

Enhancing Climate Studies in Libya Data Rescue Effort!

Ali Salem Eddenjal
Climate Directorate, director
(LNMC)



STATION ID	DATE	TEMPERATURE	RELATIVE HUMIDITY	WIND SPEED	WIND DIRECTION	PRECIPITATION	...
00000	2000-01-01	24	58	10	100	0.0	...
00000	2000-01-02	23	55	12	110	0.0	...
00000	2000-01-03	22	52	15	120	0.0	...
00000	2000-01-04	21	50	18	130	0.0	...
00000	2000-01-05	20	48	20	140	0.0	...
00000	2000-01-06	19	45	22	150	0.0	...
00000	2000-01-07	18	42	25	160	0.0	...
00000	2000-01-08	17	40	28	170	0.0	...
00000	2000-01-09	16	38	30	180	0.0	...
00000	2000-01-10	15	35	32	190	0.0	...
00000	2000-01-11	14	32	35	200	0.0	...
00000	2000-01-12	13	30	38	210	0.0	...
00000	2000-01-13	12	28	40	220	0.0	...
00000	2000-01-14	11	25	42	230	0.0	...
00000	2000-01-15	10	22	45	240	0.0	...
00000	2000-01-16	9	20	48	250	0.0	...
00000	2000-01-17	8	18	50	260	0.0	...
00000	2000-01-18	7	15	52	270	0.0	...
00000	2000-01-19	6	12	55	280	0.0	...
00000	2000-01-20	5	10	58	290	0.0	...
00000	2000-01-21	4	8	60	300	0.0	...
00000	2000-01-22	3	5	62	310	0.0	...
00000	2000-01-23	2	3	65	320	0.0	...
00000	2000-01-24	1	2	68	330	0.0	...
00000	2000-01-25	0	0	70	340	0.0	...
00000	2000-01-26	-1	-2	72	350	0.0	...
00000	2000-01-27	-2	-5	75	360	0.0	...
00000	2000-01-28	-3	-8	78	370	0.0	...
00000	2000-01-29	-4	-10	80	380	0.0	...
00000	2000-01-30	-5	-12	82	390	0.0	...
00000	2000-01-31	-6	-15	85	400	0.0	...





Climate Directorate

Precipitation & Agrometeorological

Rainfall Unit

Agrometeorological Unit

Climatic Information Technology

Digitizing Unit

CDMS Unit

Climatic Operations

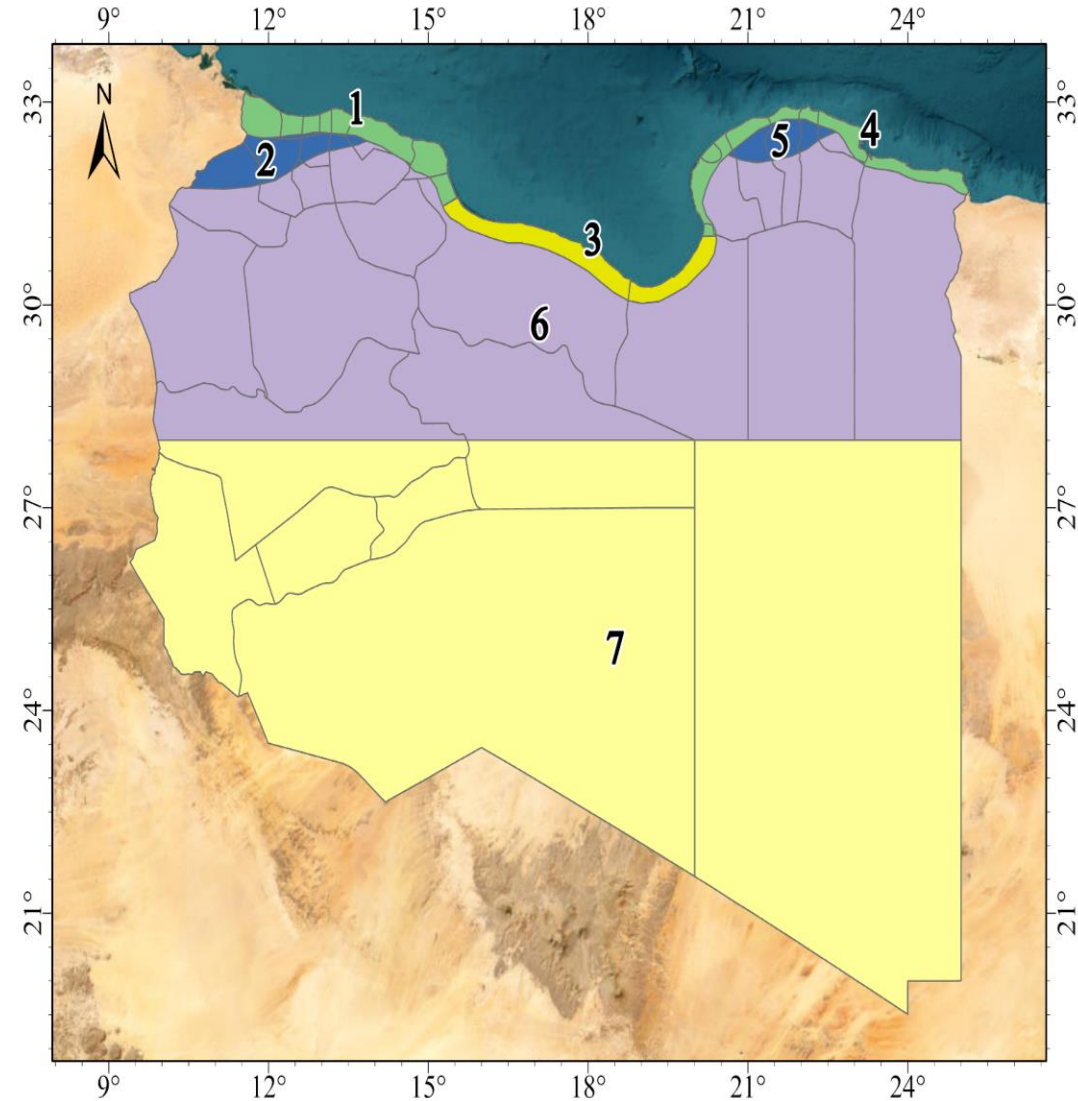
Climate Audit Unit

Climate Inquires Unit

Climate Archive Unit

Libya's climatic regions.

- + Regions **1 and 4**, with average of 261.9 mm rainfall annually;
- + Region **3** with annual rainfall of ≈ 128.9 mm.
- + Zones **2 and 5** (Northern Mountains), with greater rainfall ($\approx 400 - 600$ mm in Jabal ElAkhdar & $160 - 400$ mm in Jabal Nafousa annually);
- + Region **6** (Internal Depressions), located in middle of country (where predesert & desert climatic conditions dominate with annual average (53.2 mm);
- + Zone **7** (Southern regions), includes southern mountains (Tibesti & Akakos) with no or little annual rainfall (0 to 50 mm) & higher temperatures.



Libyan National Meteorological Center (LNMC)

- Meteorological observations in Libya began in 1916 during colonial era,
- Contribution of Libyan meteorologists in observing weather began at the end of the 1940s,
- Observing network currently includes **28** synoptic stations, some of which provide monitoring services for Aviation in addition to SYNOP.
- In addition to 8 Climatic stations & 71 raingauges.

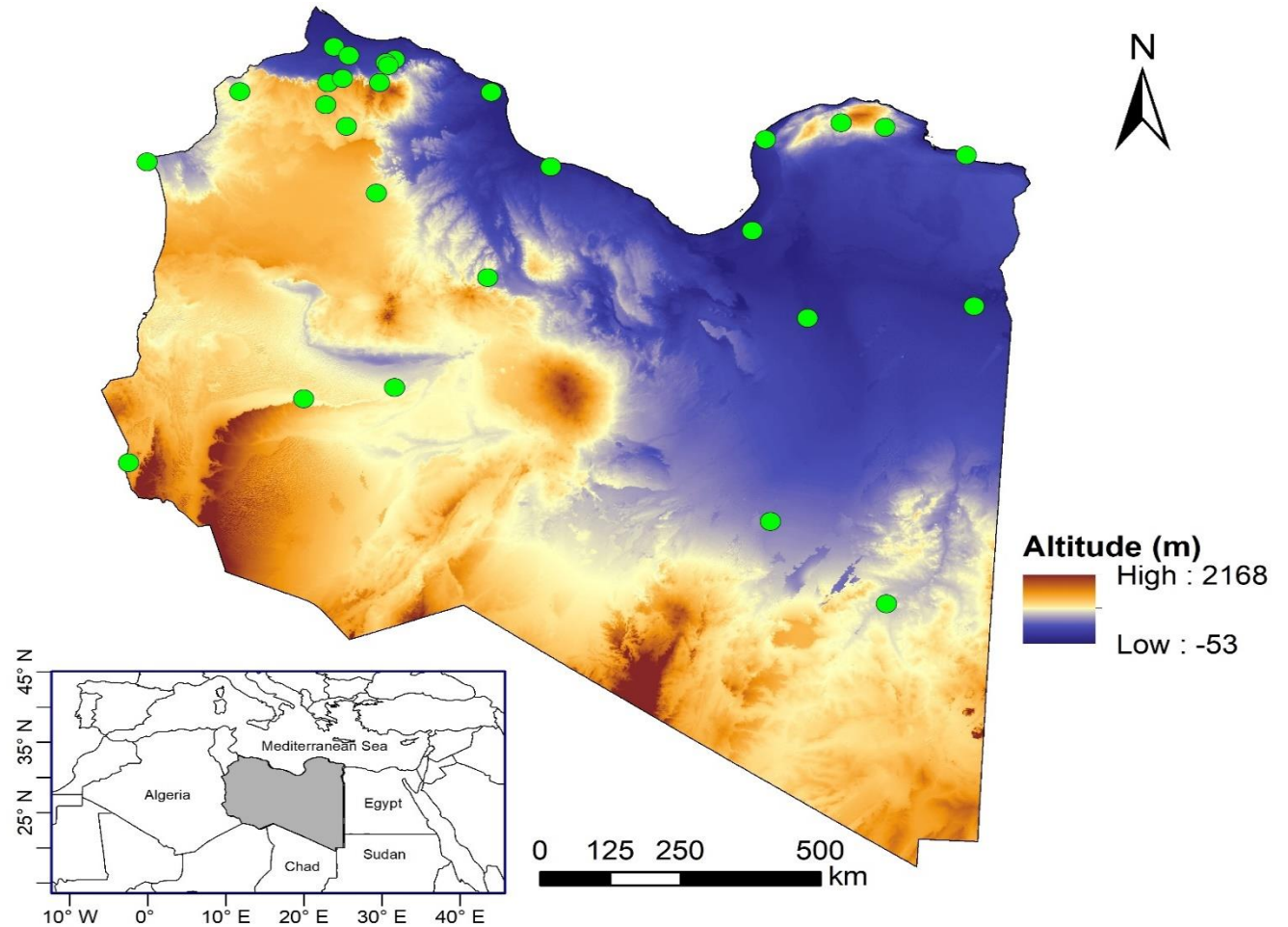


Spatial Distribution of Synoptic Station

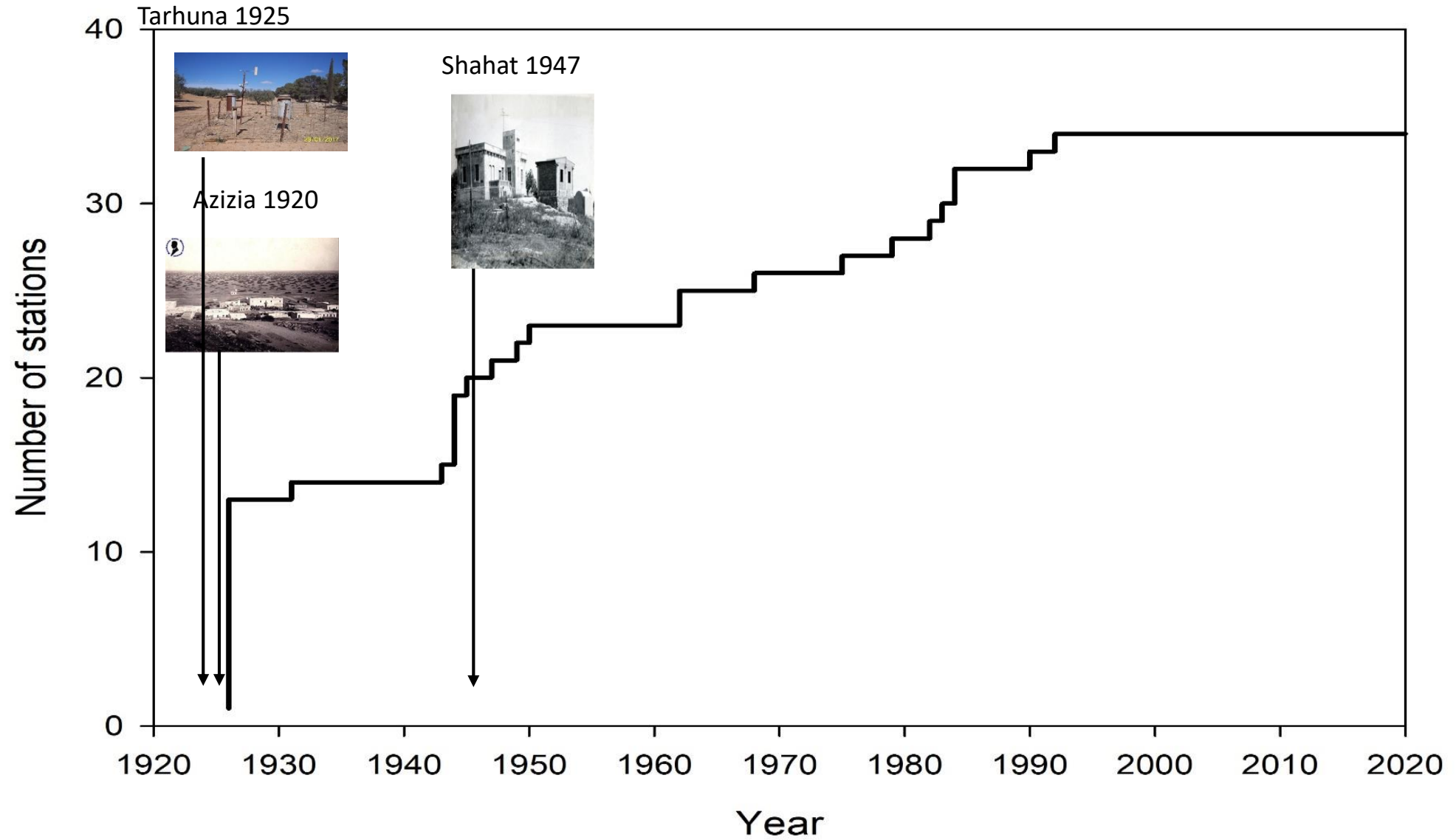
28 stations, 4 stations > 600 m.

Libya encompasses approximately 1.6 m Km²,

With a huge desert covers most of country.



Time Evolution of Available Series



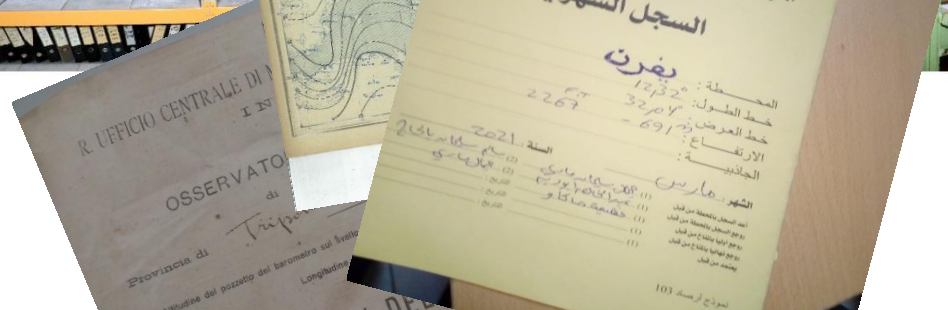
Experience in historical data rescue

Inventory of paper archives

Time period of LNMC's entire historical weather data archives (in paper): 1916 – 2023,

However, Above-mentioned period doesn't apply for all stations,

Furthermore, there are many missing periods, especially during colonial era & also since 2011 on.



Temporary site of LNMC's main Archive, Tripoli, Soaq El Jouma

Imaging of Archives

تأخر الرصد

BASE OF LOWEST CLOUD	أقل ارتفاع قواعد السحب المنخفضة من سطح المحطة كما تم تقديره بالأمتار وعند وجود سحب يسفل ارتفاع قواعدها عن مستوى المحطة (المعاملات الجوية) أو عدم تمكن من رؤية السحب بوجود ضباب مثلاً (توضع علامة /) ، وعند وضعها في الفترة أتبع ما جاء بأحد جدول الرصد رقم (1600) أو الجدول رقم (1677) بحسب الحالة .
VISIBILITY	مدى الرؤية الأفقية ويظهر رسمها في كل الاتجاهات وفي حالة عدم تساويها في الاتجاهات المختلفة يجري تدوين أقل مدى مرصود (بأمتار إذا قلت عن 5 كم ، وبكيلو متر إذا كانت 5 كم أو أكثر) وعند وضعها في الفترة يجب اختيار الرقم الأقرب في حالة وقوع القيمة المرصودة بين قيمتين من أهم الفترة (مثلاً : إذا كانت الرؤية 3500 متر فإن الرقم التقريبي الذي يجب اختياره هو 30 وليس 40 - الجدول التقريبي رقم 4377) .
N	الكمية الكلية للسحب وتقدر بعد الأمتار من قبة السماء المقابلة بالسحب إذا كانت أنواعها (جدول رقم 2700) - لظن التعيينات (12-2-2-1 إلى 12-2-2-6) بتأني الضربات .
dd	اتجاه الرياح السطحية بعشرات الدرجات شرق الشمال ويؤخذ الاتجاه السائد خلال الساعة فقط الساعة مباشرة لوقت الرصد بدلالة خريطة تسجيل الرياح وفي حالة عدم وجود مسجل رياح يقدر الاتجاه السائد بالمقارنة لمدة حوالي 10 دقائق (في حالة حدوث تغير حاد في الاتجاه خلال فترة الساعة فقط الساعة بدون الاتجاه بعد الضرب أو لم يصل منه إلى 10 دقائق) .
ff	سرعة الرياح بالقد (1 عقدة = 0.515 م/ث) وتؤخذ كنسبة السرعات خلال فترة 10 دقائق الساعة مباشرة لوقت الرصد ، وتبين فيها ما يتبع في حالة رصد اتجاه الرياح .
TTT	درجة حرارة الترمومتر الجاف بالدرجات مئوية ، وتقدر العنصري وعند درجات الحرارة السالبة توسع توضع حالة العنصر صفرًا .
T _{max}	درجة حرارة الترمومتر المائل بالدرجات مئوية ، وتقدر العنصري وتضع لظن الطريقة المقيمة في حالة درجة حرارة الترمومتر الجاف .
T _g T _a T _e	درجة حرارة نقطة الندى بالدرجات مئوية ، وتقدر العنصري وتبين في تلك ما يتبع في درجة الحرارة عند تسليها .
V.P	ضغط بخار الماء بالهكتوباسكال مقرباً إلى أقرب رقم عشري واحد .
R.H	الرطوبة النسبية مقربة إلى أقرب عدد صحيح .
Pressure As read	قراءة الضغط من البارومتر المعنى أو الزئبقي ويقراً بمحاذاة عمود السطح الزئبقي بالهكتوباسكال ، وتقدر العنصري .
T _{air}	درجة حرارة الترمومتر الممسك بالدرجات مئوية ، وتقدر العنصري .
P _{air} P _h P _g	الضغط الجوي مصححاً لمستوى سطح المحطة بالهكتوباسكال ، وتقدر العنصري . ملاحظة: قراءة البارومتر المعنوي تعبر عن الضغط عند سطح المحطة .
PPPP	الضغط الجوي مصححاً لمستوى سطح البحر بالهكتوباسكال ، وتقدر العنصري وفي حالة المحطات الجبلية يدرج ارتفاع مستوى ضغط 850 هكتوباسكال إلى أقرب متر جهد أرضي .
a	شكل العمود البارومتري (جدول رقم 1020) .
PPP	قيمة التغير في الضغط الجوي عما كان عليه منذ 3 ساعات سابقة وبأمتار الهكتوباسكال بالنسبة للضغط المصحح لمستوى سطح المحطة .

يقلق عن فواع وترقيم الأجهزة المعتمنة

البارومتر الزئبقي : 82833... 82834... 82835... 82836... 82837... 82838... 82839... 82840... 82841... 82842... 82843... 82844... 82845... 82846... 82847... 82848... 82849... 82850... 82851... 82852... 82853... 82854... 82855... 82856... 82857... 82858... 82859... 82860... 82861... 82862... 82863... 82864... 82865... 82866... 82867... 82868... 82869... 82870... 82871... 82872... 82873... 82874... 82875... 82876... 82877... 82878... 82879... 82880... 82881... 82882... 82883... 82884... 82885... 82886... 82887... 82888... 82889... 82890... 82891... 82892... 82893... 82894... 82895... 82896... 82897... 82898... 82899... 82900... 82901... 82902... 82903... 82904... 82905... 82906... 82907... 82908... 82909... 82910... 82911... 82912... 82913... 82914... 82915... 82916... 82917... 82918... 82919... 82920... 82921... 82922... 82923... 82924... 82925... 82926... 82927... 82928... 82929... 82930... 82931... 82932... 82933... 82934... 82935... 82936... 82937... 82938... 82939... 82940... 82941... 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According to the IPCC, Libya is very vulnerable to climate change & its impacts, especially weather extremes & climate events as they are expected to increase in severity with more lasted period;

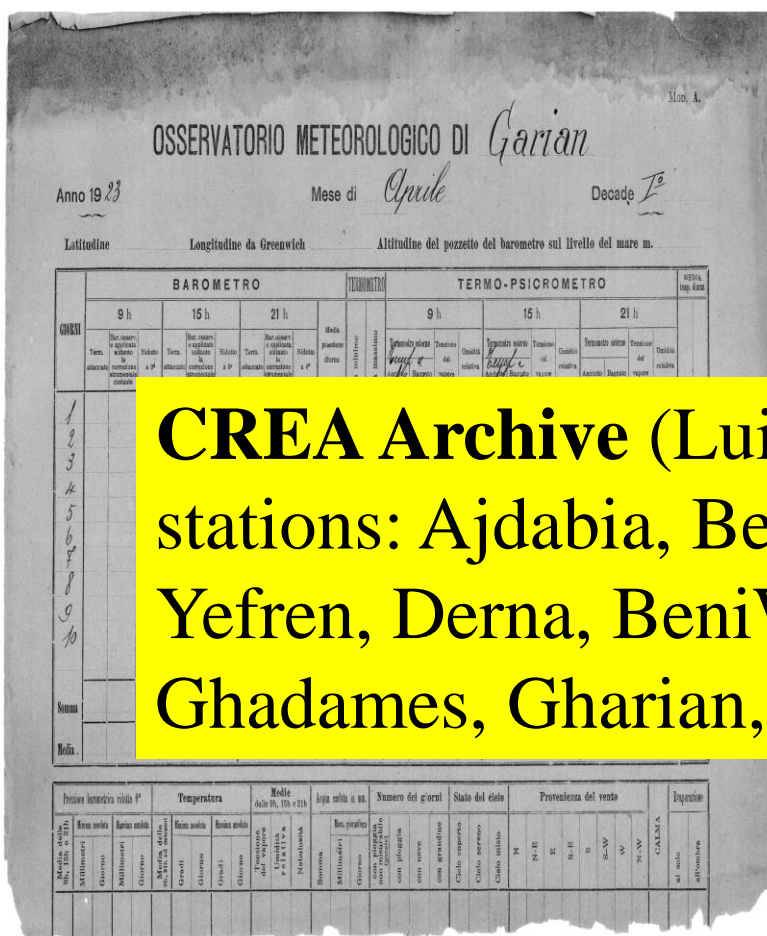
Thus, effective climate change monitoring is needed to help adopt more effective measures to mitigate these negative impacts,

As we adapt to a changing climate paradigm, it is of critical importance we leverage the science encapsulated in our historical climate data,

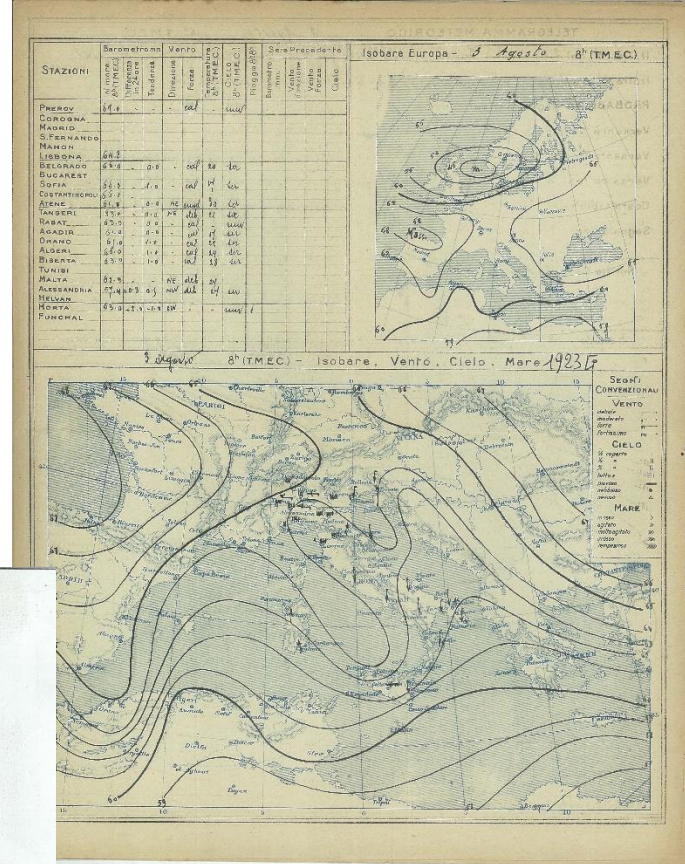
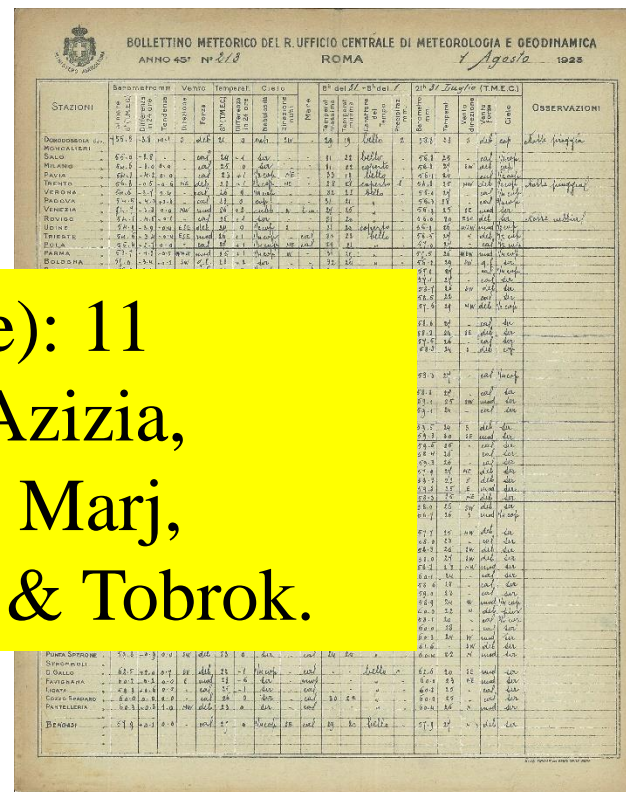
LONGER period of historical data availability is a must!

Recovering Old Archive Activities

LNMC have received scanned Log books of some Libyan historical climatic data from Italian institutions;




CREA Archive (Luigi Iafrate): 11 stations: Ajdabia, Benghazi, Azizia, Yefren, Derna, Beni Walid, El Marj, Ghadames, Gharian, Khoms & Tobrok.



Recovering Old Archive Activities (Cont'd.)

Tripoli & Benghazi for Aug, 1923
 Bollettino Meteorico Giornaliero
 (Maurizio Maugeri).


BOLLETTINO METEORICO DEL R. UFFICIO CENTRALE DI METEOROLOGIA E GEODINAMICA
 ANNO 45° N° 213 ROMA *1 Agosto* 1923

STAZIONI	Barometro mm		Vento		Temperat		Cielo		Mare	8 ^h del 31		-8 ^h del 1		21 ^h 31 Luglio (T.M.E.C.)		OSSERVAZIONI			
	al mare	Differenza in 24 ore	Direzione	Forza	8 ^h T.M.E.C.	Differenza in 24 ore	Nebulosa	Dirazione nuvi		Temperat massima	Temperat minima	Quantità di pioggia	Tempo	Barometro	Temperat		Vento direzione forza	Cielo	
DONDOSOBOLA	755.2	-2.2	0	0	21	0	cafi	SW	-	29	19	bello	2	50.2	23	S	deb	cafi	Notte serena
MONCALIERI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MILANO	754.6	-3.0	0	0	24	-1	der	-	-	31	22	bello	-	50.2	25	-	cal	incap	-
PAVIA	754.1	-4.2	0	0	23	+1	incap	NE	-	30	19	bello	-	50.1	24	-	cal	incap	-
TRENTO	750.8	-0.5	0	0	23	+1	cafi	NE	-	29	22	coperto	1	50.2	25	NW	deb	cafi	Notte serena
VERONA	754.6	-2.7	0	0	24	0	cafi	-	-	31	21	bello	-	50.1	24	-	cal	incap	-
PADOVA	754.5	-4.0	0	0	23	0	cafi	-	-	31	21	-	-	50.3	28	-	cal	incap	-
VENEZIA	754.7	-3.8	0	0	26	+2	cafi	N	lim	31	25	-	-	50.3	25	SE	mod	der	-
ROVIGO	754.1	-4.6	0	0	25	+0	der	-	-	31	20	-	-	50.0	26	SE	mod	der	-
UDINE	754.9	-3.9	0	0	24	0	cafi	0	-	31	20	coperto	-	50.4	26	NW	mod	der	-
TRIESTE	754.6	-3.4	0	0	24	+1	incap	cafi	lim	30	22	bello	-	50.5	27	N	deb	cafi	Notte nebbia
UDINE	754.1	-4.6	0	0	25	+0	der	-	-	31	20	-	-	50.0	26	SE	mod	der	-
PARMA	753.7	-4.3	0	0	25	+1	incap	0	-	31	25	-	-	51.5	26	NW	mod	der	-
BOLZOGNA	751.0	-3.4	0	0	24	+2	der	-	-	32	24	-	-	50.2	29	SW	mod	der	-
PIACENZA	751.2	-4.2	0	0	24	+2	incap	SW	cafi	30	21	-	-	50.1	27	-	cal	der	-
TERAMO	752.3	-3.2	0	0	24	0	cafi	NW	-	30	24	-	-	50.1	27	-	cal	der	-
CHIETI	752.3	-3.2	0	0	24	0	cafi	NW	-	30	24	-	-	50.1	27	-	cal	der	-
ASINONE	751.7	-4.0	0	0	25	+2	incap	-	-	30	18	-	-	50.5	26	-	cal	der	-
FOGGIA	752.4	-4.0	0	0	26	+2	cafi	-	-	31	25	-	-	51.0	29	NW	deb	cafi	-
BARI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TARANTO	752.3	-0.9	0	0	25	0	der	-	cafi	31	23	bello	-	50.6	27	-	cal	der	-
LECCE	752.3	-0.8	0	0	25	+1	der	-	cafi	31	23	-	-	50.2	28	SE	mod	der	-
SIRENO	752.0	-0.4	0	0	25	+1	der	SW	lim	31	21	-	-	50.5	28	-	cal	der	-
GENOVA	751.3	-1.4	0	0	24	0	cafi	SE	cafi	29	23	coperto	-	50.3	24	0	deb	cafi	-
SPERZA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FIRENZE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LIVORNO	751.1	-1.3	0	0	24	0	incap	W	mod	30	22	bello	-	50.2	27	-	cal	incap	-
SIENA	750.7	-0.2	0	0	22	+2	incap	SW	-	18	18	coperto	-	50.3	27	-	cal	der	-
ROMA	750.3	-1.1	0	0	25	+1	incap	-	-	21	21	bello	-	50.1	25	SW	mod	der	-
NAPOLI	750.5	-0.5	0	0	24	0	incap	SW	cafi	29	21	-	-	50.1	24	-	cal	der	-
TEBESIA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SASSARI	749.7	-2.1	0	0	25	+3	der	-	-	30	21	coperto	-	50.5	24	0	deb	der	-
CAGLIARI	749.4	-1.1	0	0	23	+4	der	-	lim	21	21	bello	-	50.3	20	SE	mod	der	-
MESSINA	749.3	-0.9	0	0	24	0	der	-	cafi	30	22	-	-	50.4	25	-	cal	der	-
CATANIA	749.0	-1.2	0	0	23	-1	der	-	cafi	30	19	-	-	50.0	26	-	cal	der	-
SIRACUSA	749.0	-0.0	0	0	20	-	incap	W	lim	34	13	-	-	50.3	20	-	cal	der	-
TRAPANI	749.0	-0.9	0	0	20	-1	der	-	cafi	28	26	-	-	51.4	27	NE	deb	der	-
PALERMO	749.3	-0.5	0	0	26	0	incap	cafi	0	30	18	-	-	50.3	25	E	deb	der	-
CATANISSETTA	749.2	+0.8	0	0	25	0	der	-	cafi	29	24	-	-	50.2	25	E	mod	der	-
TRIPOLI	748.2	-0.7	0	0	25	+3	der	-	cafi	29	21	-	-	50.2	25	NE	deb	der	-
FUMI D'ETI	748.2	-1.6	0	0	25	+2	incap	-	lim	29	24	-	-	50.0	25	SW	deb	der	-
M. CAMPUCCI	747.8	-1.1	0	0	25	0	incap	-	cafi	28	24	-	-	50.7	26	3	mod	incap	-
VIESTE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BRINDISI	747.1	-0.5	0	0	24	+2	der	-	lim	29	21	bello	-	50.7	25	NW	deb	der	-
S. M. LEUCA	747.1	-0.1	0	0	24	0	der	-	cafi	29	21	-	-	50.6	23	-	cal	der	-
C. COLONNE	746.7	-4.2	0	0	23	0	der	-	cafi	-	-	-	-	50.3	26	SW	deb	der	-
C. PARTIVENTOL	746.0	-0.0	0	0	27	+1	der	-	cafi	30	25	-	-	50.0	27	SW	deb	der	-
C. PALINURO	745.7	-1.5	0	0	23	-2	der	-	lim	23	22	-	-	50.2	23	NW	mod	der	-
IBICIA	745.0	-0.3	0	0	26	+1	cafi	-	cafi	31	22	-	-	50.1	24	-	cal	der	-
FOSSO CUPO	744.8	-0.1	0	0	24	-1	incap	-	cafi	28	20	-	-	50.6	28	-	cal	der	-
GIOLIO	744.1	-1.8	0	0	21	-2	incap	-	cafi	28	20	-	-	50.0	23	-	cal	der	-
CARRARA	743.9	-1.4	0	0	24	0	cafi	-	-	-	-	-	-	50.9	24	W	mod	der	-
PALMARIA	743.2	+0.2	0	0	26	+2	der	-	cafi	26	25	-	-	60.0	22	N	deb	der	-
C. MELE	741.0	-5.0	0	0	23	+1	incap	-	cafi	24	20	-	-	50.1	20	-	cal	der	-
PORFOTORRES	60.0	-2.0	0	0	25	0	der	-	cafi	28	21	-	-	50.0	28	-	cal	der	-
C. FIGARI	60.3	-0.1	0	0	27	+3	der	-	cafi	30	24	-	-	60.3	24	W	mod	der	-
C. CARBONARA	60.0	-3.0	0	0	28	-1	der	-	lim	-	-	-	-	61.0	-	SW	deb	der	-
PUNIA SPERONE	59.8	-0.9	0	0	23	0	der	-	cafi	24	20	-	-	60.4	22	N	mod	der	-
STRONCHI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G. GALLO	62.5	+2.0	0	0	22	-1	incap	-	-	-	-	bello	-	62.0	20	SE	mod	der	-
FAVIGNANA	60.3	-0.2	0	0	23	-6	der	-	cafi	-	-	-	-	60.0	23	NE	mod	der	-
LIGATA	60.4	-0.6	0	0	25	-1	der	-	cafi	-	-	-	-	60.1	25	-	cal	der	-
COZZO SPADARO	60.0	0.0	0	0	26	0	der	-	cafi	30	24	-	-	60.0	25	-	cal	der	-
PANTELLERIA	60.3	-0.8	0	0	23	0	der	-	cafi	-	-	-	-	60.4	26	N	mod	der	-
BENGASI	57.9	+0.1	0	0	27	0	incap	SE	cafi	29	20	bello	-	57.9	27	N	deb	der	-

Getting all old data from Italian archives will strength our climate change understanding as such climate studies require long time series, especially when it comes to obtain reasonable estimates of intensity & frequency of rare events.

Such as, NW Libya Blizzard in 1949, 58 °C record in Azizia in 1922 & recent rainfall record of 414.1 mm in El Bayda in 11/9/2023.



Climate Change Making Weather More Extreme?



But,

Digitization of Images: Key Challenges

R. UFFICIO METEOROLOGICO
OSSERVATORIO PRINCIPALE
BENGASI

Memorie osservate e mensili dei dati Meteorologici del mese di Gennaio 1935. VII

Giorno	Pressione a 0°	Temp. MAX.	Temp. MIN.	Temp. MED.	Umidità	No. di Precipitazioni			M.M.S. All.	Vento fines	Vento dir.	Vento fines	Totale precip. diurna	Vento cost.	Vento vel.	Stato Cielo			Vento max.	Vento min.	NOTE	
						acqua	calda	calda								sereno	nuvol.	nuvol.				
I	761.41	18.6	12.1	12.4	65				12.0	9	NE	8	37.15.00	W	69	0	10	0	1.5	72.0	9	
II	762.58	15.4	9.1	10.3	63				15.8	19	NE	18	37.12.30	W	69	1	9	0	6.6	31.1	7	
III	760.68	12.0	9.4	11.7	26				21.1	26	SE	22	63.12.30	SE	61	1	10	0	4.6	24	3	
	761.55	16.6	9.5	12.1	7.1										66					113.7		

Digitization of Images: Key Challenges (Cont'd)

Mon. A.

OSSERVATORIO METEOROLOGICO DI Roma

Anno 1914

Mese di Giugno

Decade 3

Latitudine 42° 06' 47" Longitudine da Greenwich 12° 18' 21" Altitudine del pozzetto del barometro sul livello del mare m. 10

GIORNI	BAROMETRO									TERMOPTERMO		TERMO-PSICROMETRO									MEDIA temp. - media
	9 h			15 h			21 h			Meteo previsioni Stato	Temperatura aerea	9 h			15 h			21 h			
	Term. aerata	Esp. umidità a 1000 m	Stato a	Term. aerata	Esp. umidità a 1000 m	Stato a	Term. aerata	Esp. umidità a 1000 m	Stato a			Temperatura aerata	Temperatura del vapore	Umidità relativa	Temperatura aerata	Temperatura del vapore	Umidità relativa	Temperatura aerata	Temperatura del vapore	Umidità relativa	
21	27	766.4	766.1	27	763.0	762.2	27	762.0	762.0	27.0	26	22	69	21	20	67	26	19	74		
22	30	768.1	768.1	30	763	757	29	762.1	757.5	29.4	25	22	27	26	21	63	24	21	75		
23	28	763.6	763.6	27	764.6	761.2	26	766.3	762.1	29.2	22	21	23	25	20	61	22.6	21.6	71		
24	25	767.1	766	30	764.1	764	28	762.1	762.6	29.7	20	22	28	25	22	26	22	21	83		
25	26	765.4	762.1	29	765	761.6	27	764.1	760.8	29.9	21	21	25	26	21	62	22.5	20.4	82		
26	21	765	761.2	29	765.2	761.2	27	765.3	761.9	29.9	22	21	68	25	21	67	22.4	19	81		
27	21	766.4	762.6	20	766.4	762.5	27	766.1	762.9	29.8	21	21	64	25	20	64	22	20	76		
30	25	766.6	761.5	29	766.5	764.9	28	766.4	764.9	29.6	27	20	64	25	20	64	22	20	76		
Somma													908.0		258.8	205			802.0		
Media		61.9			61.6			61.7		29.6	20.1	20.8	20.2	64	25.9	20.3	66	25.5	20.3	76	

As well as language barrier, especially when it comes to old handwriting

Any questions?



Thank you