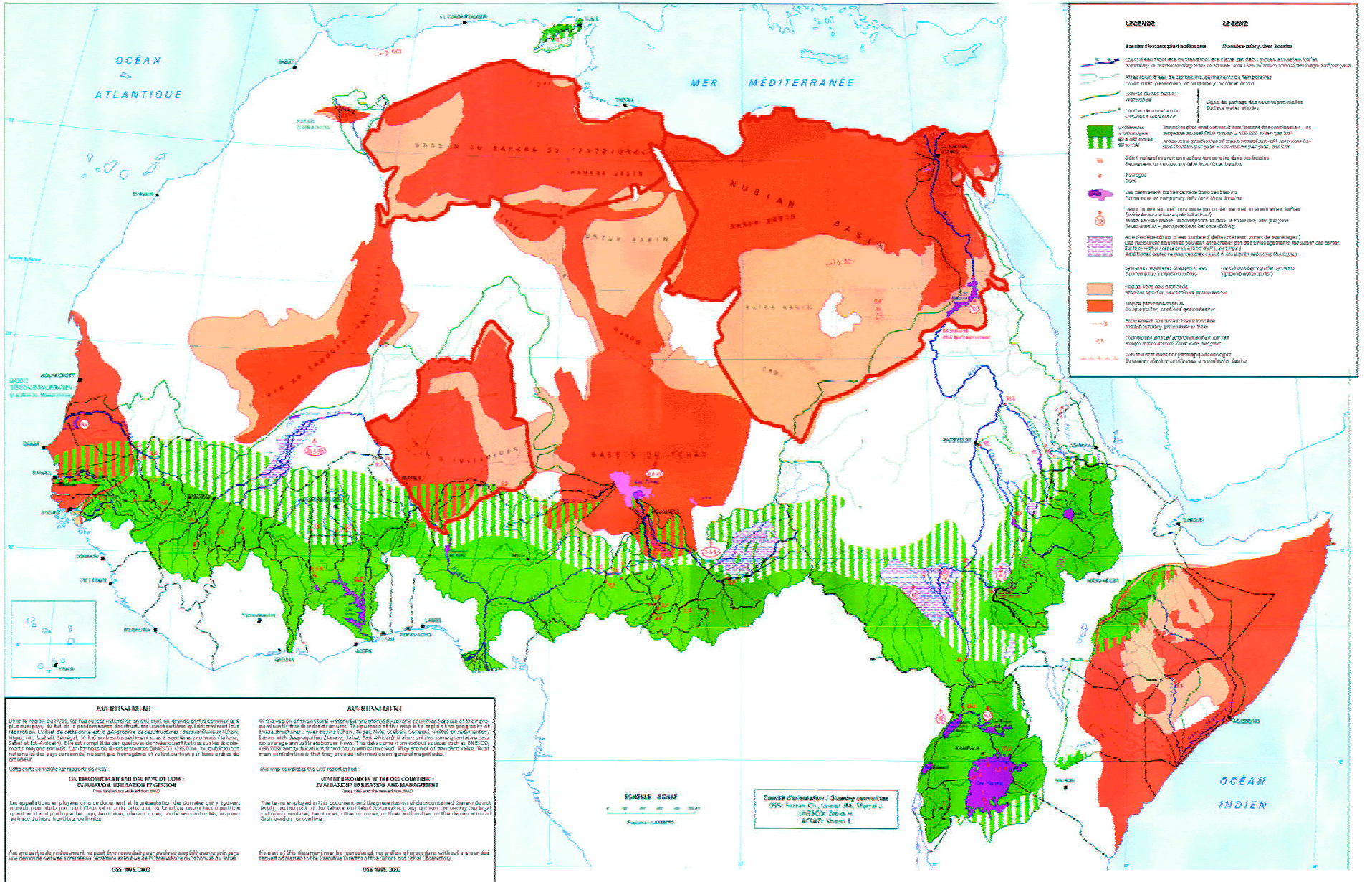
CONSULTED MANAGEMENT OF A SHARED RESOURCE CASE OF NORTH WESTERN SAHARA AQUIFER SYSTEM

OBSERVATOIRE DU SAHARA ET DU SAHEL
SAHARA AND SAHEL OBSERVATORY

GREAT SHARED CIRCUM SAHARA BASINS



BASINS CHARACTERISTICS

Basin		Countries sharing the basin	Area in km2	Reserves in billion of m3	
Northern Sahara	Nubian sandstone	Libya, Egypt, Sudan, Tchad	2.000.000	150.000	6.000
	Septentrional Sahara	Algeria, Tunisia, Libya	1.000.000	60.000	8 à 10
Southern Sahara	LakeTchad	Tchad, Niger, Cameroun, Nigeria	350.000		20
	Iullemenden	Niger, Mali, Algeria	200.000	40.000	200
	Taoudéni	Mali, Mauritania, Algeria	500.000	2.000	25
	Senegalo-Mauritanian	Mauritania, Senegal, Guinea-Bissau, Gambia	30.000	500	20

CHALLENGE AND OPPORTUNITIES

- **SIGNIFICANT RESERVES BUT SLIGHTLY RENEWABLE**
- **VOLUMES LIMITS ECONOMICALLY EXPLOITABLE FOR AGRICULTURE**
- **GROWTH NEEDS**
- **NON CONSULTED MANAGEMENT**

BASIN AWARENESS

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KNOWLEDGE CONTROL

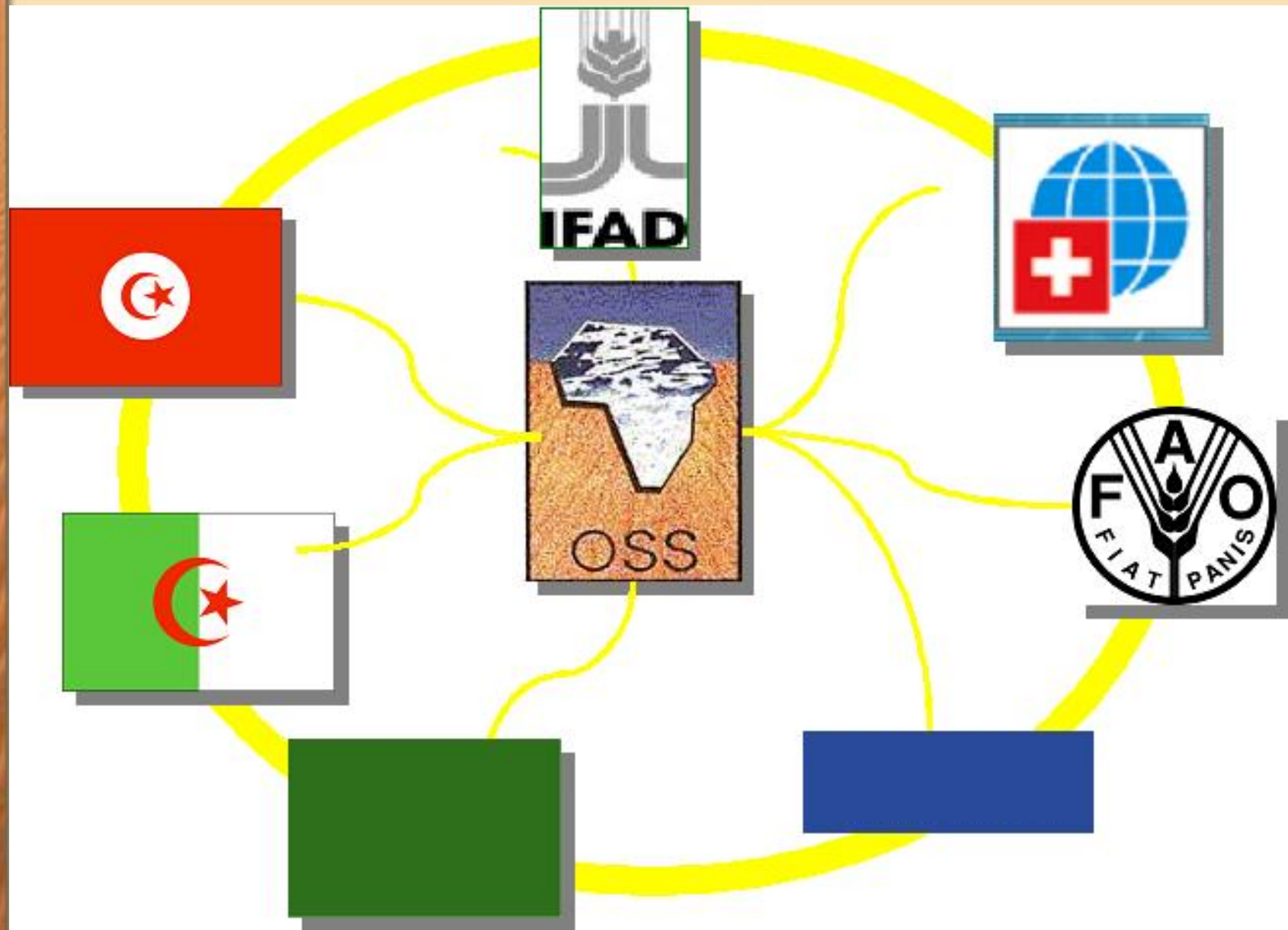
COOPERATION AND TECHNICAL EXCHANGE

PERMANENT CONSULTATION

↓

NWSAS BASIN

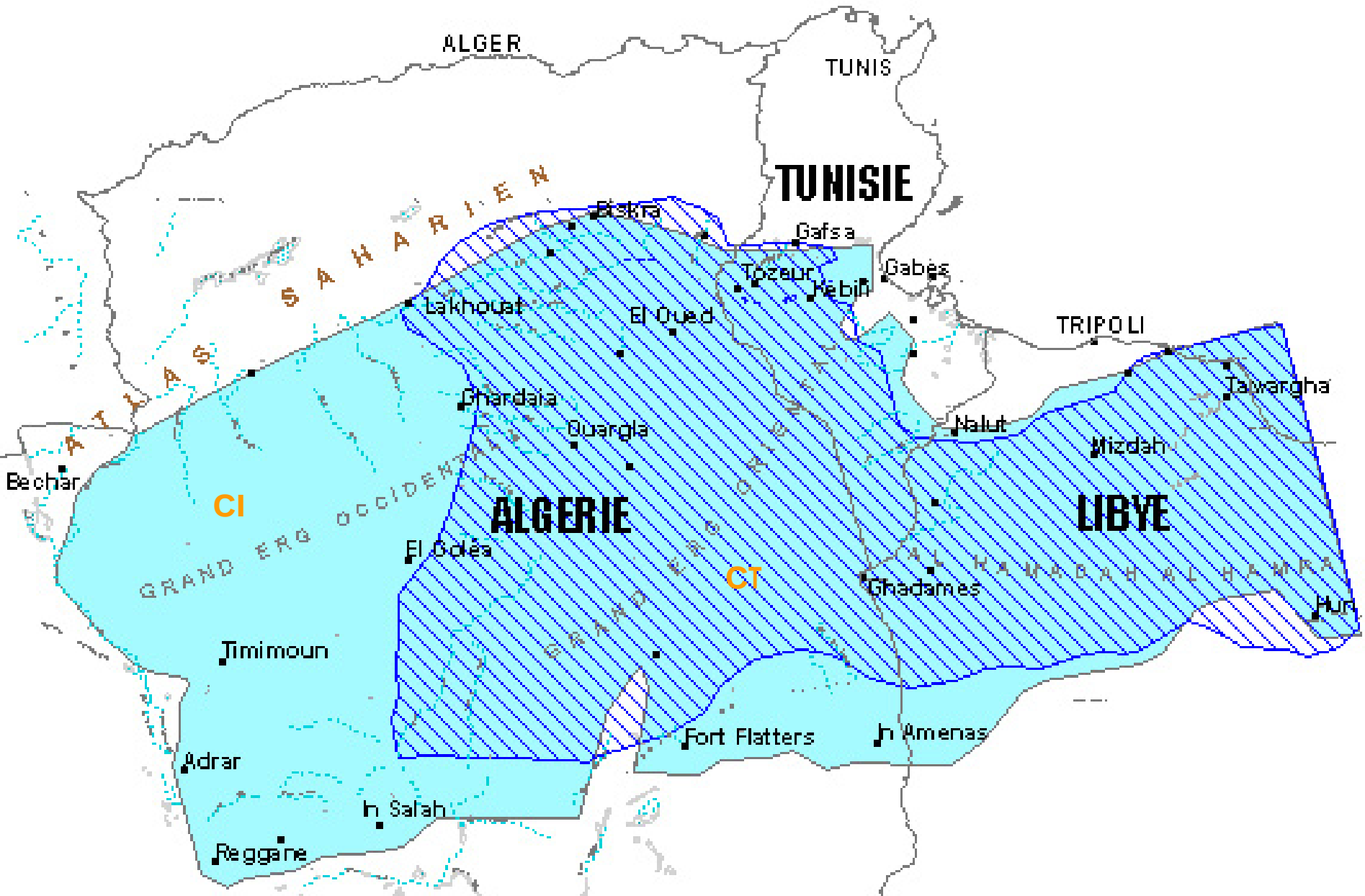
1ST PHASE OF NWSAS PROJECT / 1999 - 2002



NWSAS PROJECT COMPONENT

- **INFORMATION SYSTEM :**
  - **Common data base**
  - **Common GIS**
- **MATHEMATICAL MODEL**
  - **Integration of the whole basin (for the first time)**
  - **Realization of the Simulations**
- **CONSULTATION MECHANISM**
  - **Shared vision**
  - **Sustainable management of the basin**

NWSAS LIMITS



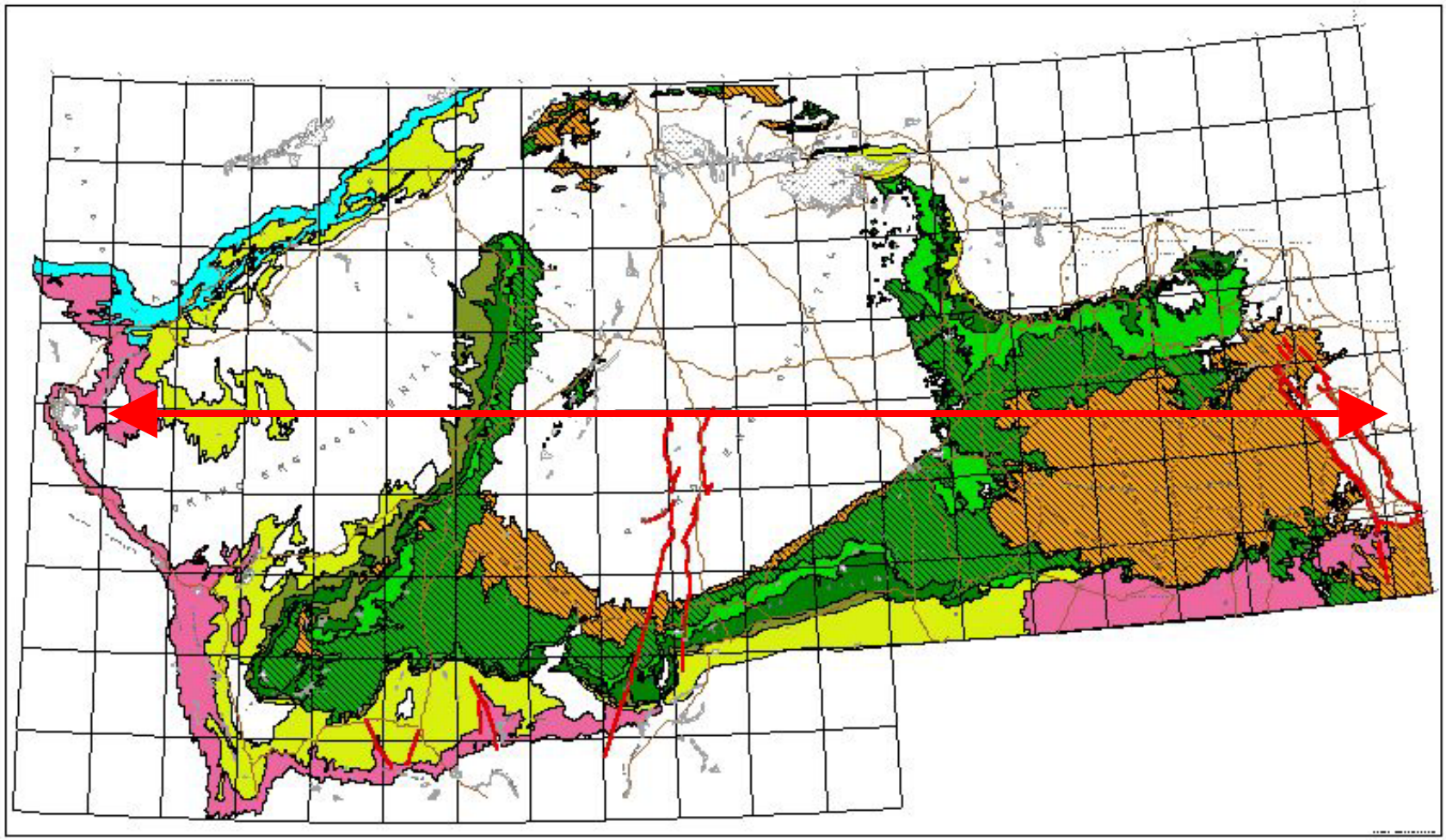
GENERAL DATA

AREA		1.000.000 km²
THEORETICAL RESERVES		60.000 Billion of m³
THEORETICAL RECHARGE		1 Milliard de m³/an
TWO AQUIFER SYSTEM	TERMINAL COMPLEX	AREA : 600 000 km² RECHARGE : 600 Mm³/an
	INTERCALARY CONTINENTAL	AREA : 1 000 000 km² RECHARGE : 300 Mm³/an

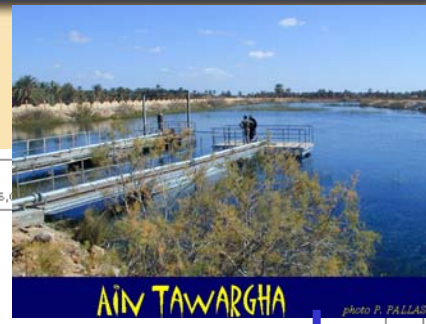
OBSTACLES TO SOIL OCCUPATION

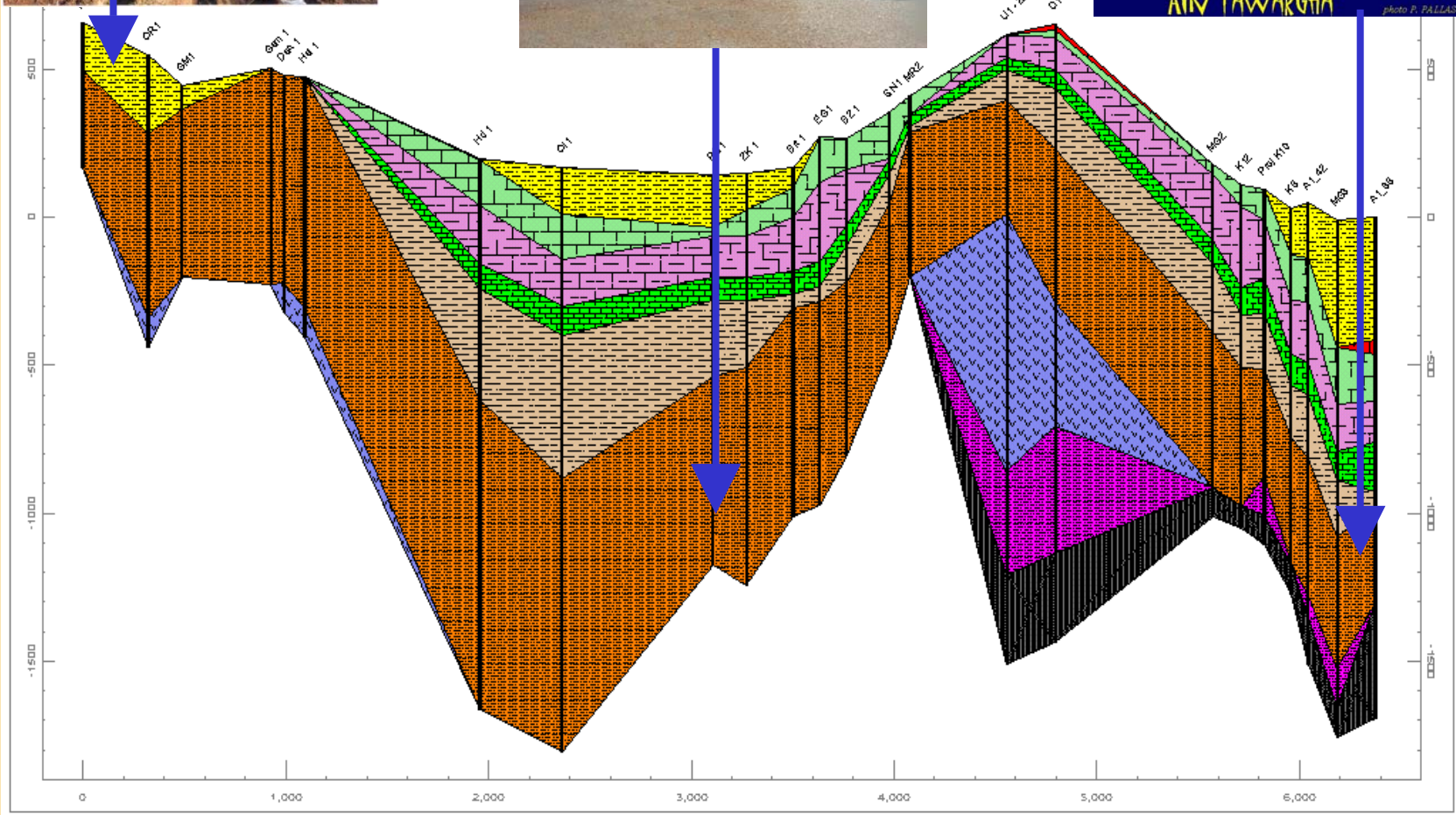
ERGS CHOTTS SEBKHAS	REDUCTION OF AVAILABLE AREAS
WATER QUALITY	• SALINISATION • TEMPERATURE
SOILS	- DISPONIBILITY - QUALITY - HEAVY INVESTMENT
WELLS	DEPTH (50 – 2500 m) PRODUCTIVITY (10 l/s – 200 l/s) PUMPING COST

NWSAS GEOLOGICAL MAP



WEST –EAST SECTION





MOBILISATION CONDITIONS

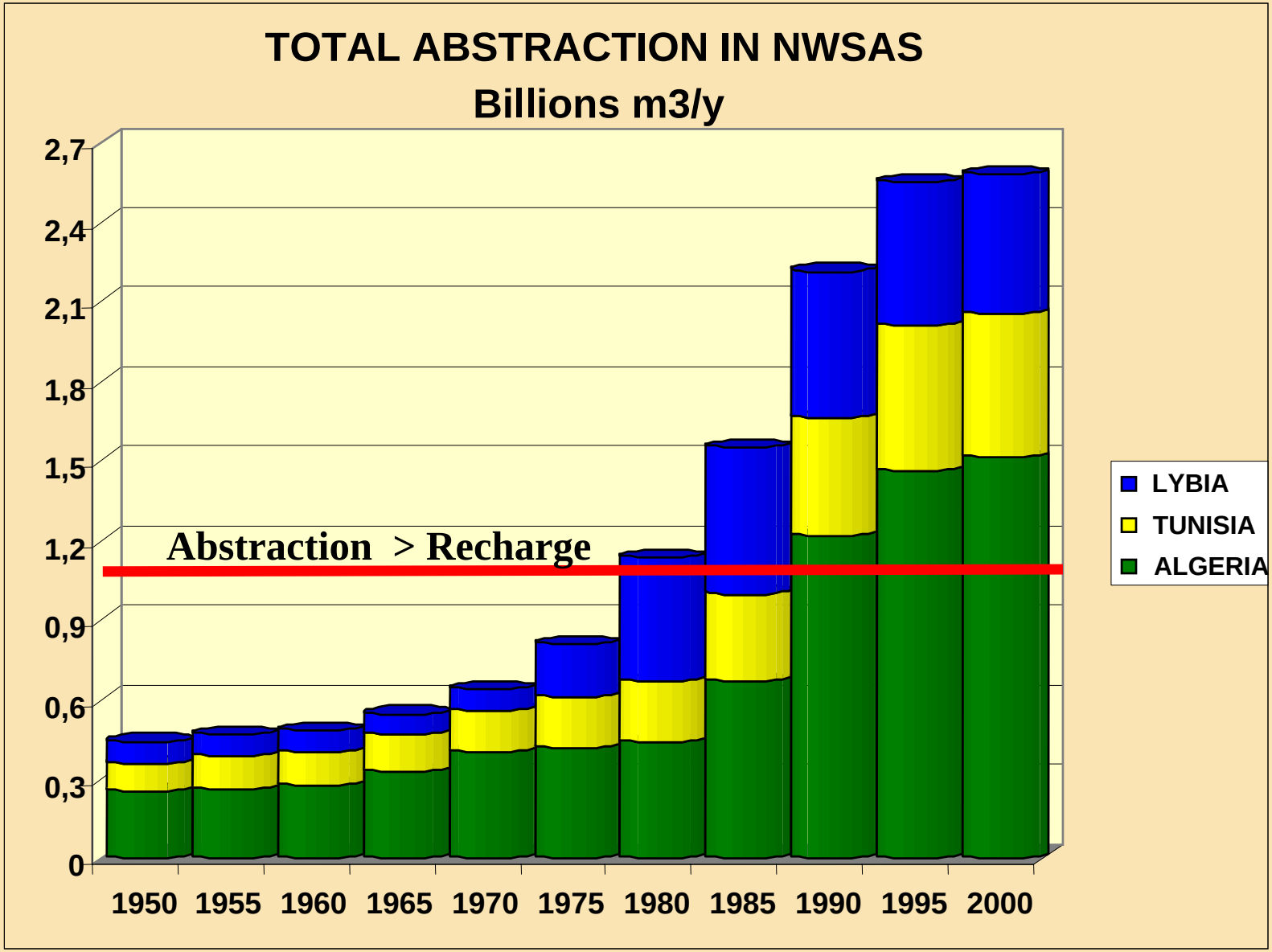
- QUALITY PROTECTION
- PUMPING DEPTH
- SAVING OF THE EXISTENT

LOW EXPLOITABLE VOLUMES / SIGNIFICANT RESERVES

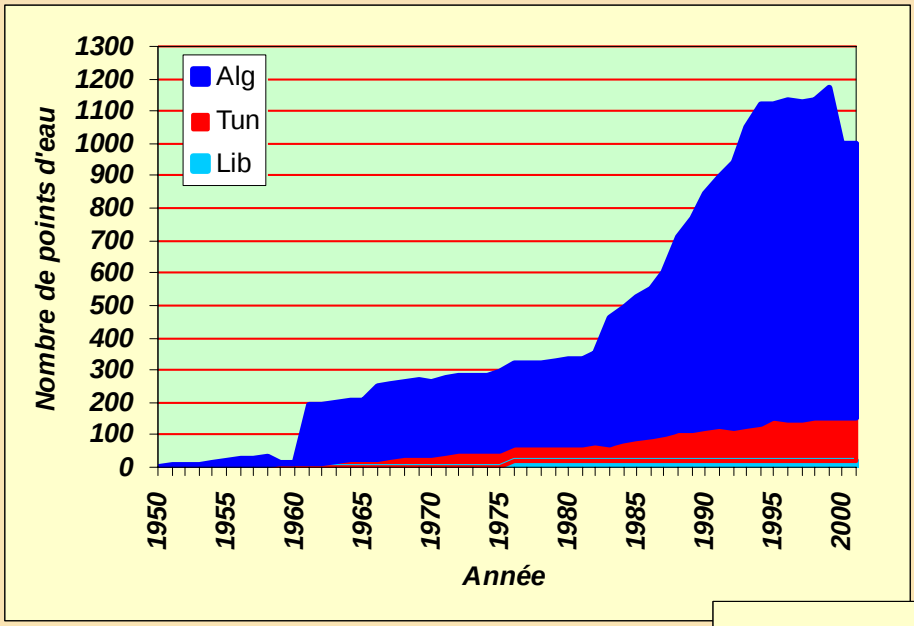
PROJECTED ABSTRACTION

	1970	2000	2030
NEEDS (m3/y)	600 Millions	2.5 Billions	8 Billions
POPULATION (Millions)	1.0	4.0	8
IRRIGATED AREAS	50.000 ha	170.000 ha	400.000 ha
COUNTRIES	ALGERIA + LIBYEA + TUNISIA		

ABSTRACTION EVOLUTION

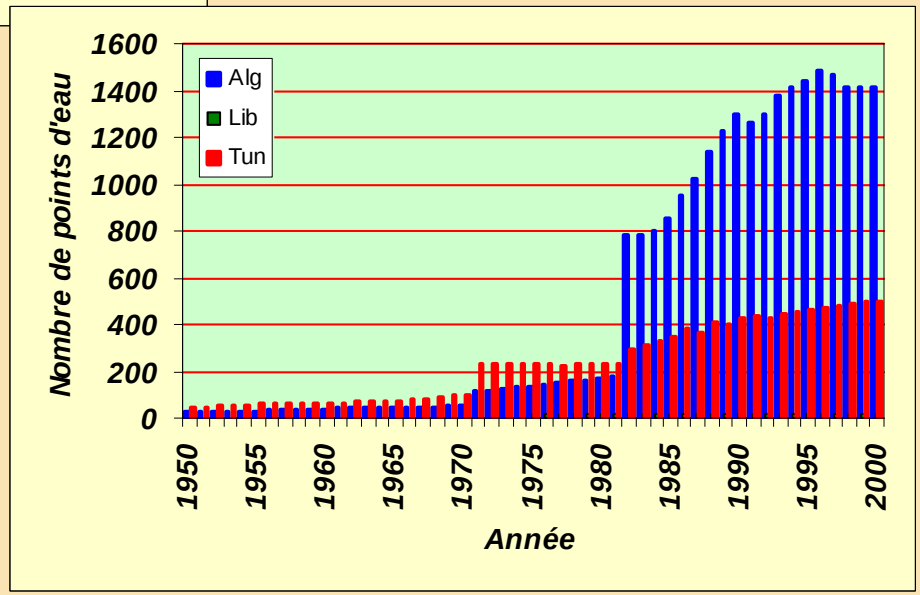


WATER POINTS EVOLUTION

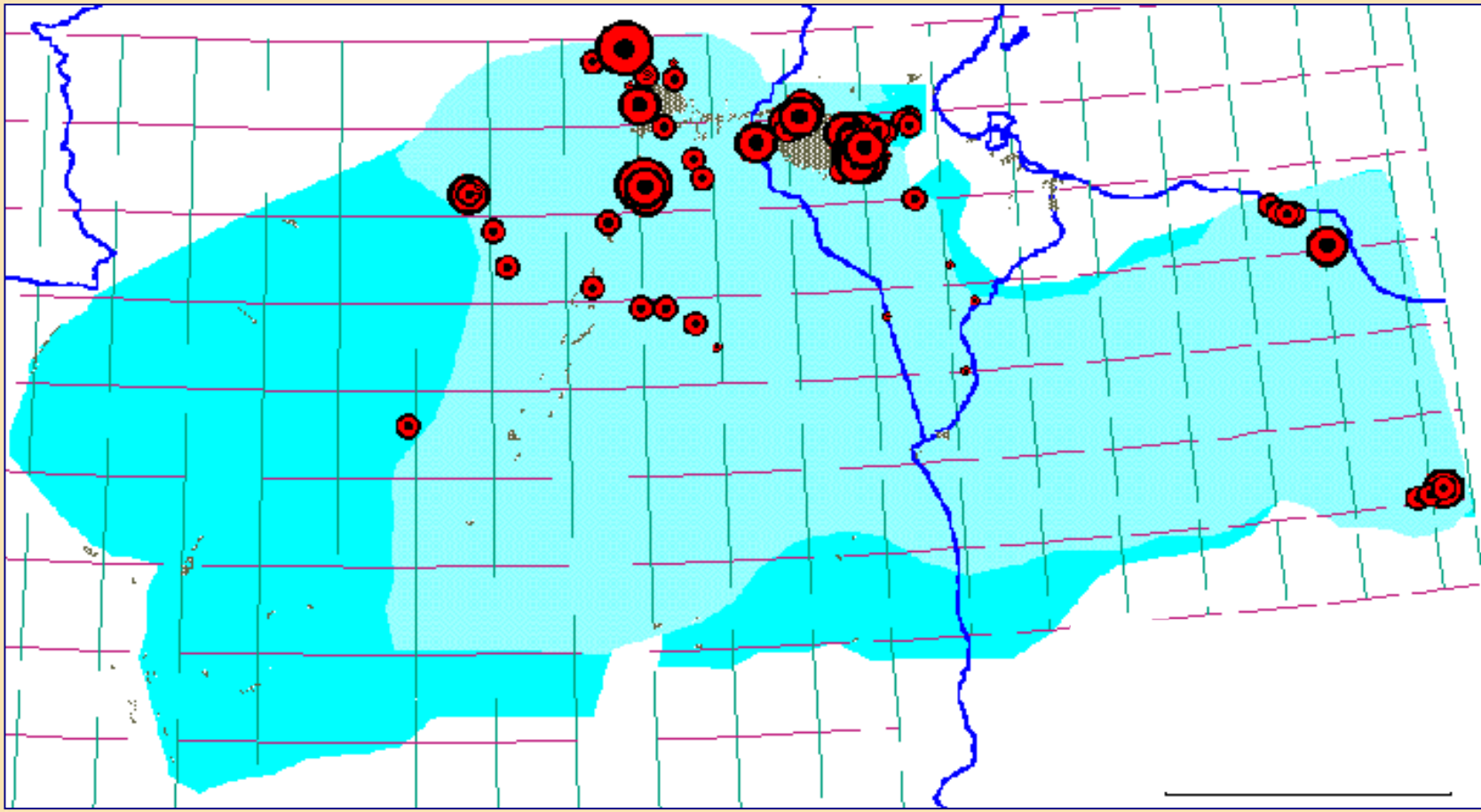


CI

CT



WATER POINTS EVOLUTION : 1960



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SAHARA AND SAHEL OBSERVATORY

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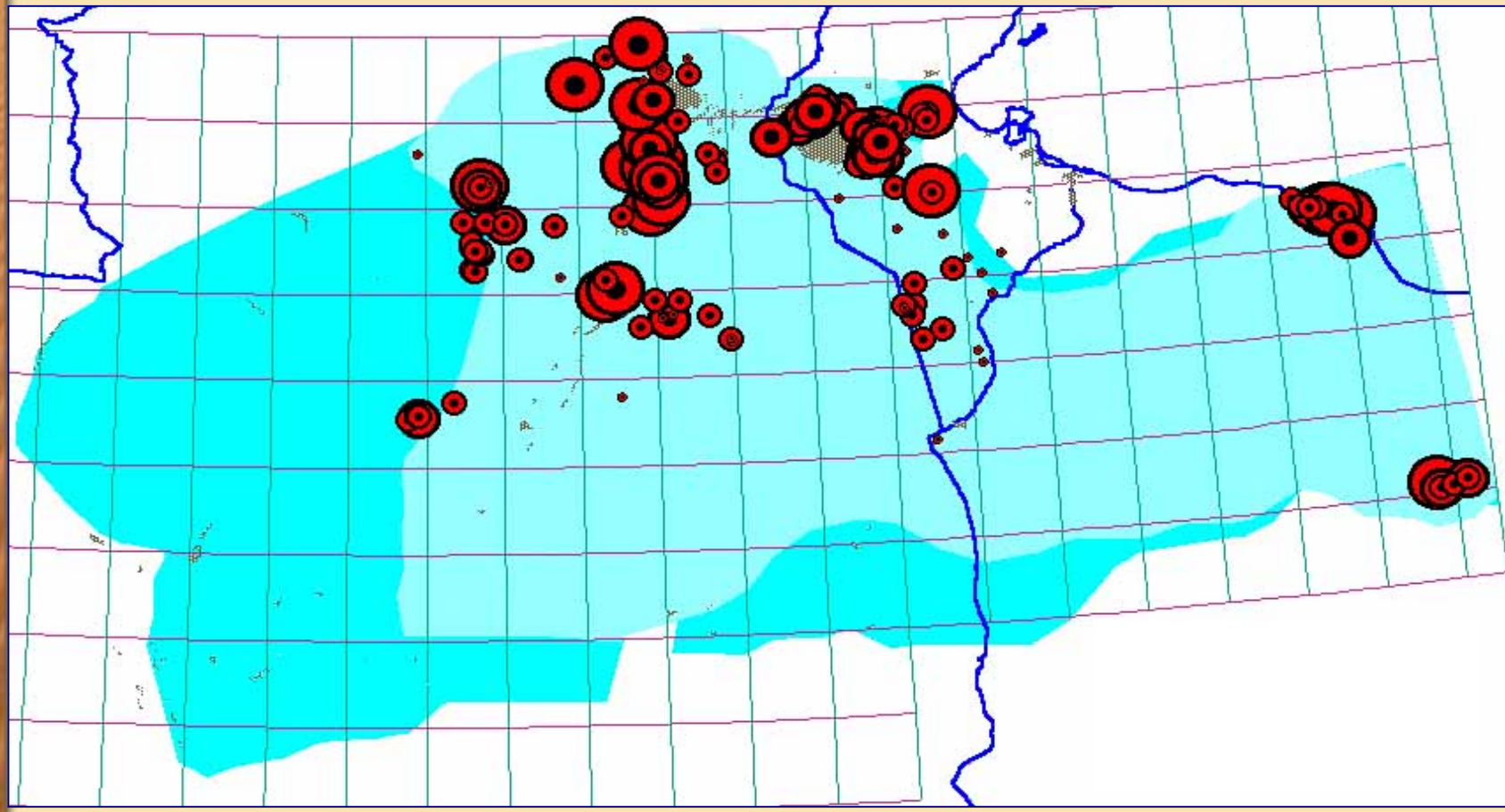
WATER POINTS EVOLUTION : 1970



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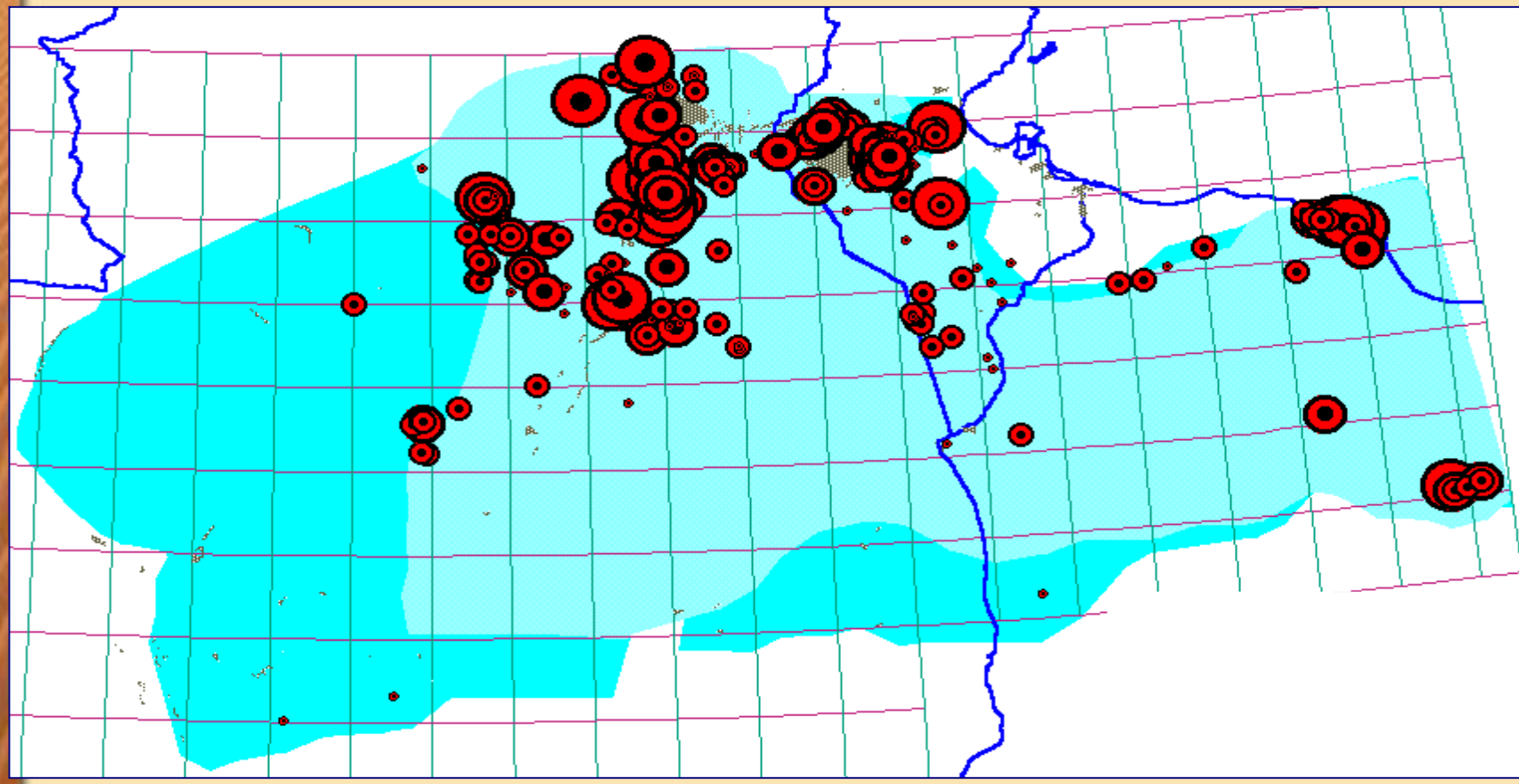
WATER POINTS EVOLUTION : 1980



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SAHARA AND SAHEL OBSERVATORY

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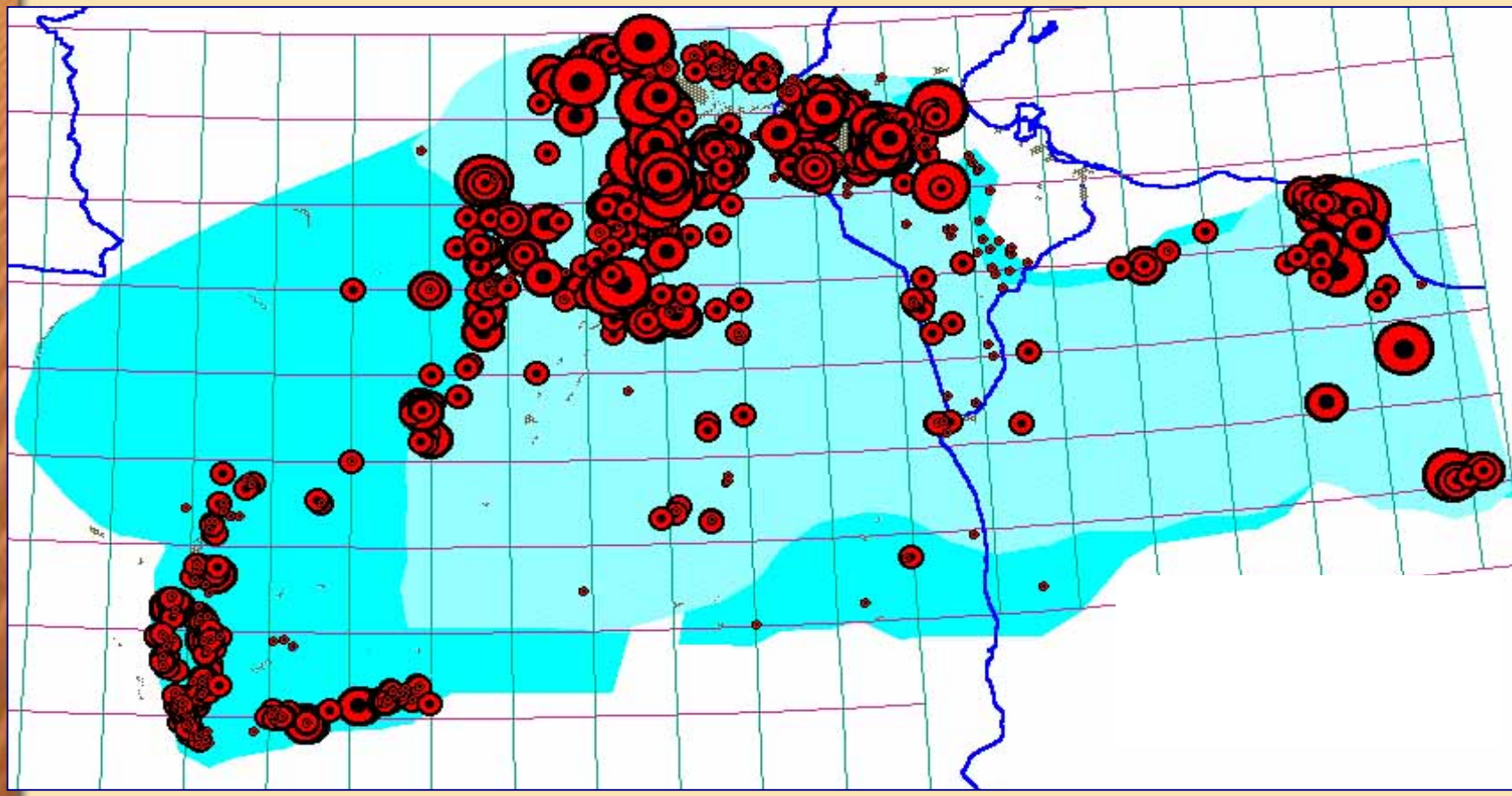
WATER POINTS EVOLUTION : 1990



OBSERVATOIRE DU SAHARA ET DU SAHEL
SAHARA AND SAHEL OBSERVATORY

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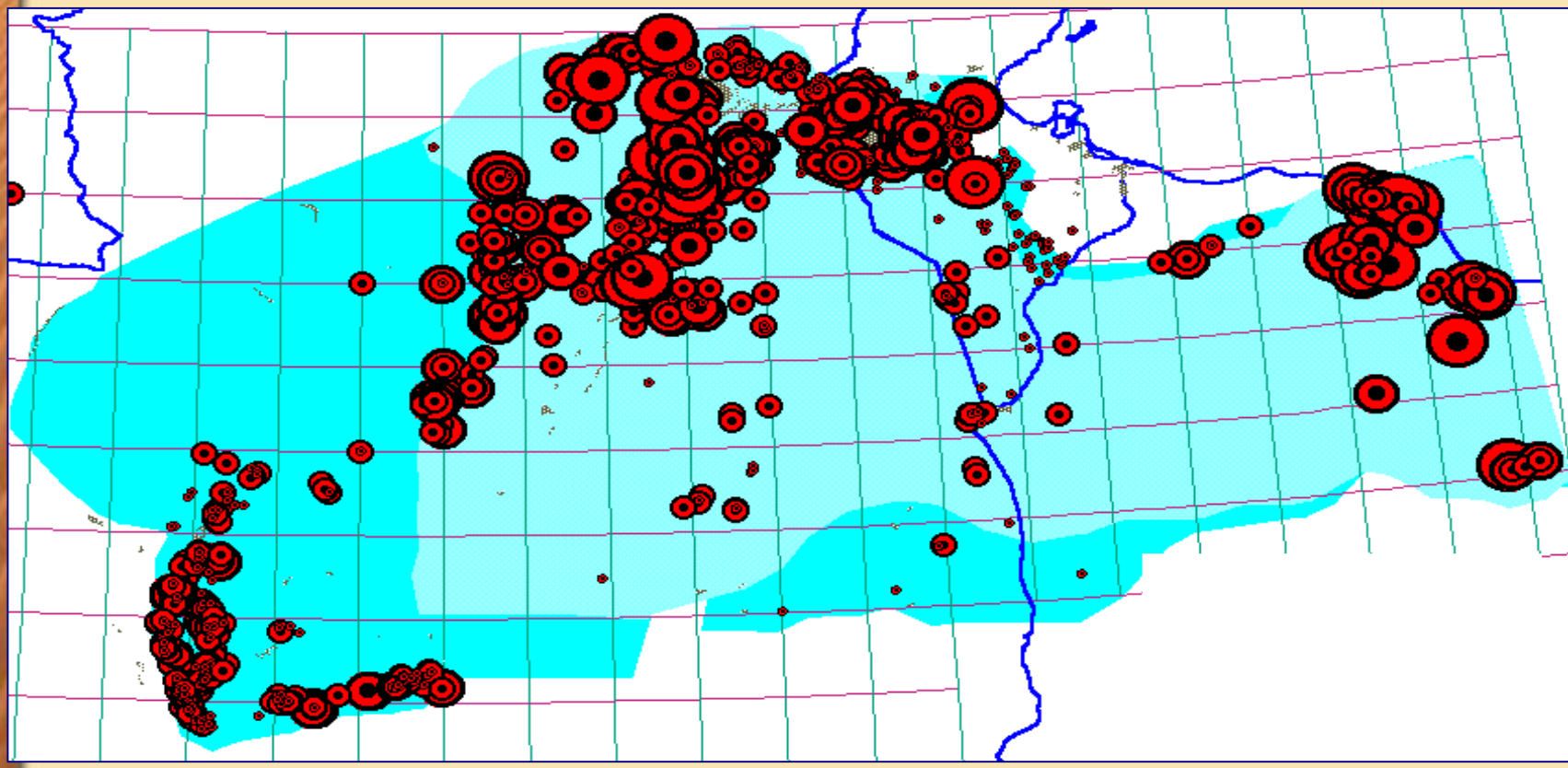
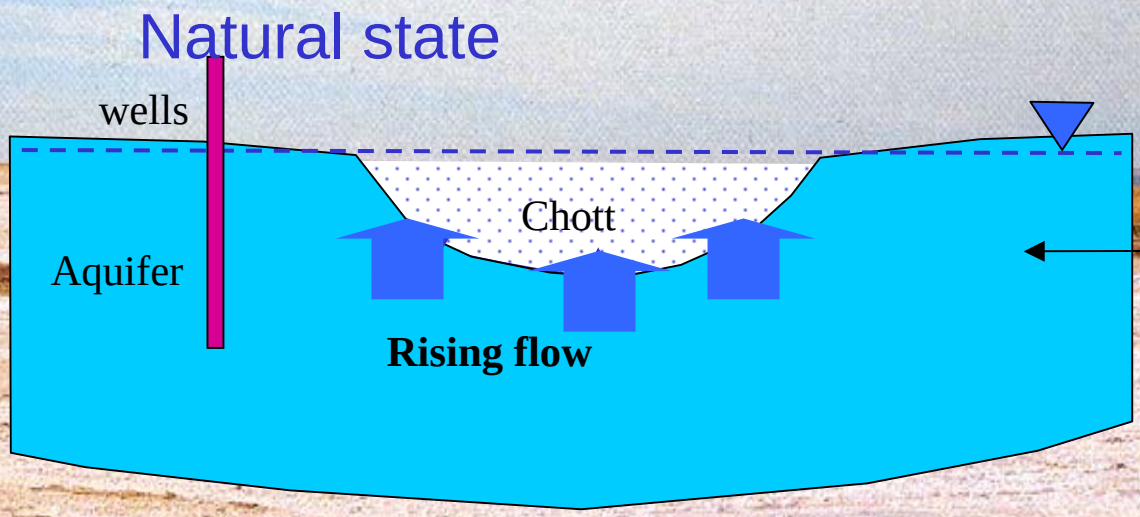
WATER POINTS EVOLUTION : 2000

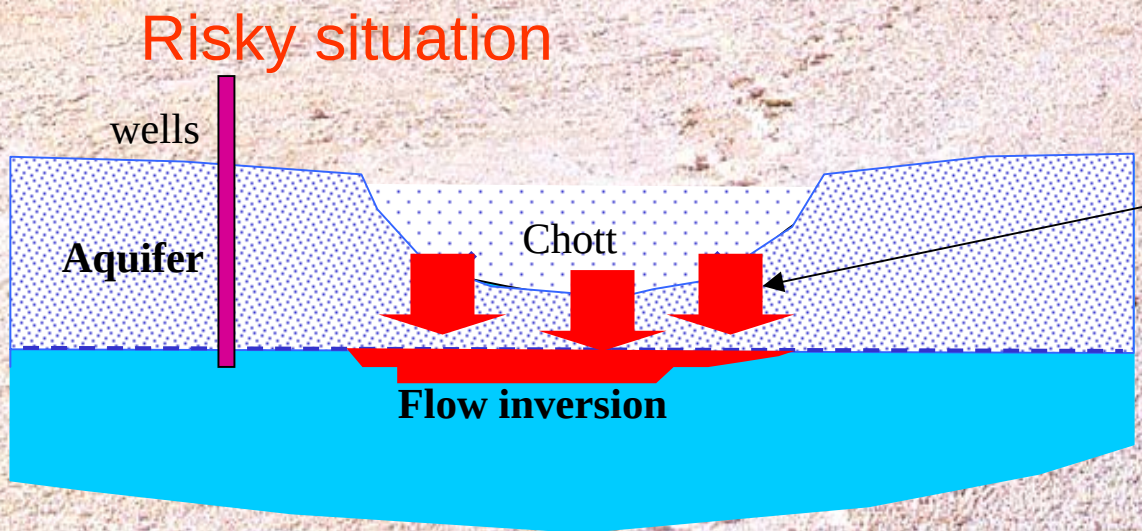


ABSTRACTION CONSEQUENCES

- Salted water
- Artésianisme disappearance
- Excessive pumping height
- Tunisian outlet depletion
- Foggaras depletion in Algeria
- Interferences : drawdown between countries
- Saline intrusion in the golf of Syrte in Libya

RISKS AT THE CHOTTS LEVEL





TERMINAL COMPLEX

1950 → 2050

SCENARIO ZERO

CURRENT SITUATION

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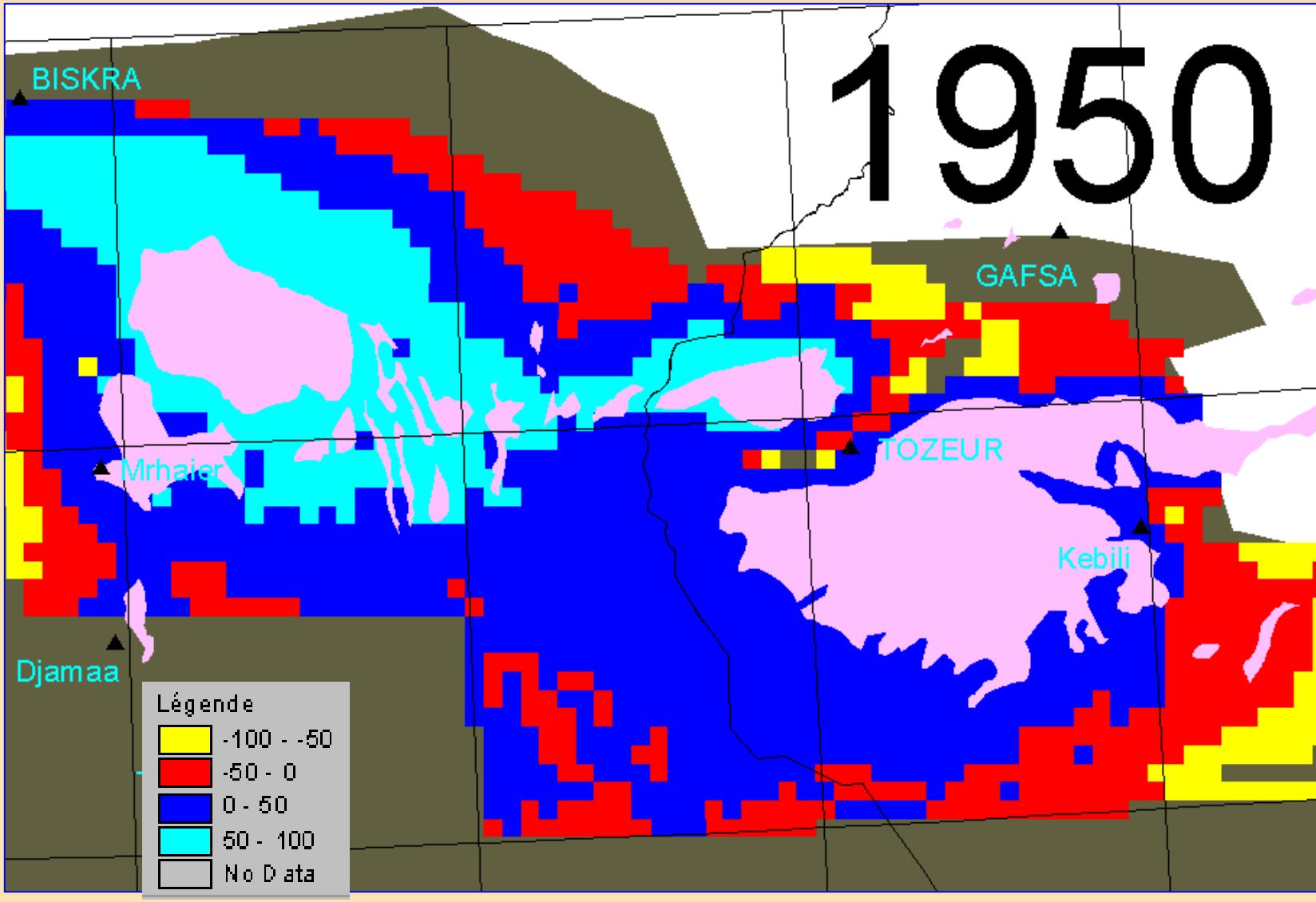
RISKS IN CHOTTS AREAS : ARTESIANISM DISAPPEARANCE AND WATER SALINISATION



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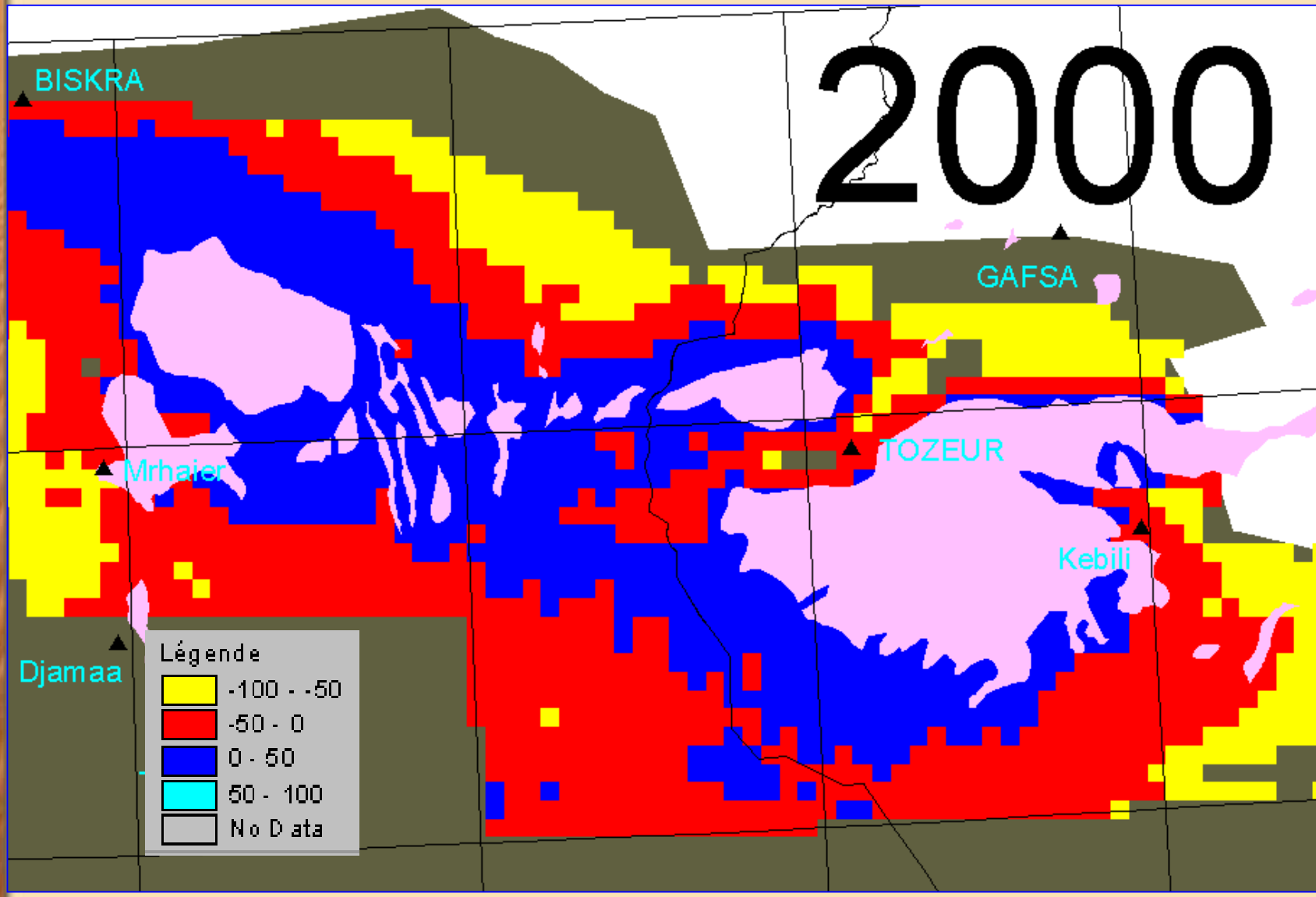
RISKS IN THE CHOTTS AREA : ARTESIANISM DISAPPEARANCE AND WATER SALINISATION



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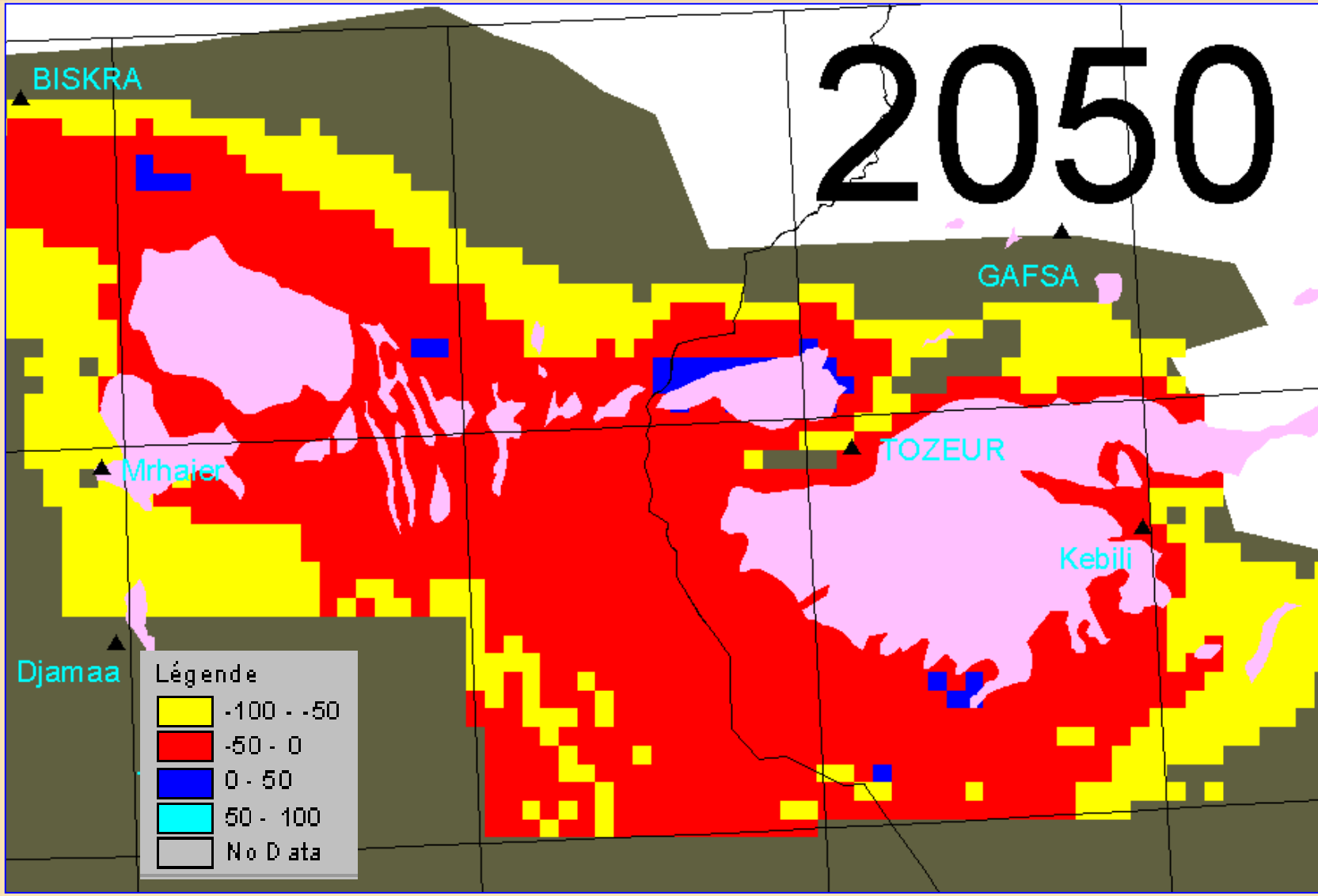
RISKS IN CHOTTS AREA : ARTESIANISM DISAPPEARANCE AND WATER SALINISATION



ARTESIANISM

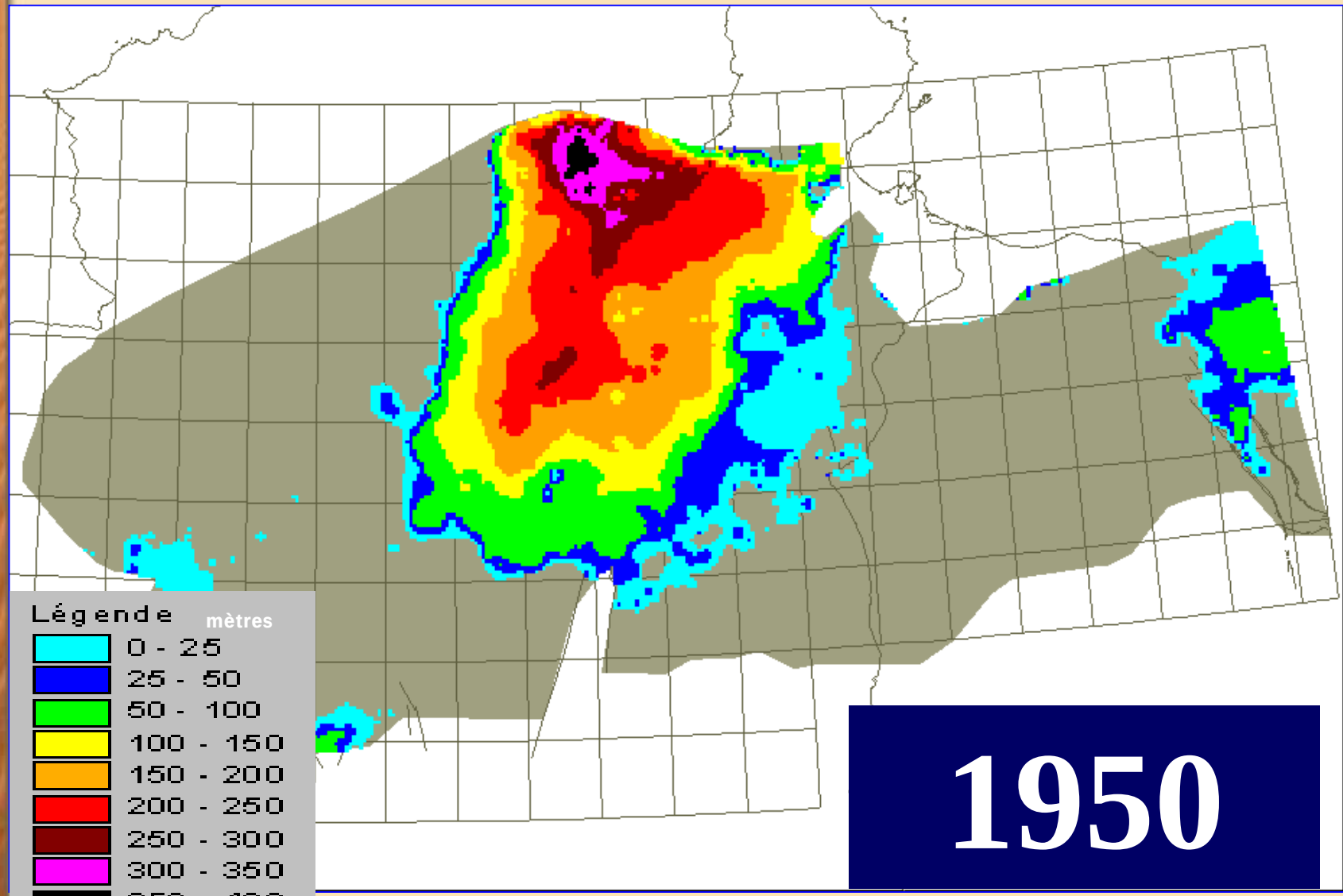
INTERCALARY CONTINENTAL

1950 → 2050

SCENARIO ZERO

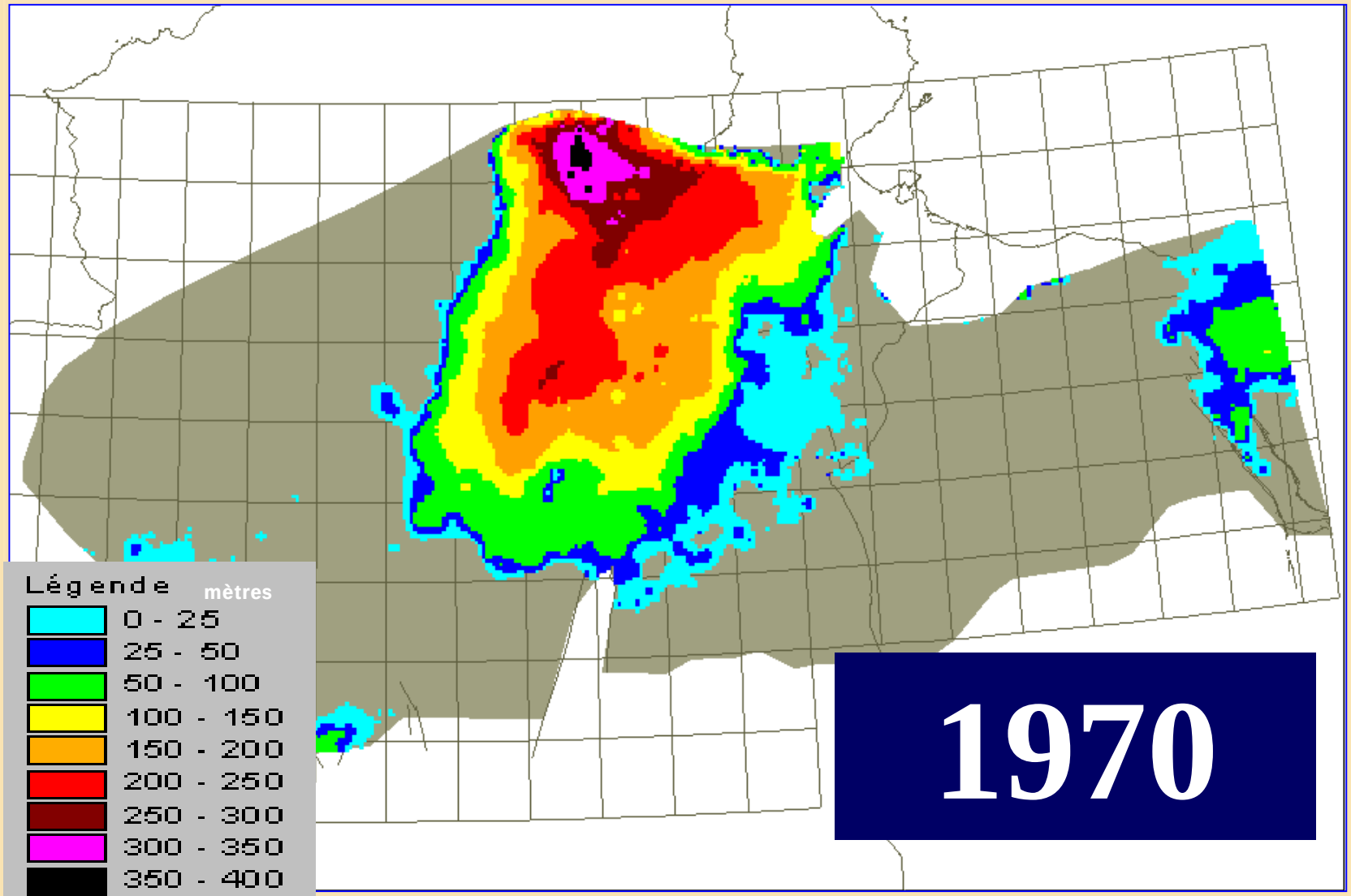
Current situation

ARTESIANISM

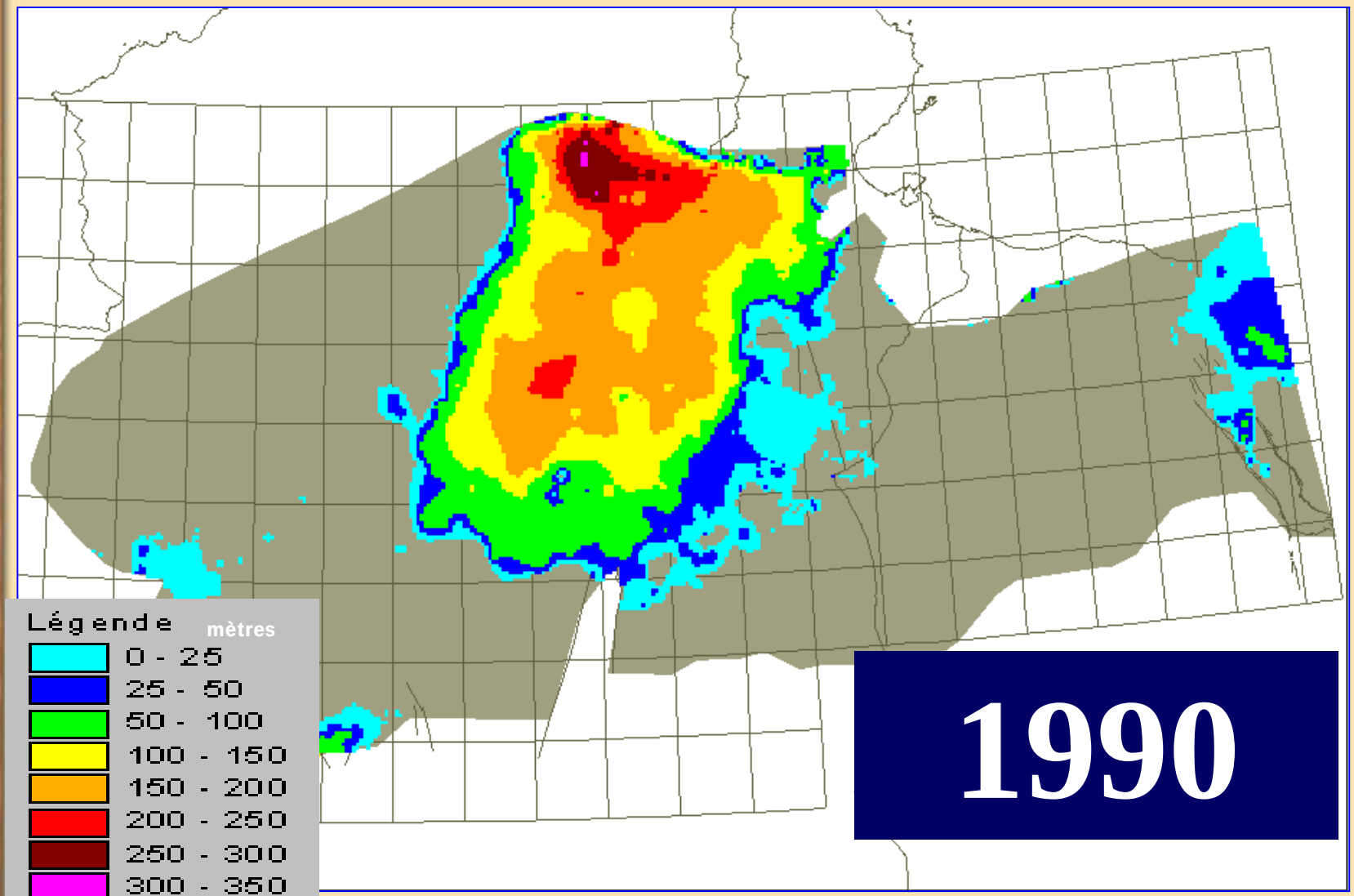


1950

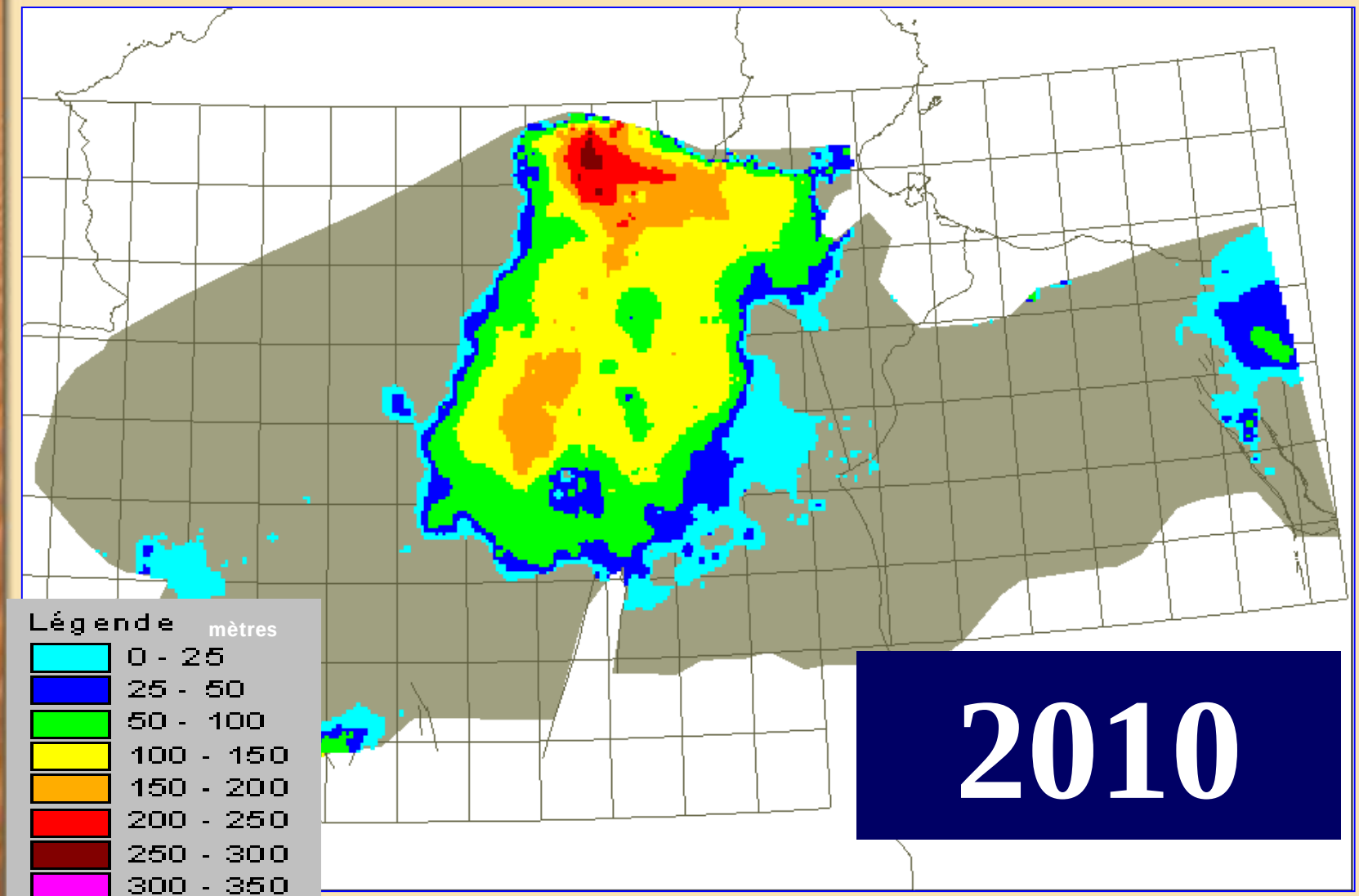
ARTESIANISM



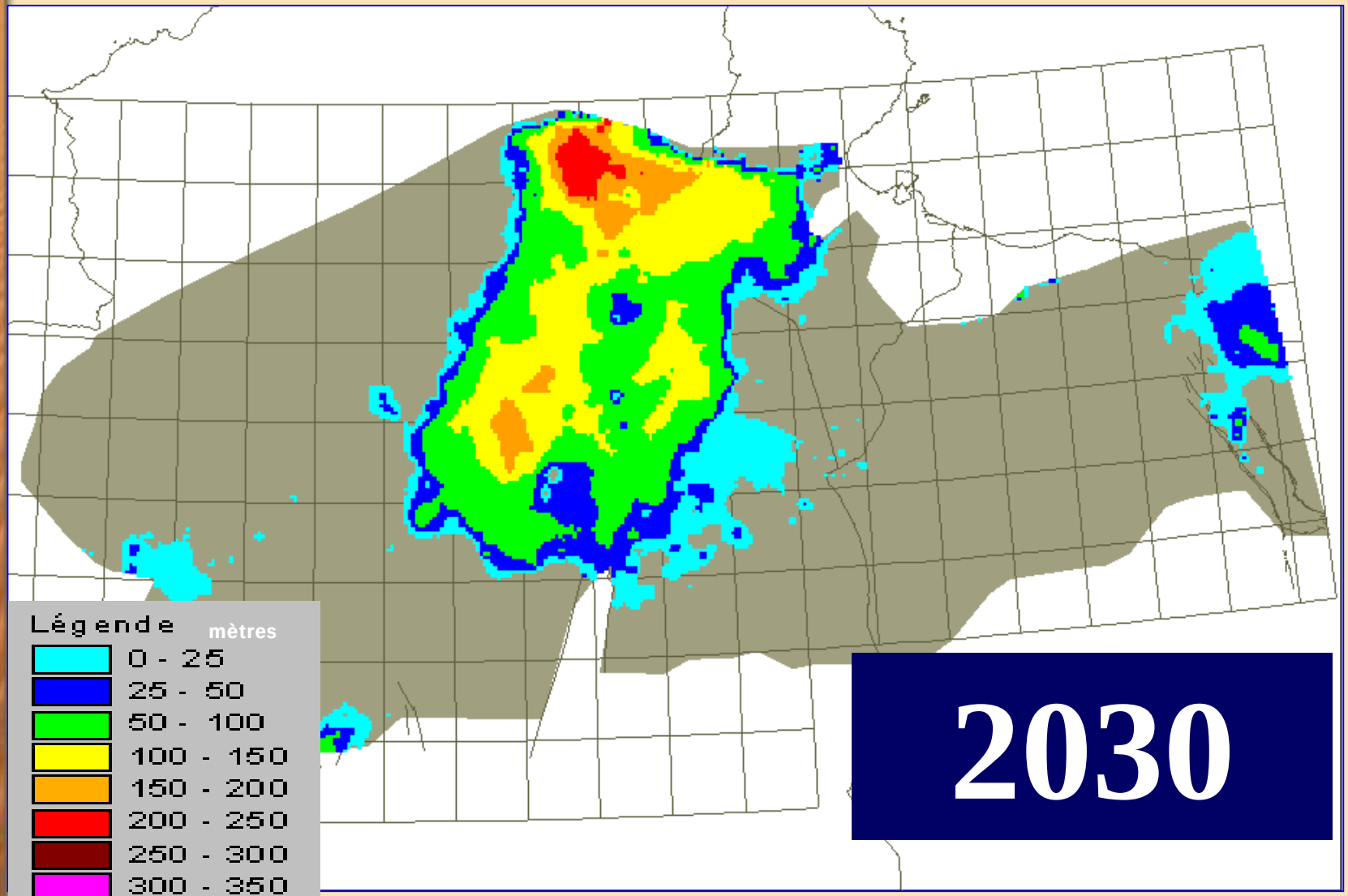
ARTESIANISM



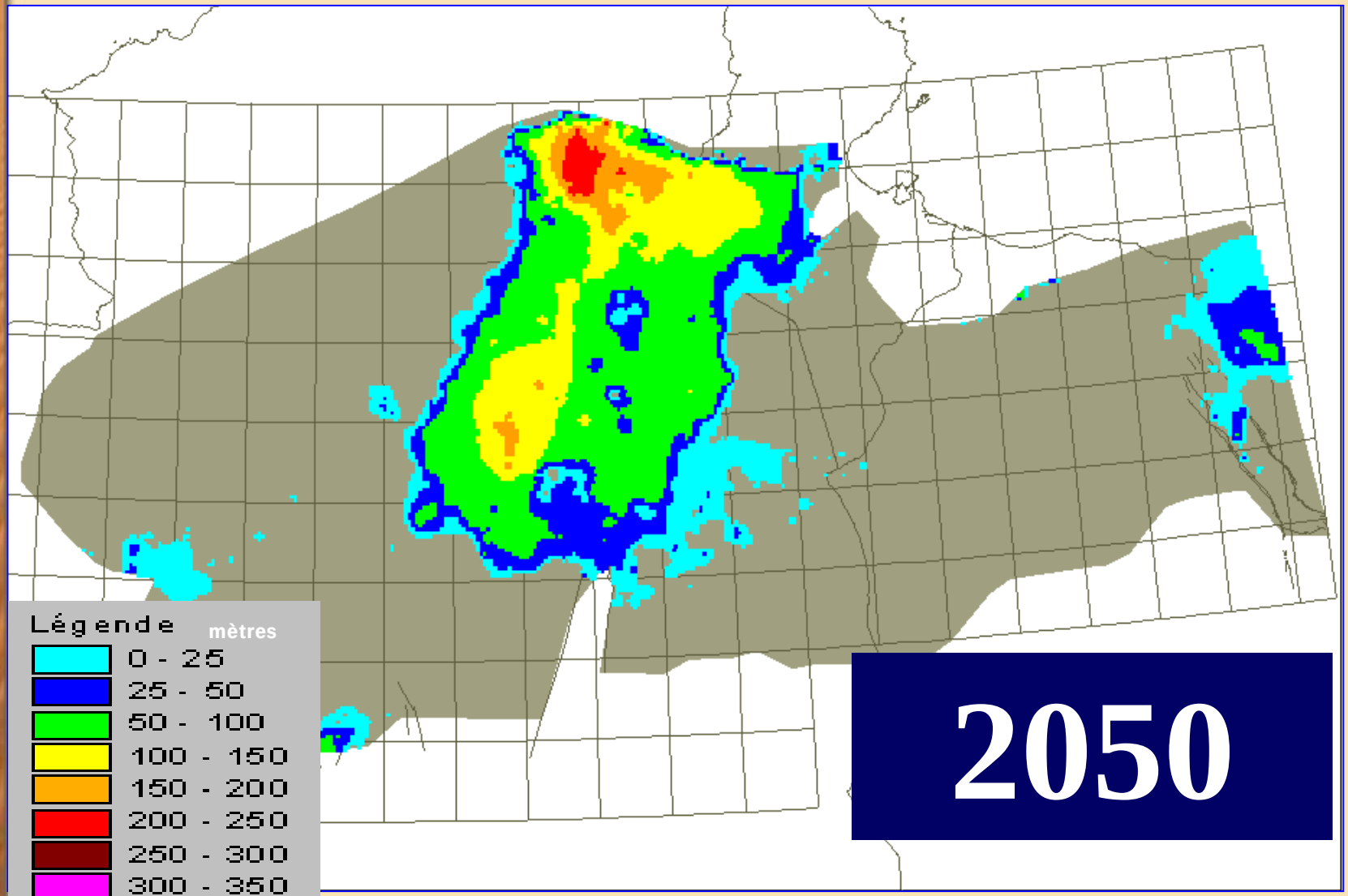
ARTESIANISM



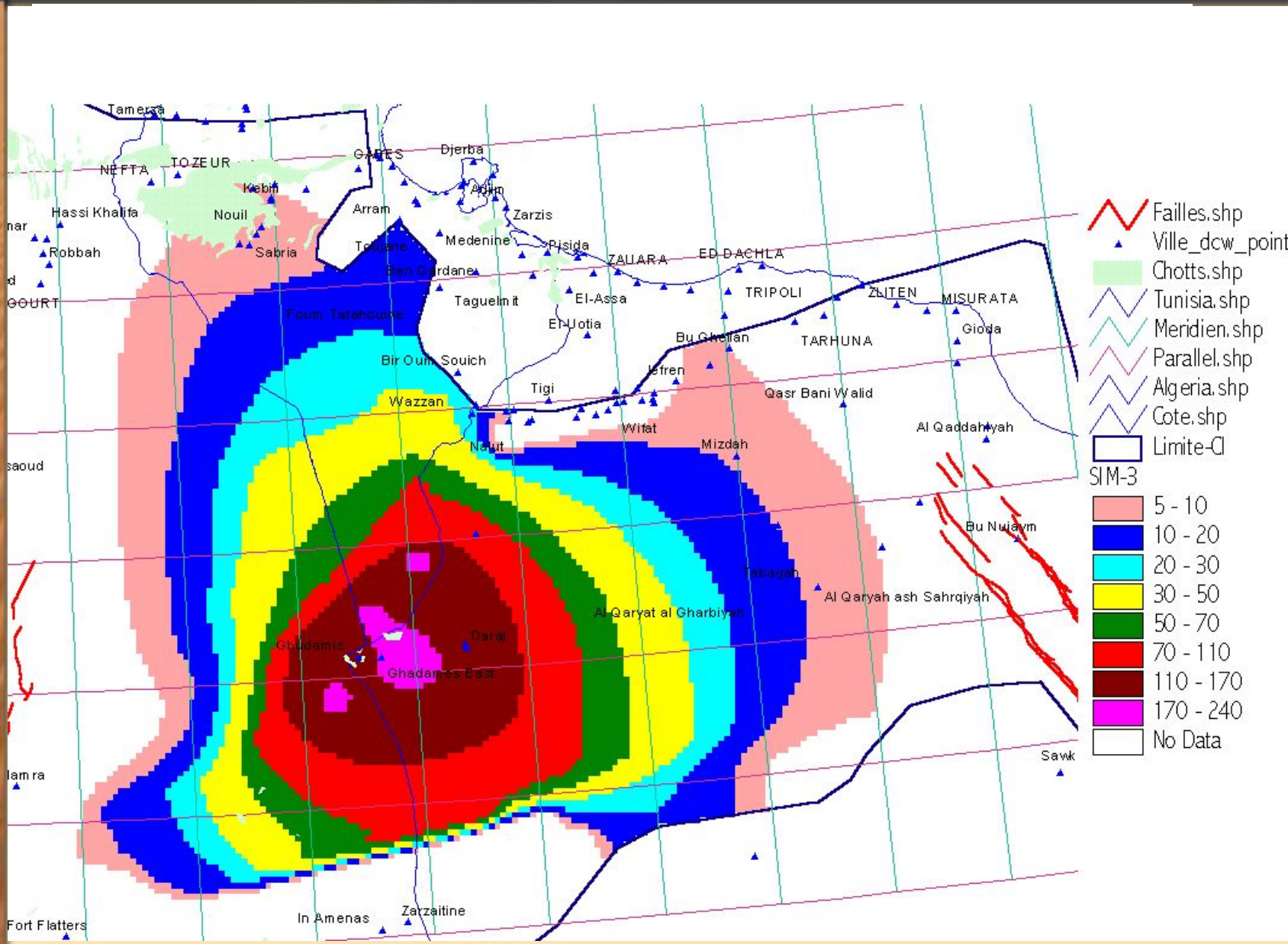
ARTESIANISM



ARTESIANISM



INTER COUNTRIES INTERFERENCES



Previsional water demand (2050)

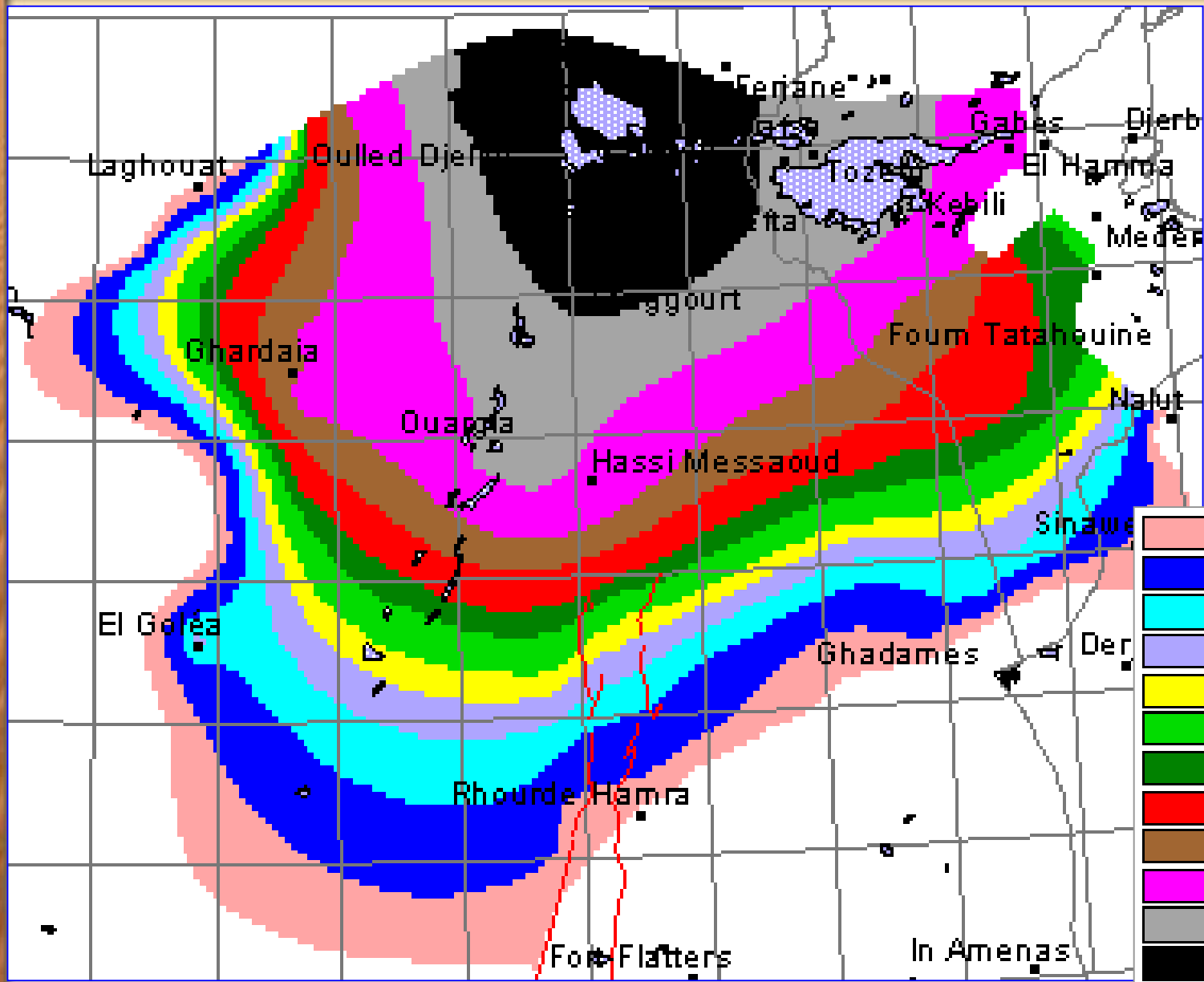
COUNTRY	Abstraction 2000 in billion m^3/year	Water demand frame 2050 in billion m3/year
ALGERIA	1,30	Scenario I : 2,00 Scenario II : 3,00
LIBYA	0,40	0,84
TUNISIA	0,51	Current situation

EXPLORATORY SIMULATIONS

Six exploratory simulations :

- **Algeria : Low Hypothesis**
- **Algeria : High Hypothesis**
- **Libya : deficit resorption 2030**
- **Libya : Ghadames field**
- **Libya : Abstractions Impacts of Djebel Hassaouna**
- **Tunisia : maintaining abstraction 2000**

CONSEQUENCES TO CI : WITHDRAWALS 2050

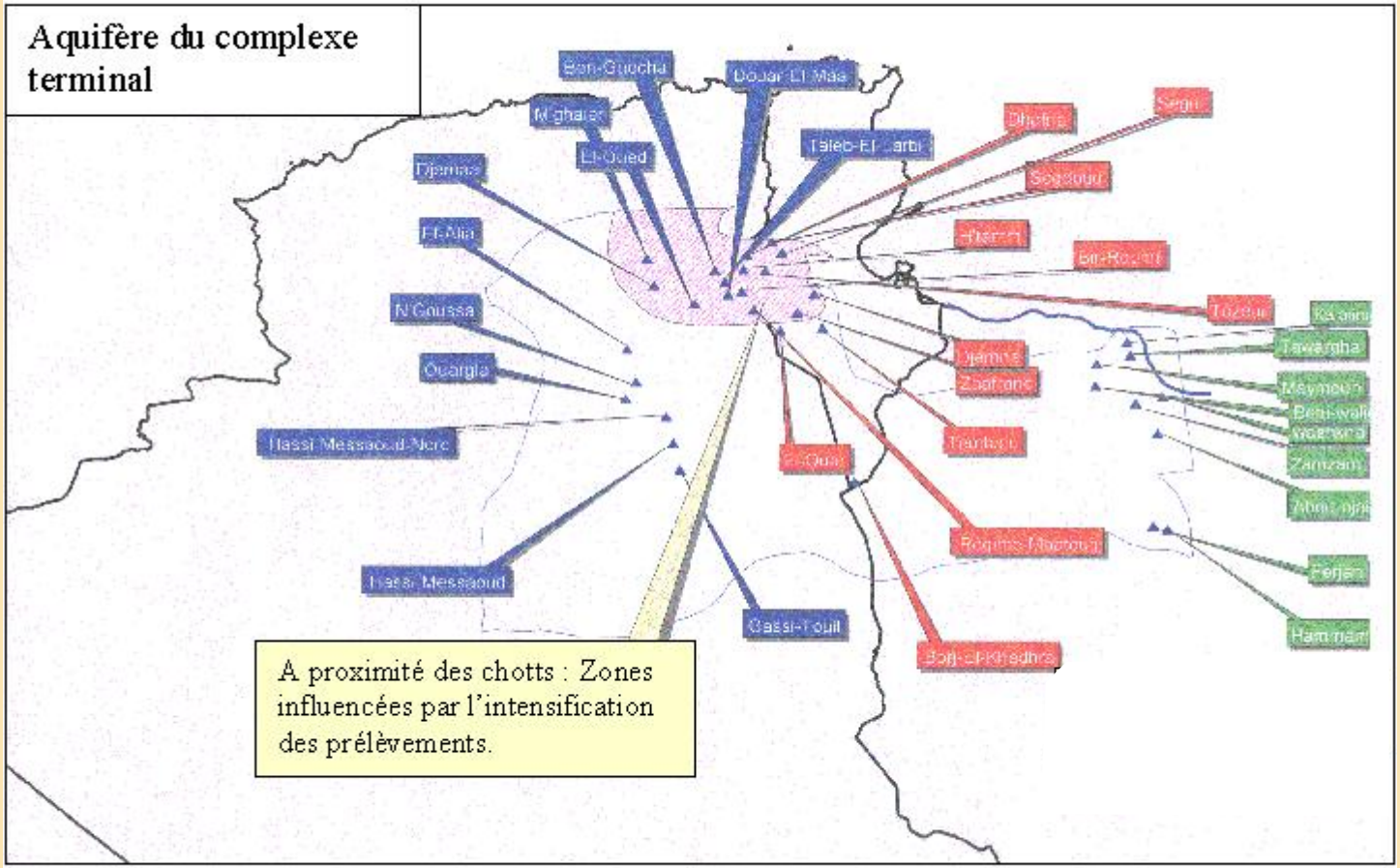


Study and results validation by the countries

Recommendations : localisation of water potentialities respecting the following constraints:

- ✓Maintaining of artesianism
- ✓Protection of foggaras
- ✓Protection of tunisian outlet
- ✓Protection of water quality
- ✓Acceptable pumping heigh

POTENTIAL ABSTRACTION ZONES IN CT



Algeria **Tunisia** **Lybia**

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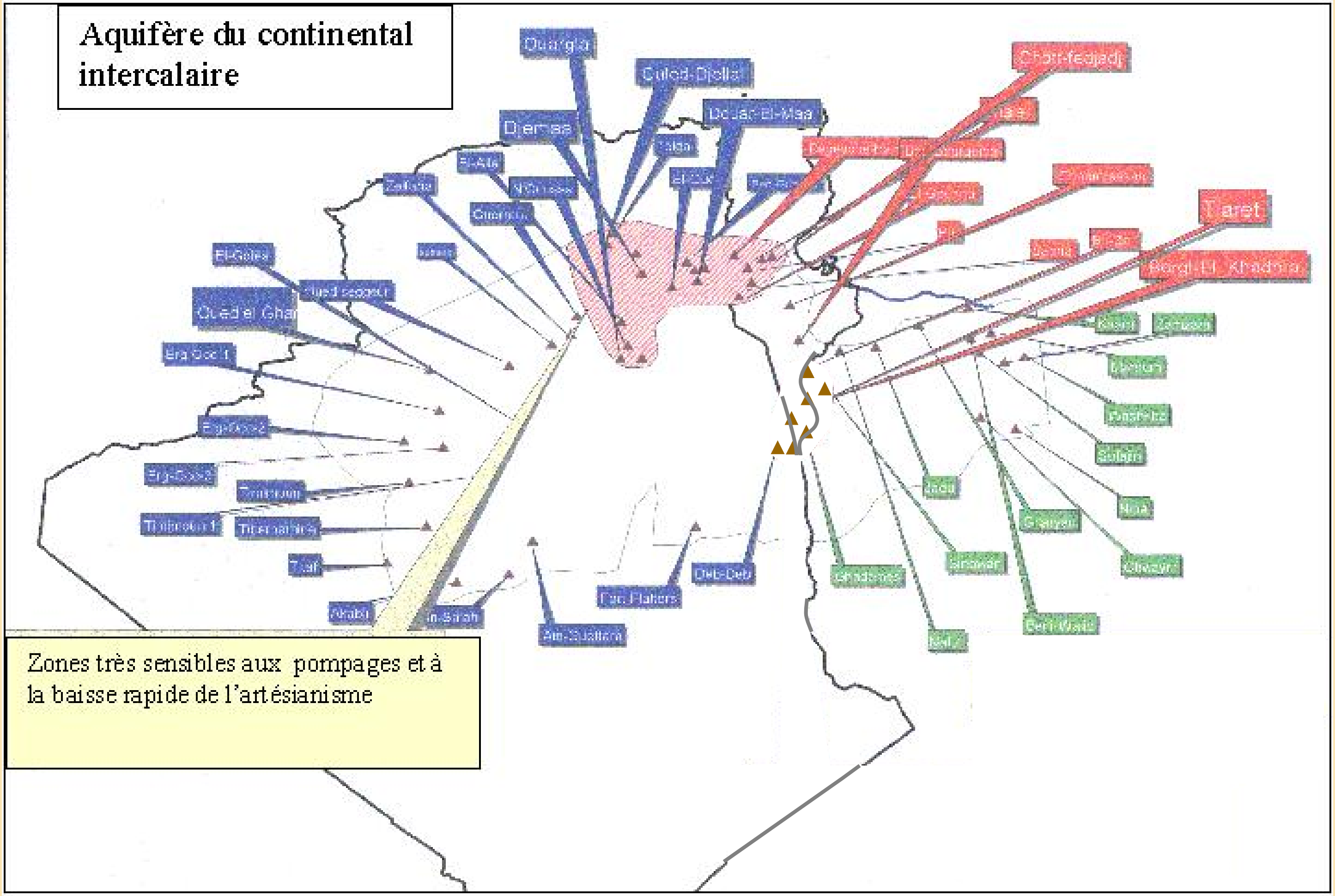
POTENTIAL ABSTRACTION ZONES IN CI



Algeria

Tunisia

Lybia

MICRO MODEL

	Ouled-djellal	El-oued	Djemaa	M'ghaier	Taleb-el-larbi	Sebseb	Guerrara	Zelfana	El-alia	N'goussa	Ouargla	H-Mess-nord	Deb-deb	C-F	Bhaier	Sabria	El-gounna	Choumrassen	Bordj-Bourguiba	Bir-zar	Tiaret	Borj-el-khadra	Hazoua	Deguache-hamm	PIK	Nalut	Sinawan	Ghadames	Rabattemnt-Total	Hauteur pompage	Etat
POMPAGES	0	0	0	0	0	3	0	4	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	3	13		
Ouled-djell	0	0	0	0	0	8	0	21	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	32	-55	Artésien
Tolga	0	0	0	0	0	8	0	20	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	32	-122	Artésien
El-oued	0	0	0	0	0	6	0	16	0	0	0	0	0	5	0	0	0	0	0	1	0	0	0	0	0	0	0	1	29	-97	Artésien
Ben-guech	0	0	0	0	0	5	0	13	0	0	0	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	1	27	-140	Artésien
Djemaa	0	0	0	0	0	8	0	21	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	34	-180	Artésien
M'ghaier	0	0	0	0	0	8	0	20	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	32	-211	Artésien
Taleb-el-lar	0	0	0	0	0	5	0	12	0	0	0	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	1	26	-100	Artésien
Douar-el-m	0	0	0	0	0	5	0	12	0	0	0	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0	1	26	-103	Artésien
Sebseb	0	0	0	0	0	27	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	136	0
Guerrara	0	0	0	0	0	18	0	46	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	89	0
Zelfana	0	0	0	0	0	24	0	42	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	67	66	0
El-alia	0	0	0	0	0	13	0	32	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	-56	Artésien
N'goussa	0	0	0	0	0	13	0	30	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	-70	Artésien
Ouargla	0	0	0	0	0	13	0	31	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	-61	Artésien
H-Mess-nor	0	0	0	0	0	10	0	24	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	-46	Artésien
Deb-deb	0	0	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0	0	0	2	0	23	0	0	0	0	0	66	114	104	0
C-F	0	0	0	0	0	2	0	6	0	0	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	1	16	-64	Artésien
Bhaier	0	0	0	0	0	3	0	7	0	0	0	0	0	11	0	0	0	0	0	2	0	1	0	0	0	0	0	1	23	-66	Artésien
Sabria	0	0	0	0	0	3	0	7	0	0	0	0	0	9	0	0	0	0	0	2	0	1	0	0	0	0	0	1	23	-77	Artésien
El-gounna	0	0	0	0	0	3	0	8	0	0	0	0	0	8	0	0	0	0	0	3	0	1	0	0	0	0	0	2	24	-52	Artésien
Ghoumrass	0	0	0	0	0	1	0	3	0	0	0	0	1	4	0	0	0	0	0	6	0	2	0	0	0	0	0	3	19	65	0
Bordj-Bour	0	0	0	0	0	1	0	2	0	0	0	0	1	3	0	0	0	0	0	11	0	3	0	0	0	0	0	7	29	80	0
Bir-Zar	0	0	0	0	0	0	0	1	0	0	0	0	5	1	0	0	0	0	0	26	0	9	0	0	0	0	0	22	65	127	0
Tiaret	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	11	0	27	0	0	0	0	0	66	120	176	0
Borj-el-kha	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	5	0	25	0	0	0	0	0	85	139	123	0
Hazoua	0	0	0	0	0	5	0	13	0	0	0	0	0	5	0	0	0	0	0	2	0	1	0	0	0	0	0	1	27	-67	Artésien
Deguache	0	0	0	0	0	3	0	7	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	1	15	26	0
PIK	0	0	0	0	0	2	0	4	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	10	-93	Artésien
Nalut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2	280	0
Sinawan	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	13	0	15	0	0	0	0	0	41	78	199	0
Ghadames	0	0	0	0	0	0	0	0	0	0	0	0	22		0	0	0	0	0	4	0	28	0	0	0	0	0	65	119	111	0

Total Algerie	8,0	Total Tunisie	1,7	Total Libye	3,0	Débit exutoire tunisien (m3/s)	0,56

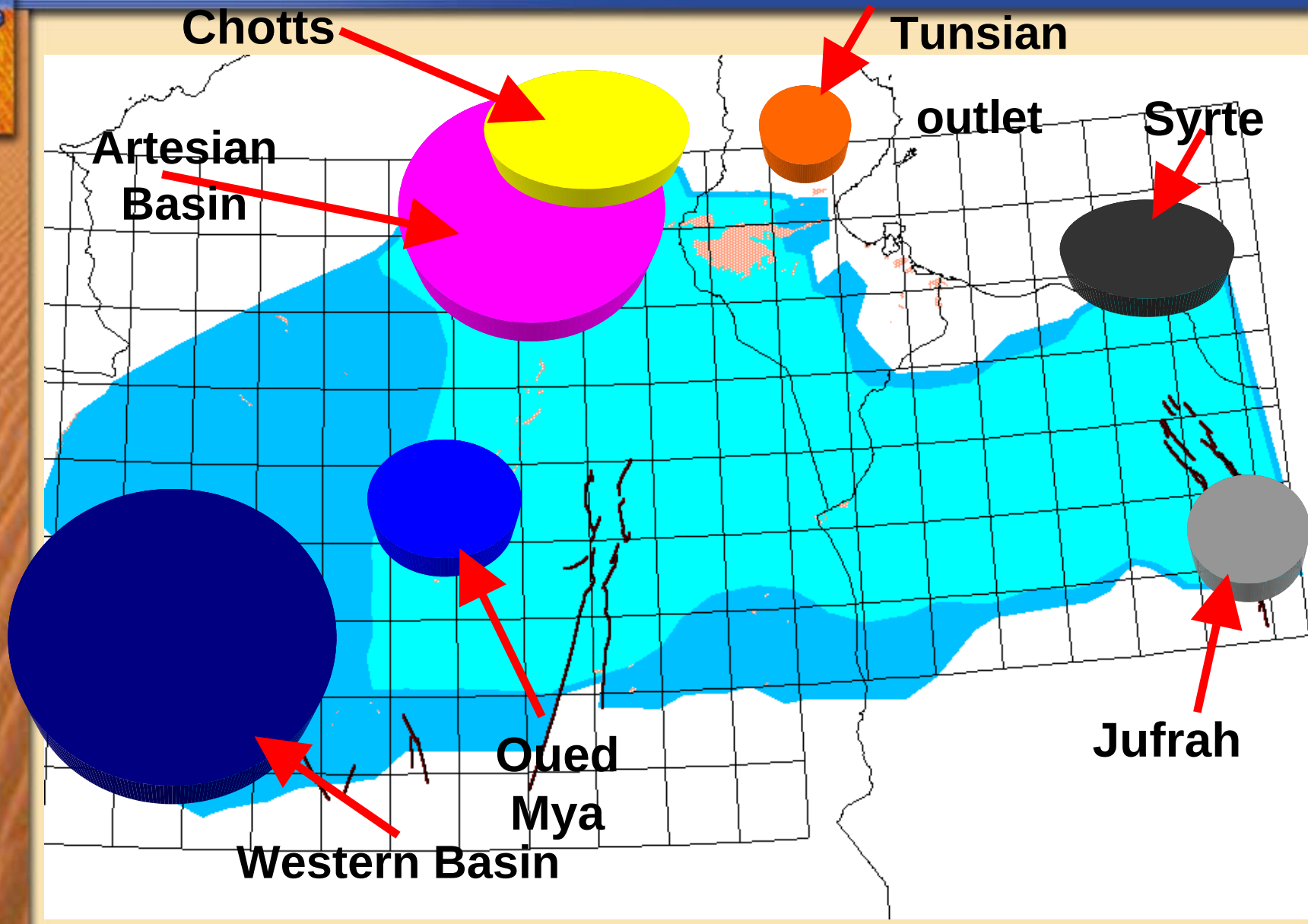
Erg-Occidental / Coef2 / TUNISIE / ALGERIE / Alg+Tun+Lib / Coeff / initiale

NEW SIMULATIONS RESULTS

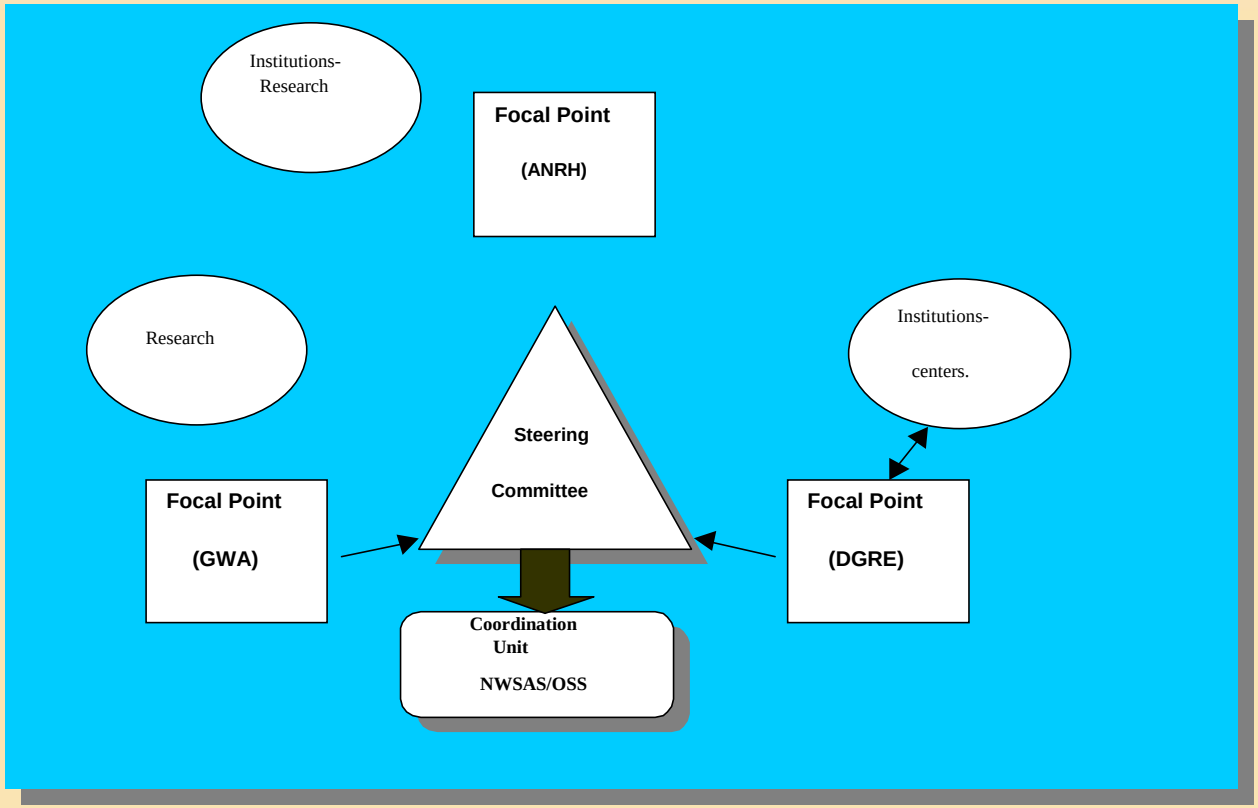
		ALGERIA	TUNISIA	LIBYA
ABSTRACTION IN BILLION m3/y	Present 2000	1.5	0.5	0.5
	Additional 2050	2.5	0.0	0.8
	NWSAS Results	6.0	0.7	1.0
WATER POINTS		6500	1200	1100
RISKS	NATIONAL SHARED			

OBSERVATOIRE DU SAHARA ET DU SAHEL
SAHARA AND SAHEL OBSERVATORY

NWSAS MAP OF RISKS



Consultation Mechanism in its first phase



Development of a permanen tripartie mechanism for the NWSAS common management and of which attributions are :

-monitoring indicator production,

- development of data base and models,

- promotion of studies, research and training

- réflexion sur l'évolution future du mécanisme

ROME workshop, December 20th 2002

Photo M.BESBES

-After this phase of investigation, what does the future hold for NWSAS?

The technical problems which the NWSAS countries have encountered are prompting them to work together: : -partnership relations throughout the NWSAS project, forged mutual confidence among the technical teams and conviction that joint actions increase the effectiveness of solutions. .

TRANSPARENCY AND CAPITALISATION OF THE INFORMATION

DYNAMIC OF EXCHANGE WITH SOLIDARITY TOWARDS THE RISK

CONSULTATION MECHANISM

NWSAS PROJECT RESULTS

PRECEDENT SITUATION

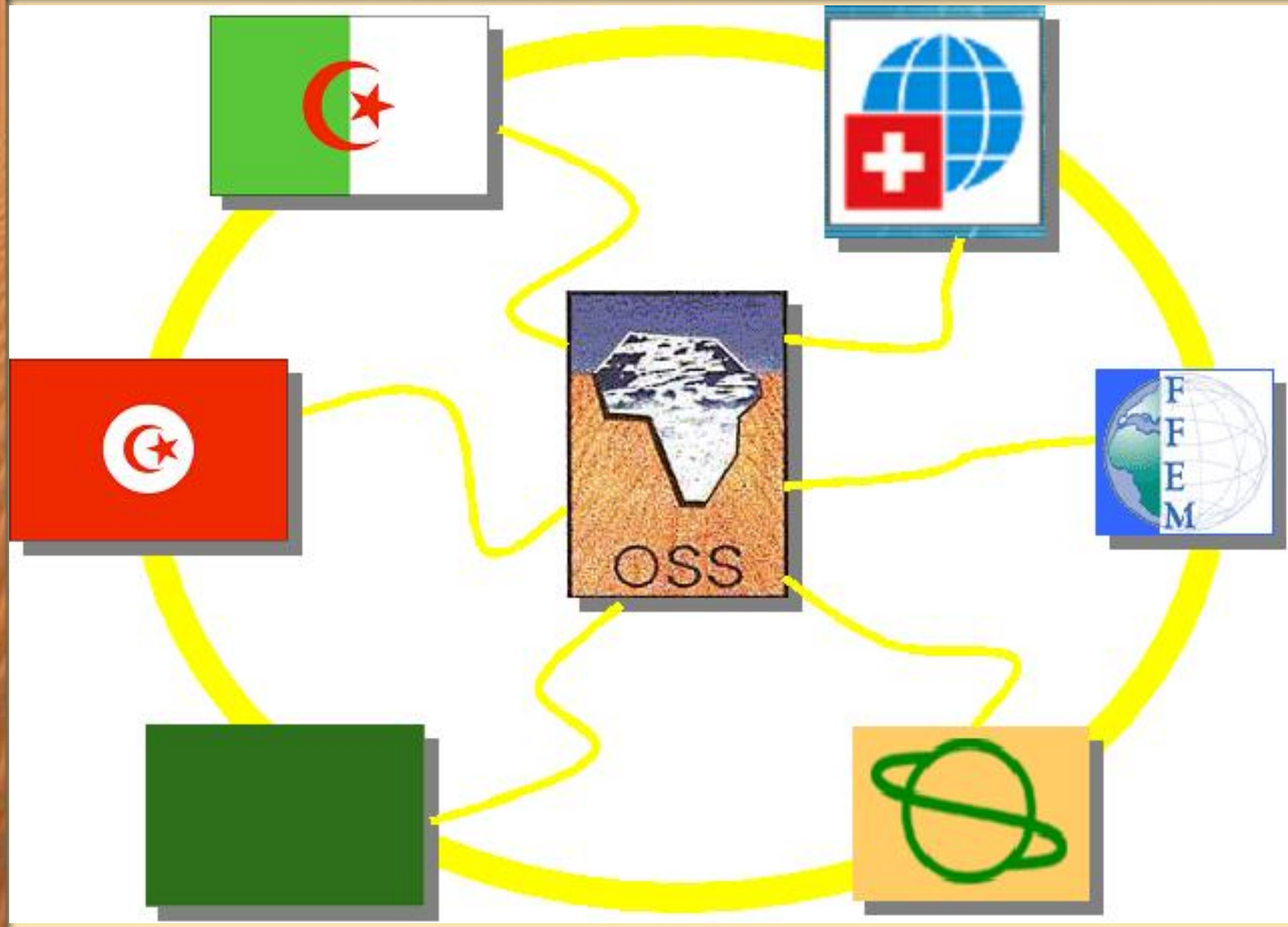
- MIXED COMMISSION
- DECISION MAKERS WILL FOR CONSULTATION
- LACK OF HARMONIZED TECHNICAL DATA
- LACK OF GLOBAL VISION

PRESENT SITUATION

- AVAILABLE HARMONISED TECHNICAL DATA
- SHARED MANAGEMENT OF RIKS
- CONSULTATION TOOLS
- DATA EXCHANGE

AVAILABLE FOR DECISION MAKERS

THE PROJECT SECOND PHASE 2003 – 2005



SECOND PHASE COMPONENT

Sub-regional model

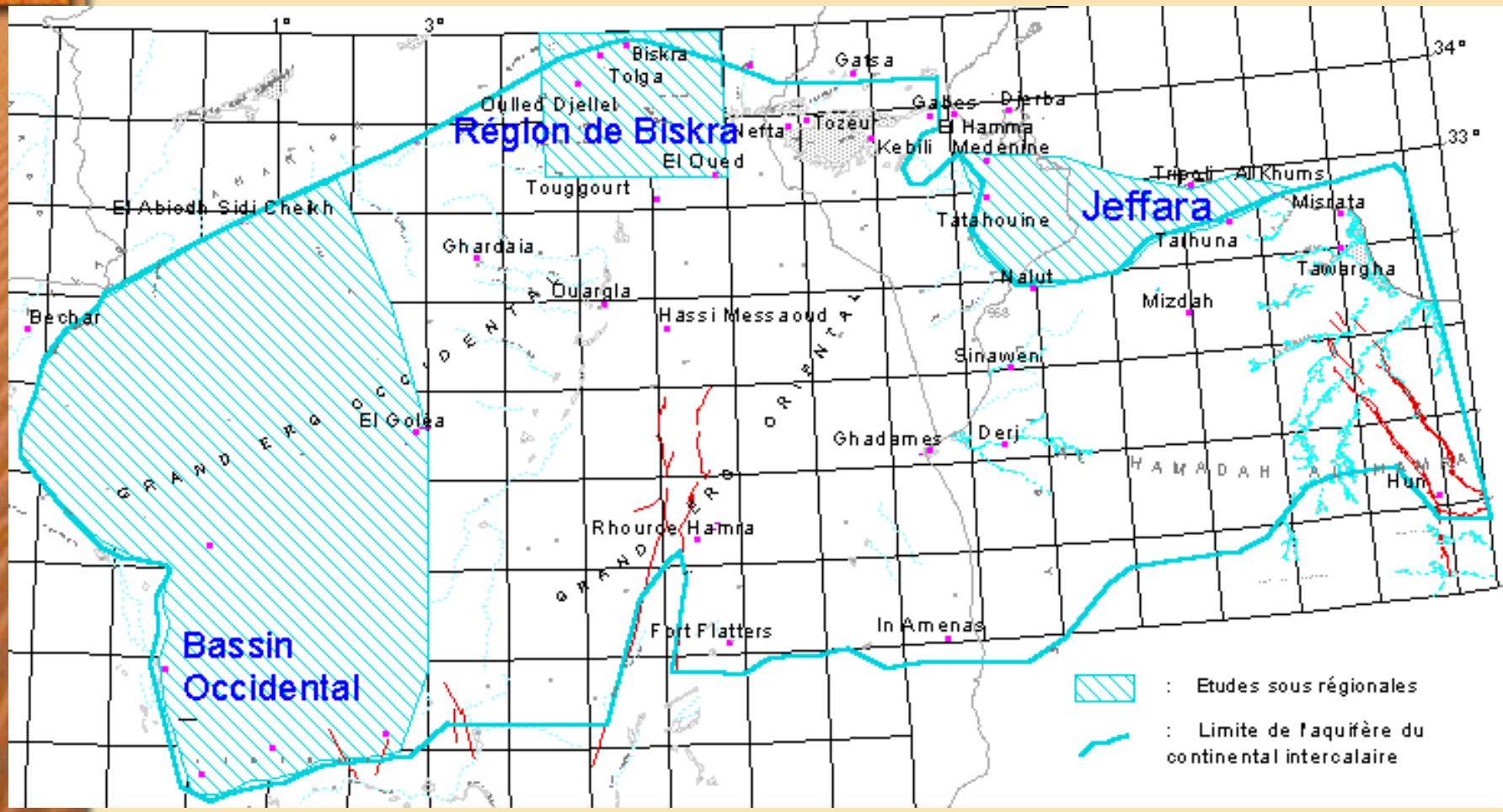
Specific Studies

impacts socio-economic Analysis

Environmental impacts Analysis

Operationnality of Consultation Mechanism

SUB-REGIONAL MODEL



SPECIFIC STUDIES

- SETTING UP OF COMMON SURVEY AND MONITORING NETWORK

-CHOTTS BASIN

-GHADAMES BASIN

- DATA BANK

SOCIO-ECONOMIC ANALYSIS

- SOCIO-ECONOMIC OF MODELLED REGIONS
- IRRIGATION METHODES AT THE SCALE OF ALL NWSAS BASIN
- TYPE OF CROPS AND IMPACTS
- SUSTAINABLE DEVELOPMENT

ENVIRONMENTAL ANALYSIS

- water quality
- Soils Salinisation
- Analyse of environmental risks
- Risks linked to phreatic aquifer
- Recharge Zones
- Wet Lands

EXTENSION TO THE OTHER PARNERS

- **AGRICULTURE**
- **ENVIRONMENT**
- **USERS**
- **LOCAL DECISION MAKERS**
- **ONG**
- **Etc ...**

FOR : CONTRIBUTION

SENSIBILISATION

ADHERENCE

CONSULTATION MECHANISM

Terms of reference:

- **operating of the structure**
- **legal and institutional aspect**
- **data base administration**
- **modes of exchange and network monitoring**
- **periodical updating related to abstractions, piezometry and quality**
- **updatinig of models simulations**
- **establishment of permanent structure**
- **Financing modalities, periodical productions ...**

END