface water based on satellite images, (4) groundwater recharge, (5) artificial recharge of aquifers, (6) piezometry (level and direction of flow) and (7) water quality and preparation of thematic maps for pilot zone 2 (e.g. piezometry, quality etc.) Development of recommendations for a sustainable management of groundwater in pilot zone 1	Development of an overview map representing "stress" factors on the state of groundwater resources in the Niger basin, such as population growth, intensive agriculture, mining activities etc.



Some Outputs of AGES Project Phase 1: Example: Niamey Project site

In the Niamey area, there are three important aquifers discovered:	The groundwater monitoring net considers the three aquifers (see Fig. 3). A separated groundwater contour map has been prepared for each aquifer after each monitoring campaign (see Fig. 5).	Only the alluvial aquifer shows an interaction with River Niger. All samples showed high bacteria loads (coliforms and enterococci) of more than 2,000 colony forming units (CFU) per 100 mL, as well as large nitrate concentrations of more than 50 mg/L. Elevated concentrations (e.g. nitrite and arsenic) occurred only in few cases.
Basement "Méta-Liptako": a granite-gneiss complex of Precambrian age; it is a fractured aquifer,	Five groundwater monitoring sampling on quarterly basis have been carried out so far.	High bacterial loads (> 1,000 CFU/100 mL) were mainly encountered in open hand-dug wells.
"Continental Terminal" (CT): a sandstone formation of Eocene - Pliocene age generated over a long sedimentation period; the CT acts as a porous aquifer	Groundwater appears to flow differently depending on the aquifer considered.	Closed wells show in average lower bacteria loads (0 – 100 CFU/100 mL).
Alluvial sands: low compacted sands of Quaternary age deposited by the Niger River; the alluvial sands act as porous aquifer of local expansion.	For nitrate however, not only the open wells but also the closed ones are affected. The presence of latrines close by are suspected to be the source of nitrate	The analyzed bacteria are of human or animal origin and enter into the open wells with the plastic cans that are permanently used to fetch the water.





Groundwater sampling with NBA staff in the project area of Niamey.

Source: BGR (Fig. 4)





Some Challenges Experienced

- Poor response from some member countries on provision of available groundwater data
- Weak facilitation from some member countries on the accessibility and status of existed groundwater monitoring network
- Slow response in translation of project document from Germany, French and English languages
- Some failure were experience at the project groundwater observation networks due to human tampering / vandalization, mechanical and electronic faults
- Poor monitoring of observation networks from member countries
- Lack of taken responsibility for ownership by some member countries
- Poor awareness, sensitization and advocacy by member countries on the importance of groundwater sustainable management
- Weak coordination from NBA due to insufficient personnel, equipment
- Some delay in the implementation due to COVID-19 Pandemic
- Some set back due to security challenge in some parts of members countries regions along the pilot areas
- Observation/monitoring networks are not enough
- Governance, policy, budget, personnel, equipment issues at country levels



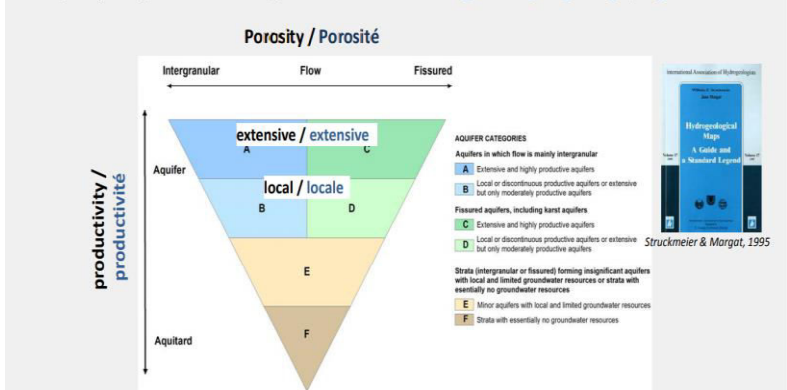
Some Achievements of the Project at the Regional Level

- Development of Groundwater management data base system
- Development of regional observation/monitoring network maps
- Potential aquifers productivity maps
- Harmonization of geological maps
- Mapping of groundwater recharge areas
- Production of stream flow networks
- Flooding dynamics simulation
- Water body extraction through Landsat & Modified Normalized Difference Water Index
- Delineation of most important flooding areas
- Identification of local recharge areas
- Improved discrimination of water & land through image enhancement
- Some levels of advocacy and sensitization has been made among members countries for sustainable magt. of groundwater resources, but more are still needed.
- Better cooperation & interaction among members countries/ groundwater data sharing etc

Potential aquifer productivity / Productivité potentielle des aquifères

A hydrogeological standard legend Une légende hydrogéologique générale

A hydrogeological standard legend Une légende hydrogéologique générale



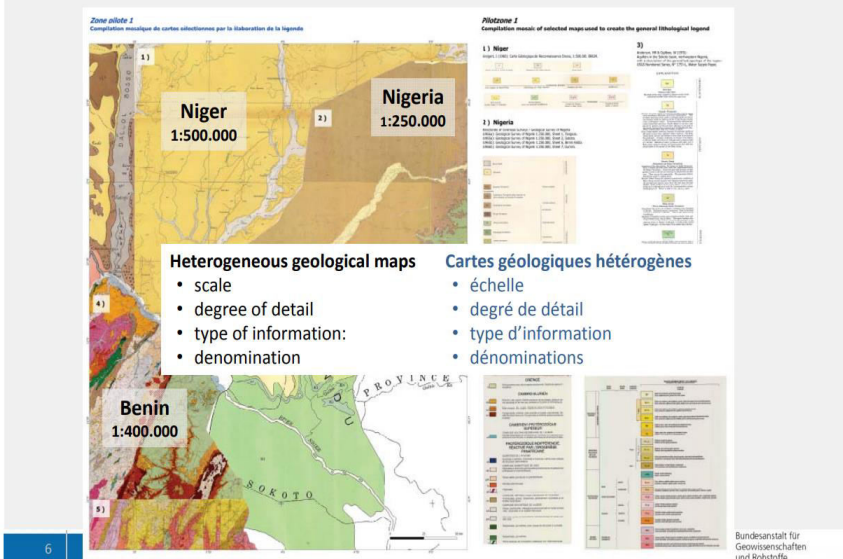
local expert knowledge / connaissance des experts locaux

- | local expert knowledge / connaissance des experts locaux | | | | |
|--|--|---|---|---|
| 1. Porosité <ul style="list-style-type: none"> • non cimenté • partiellement cimenté • cimenté | 2. Fracturation <ul style="list-style-type: none"> • aucune • fracturé / karstifié • très fracturé / karstifié | 3. Consolidation <ul style="list-style-type: none"> • non consolidé • partiellement consolidé • consolidé | 4. Continuité <ul style="list-style-type: none"> • aquifères locaux ou discontinus • aquifères régionaux au continus | 5. Productivité <ul style="list-style-type: none"> • productivité faible • productivité moyenne • productivité élevée |
| 1. Porosity | 2. Fracturation | 3. Consolidation | 4. Continuity | 5. Productivity |

Map harmonization / Harmonisation de cartes

Geological maps Cartes géologiques

Geological maps Cartes géologiques



Water body extraction / Extraction des plans d'eau

Motivation / Motivation

Stream network / Planes d'eau

- Stream network / Planes d'eau**
- spatial adjustment of digitized maps / ajustement des cartes numériques
 - base map / carte de base

Flooding dynamics / Dynamique d'inondation

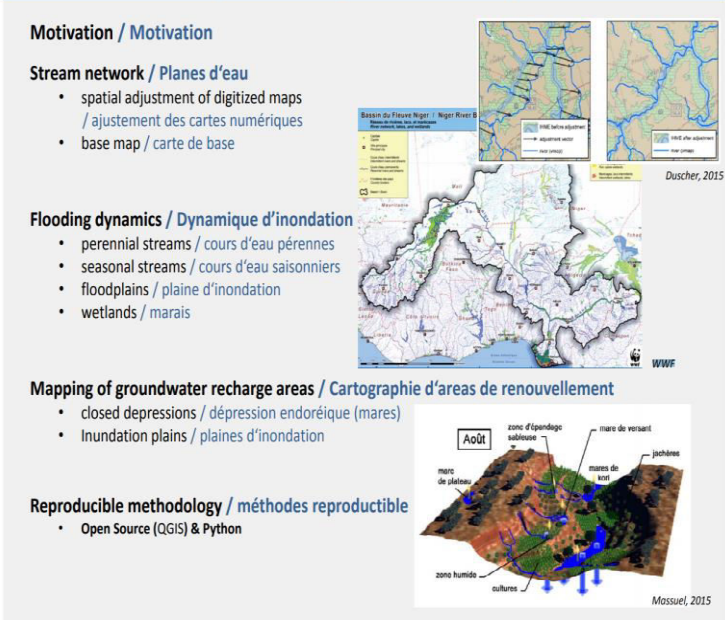
- Flooding dynamics / Dynamique d'inondation**
- perennial streams / cours d'eau pérennes
 - seasonal streams / cours d'eau saisonniers
 - floodplains / plaine d'inondation
 - wetlands / marais
- 

Mapping of groundwater recharge areas / Cartographie d'aires de renouvellement

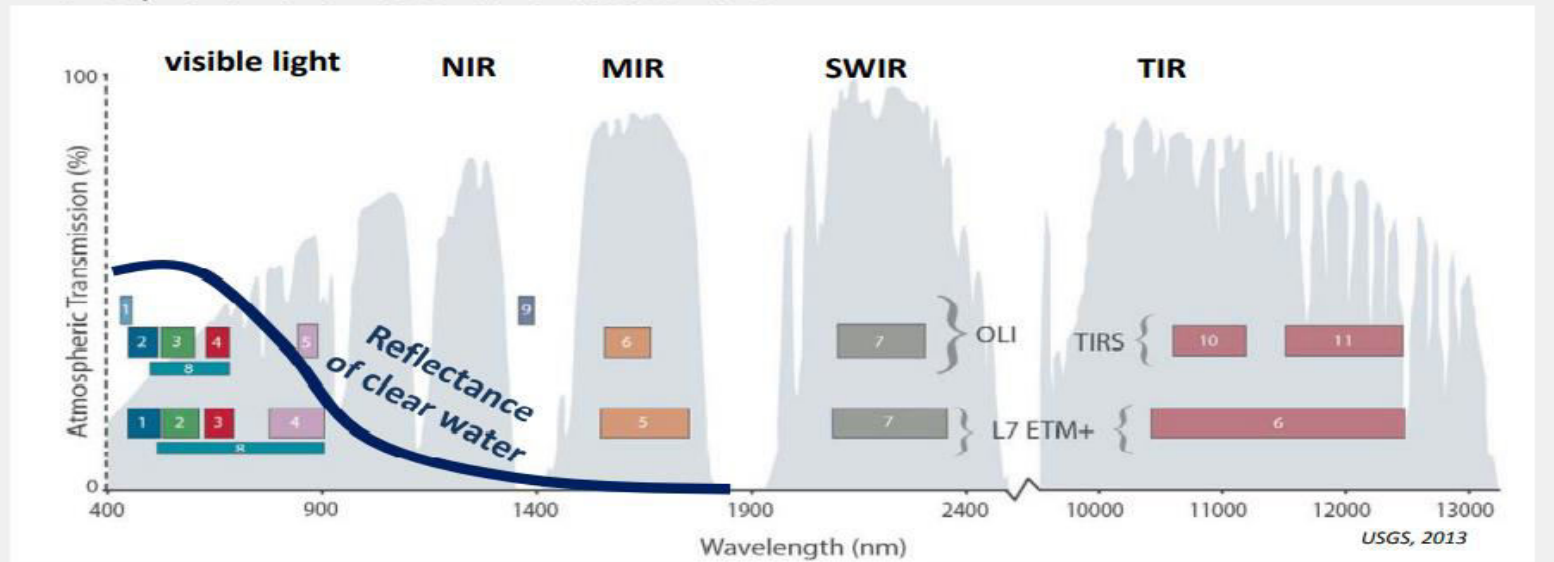
- Mapping of groundwater recharge areas / Cartographie d'areas de renouvellement**
- closed depressions / dépression endoréique (mares)
 - Inundation plains / plaines d'inondation
-

Reproducible methodology / méthodes reproductibles

- Reproducible methodology / méthodes reproductibles

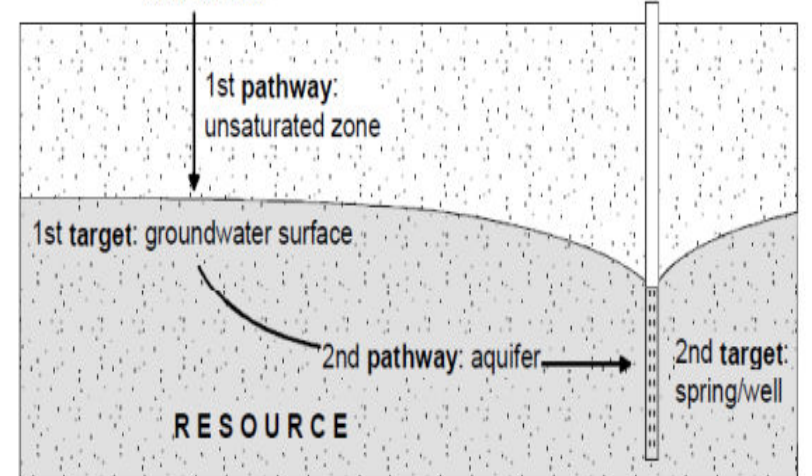


Atmospheric Transmission & Landsat Sensors



origin of a potential contamination:
land-surface

SOURCE





Some Lessons Learnt

- Correlation between capacities building and improved groundwater observation networks of some members countries through the AGES project.
- Correlation between capacities building & groundwater data collection, interpretation, storage, exchange and interaction.
- Availability of budget from member countries has (+ve) impact on data collection, maintenance, monitoring and safe guarding the observation networks.
- Availability of groundwater policy document, laws and guidelines in some member countries improved accountability, control, development and management.
- Technical know-how/Knowledge at Regional level is critical for the sustainable management of groundwater at members countries.
- The interference of human activities on land/ surface water bodies has impact on the quality of groundwater.
- The interlinkages and interdependency of surface and groundwater clearly highlight the need to manage both in an integrated manner.



Conclusion

- This is a laudable project that should be sustain and upscale in the region.
- Members countries should do more on groundwater development and sustainable management through enacting appropriate laws, setting up of institutional arrangement, policy document & enforcement of such law.
- NBA need to do more advocacy and sensitization to member countries on safe guarding of observation networks & be a regional organization for the data harmonization, storage, interpretation and dissemination.
- AGES project and NBA should try as much as possible to consolidate the observation networks through partnerships with other development partners working in the region.
- AGES project and NBA should formulate a sustainable action plan among member countries for the sustainability of all the observation networks in the region.
- More advocacy, sensitization, awareness, enlightenment and projects/ programmes are needed at NBA and members countries for sustainable magt. of groundwater resources.
- Need for more studies on River Niger & associated groundwater aquifers inter-connection in the Basin
- Need more presence of IGRAC & UNESCO-IHP in NBA

THANK YOU FOR YOUR PRECIOUS TIME!!!



MERCI POUR VOTRE PRECIEUX TEMPS!!!