Center for Environment & Water
Research Institute
King Fahd University of Petroleum & Minerals

Spatial Variability in the Physical and Chemical properties of Water in Al Asfar Lake, Al-Hasa Region, KSA

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OUTLINES

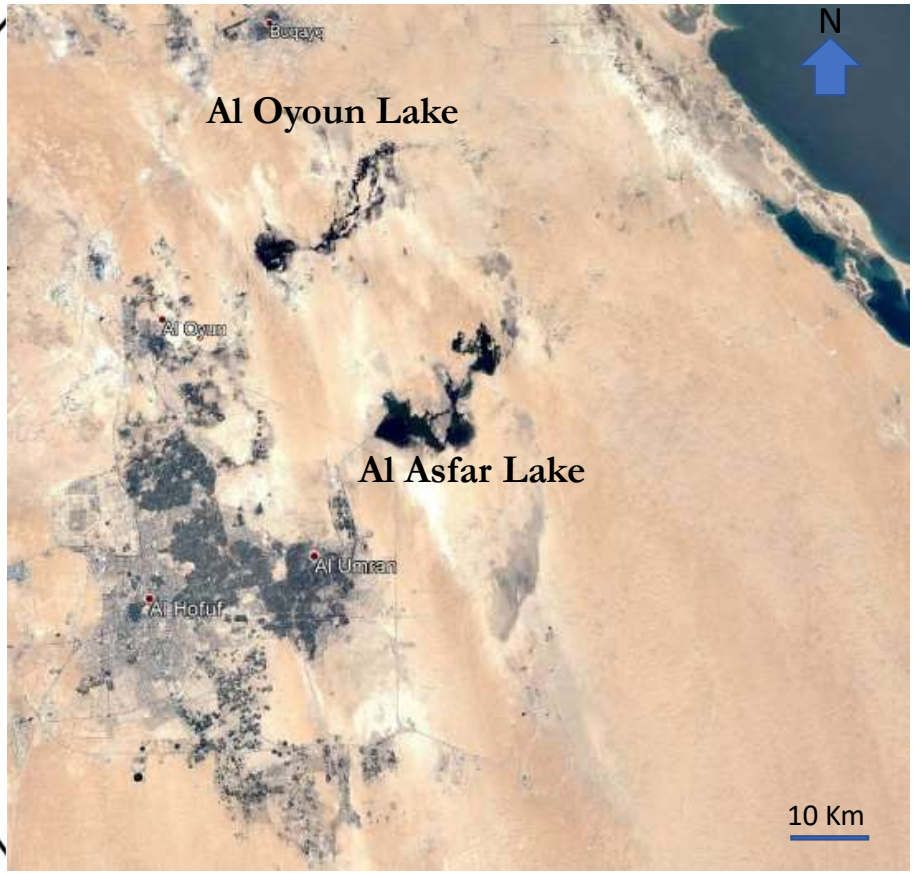
Introduction

Water Quantity Change
Remote Sensing Results

Water Quality Change
Organic & Inorganic Analysis

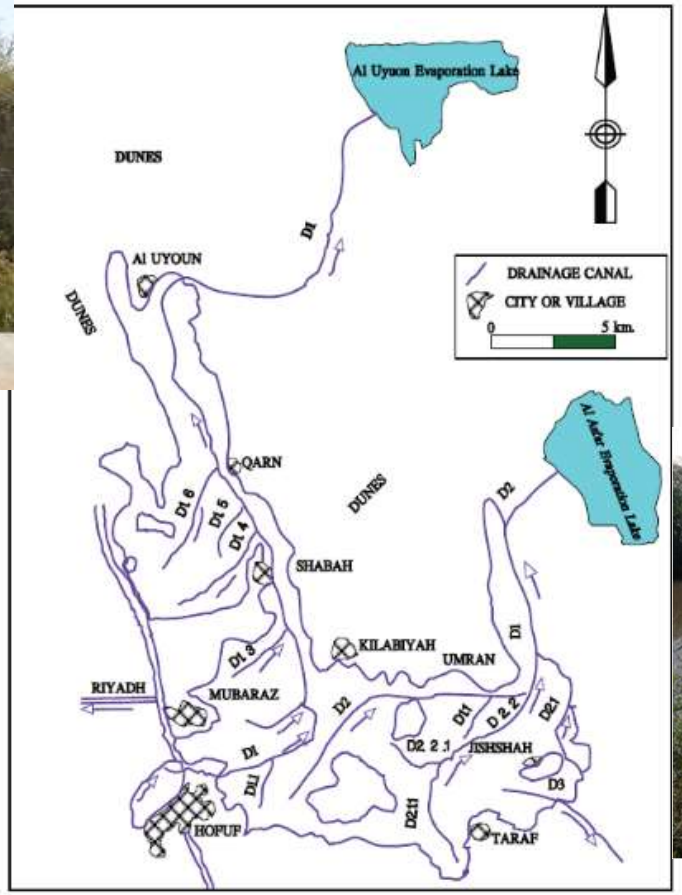
Conclusions

INTRODUCTION



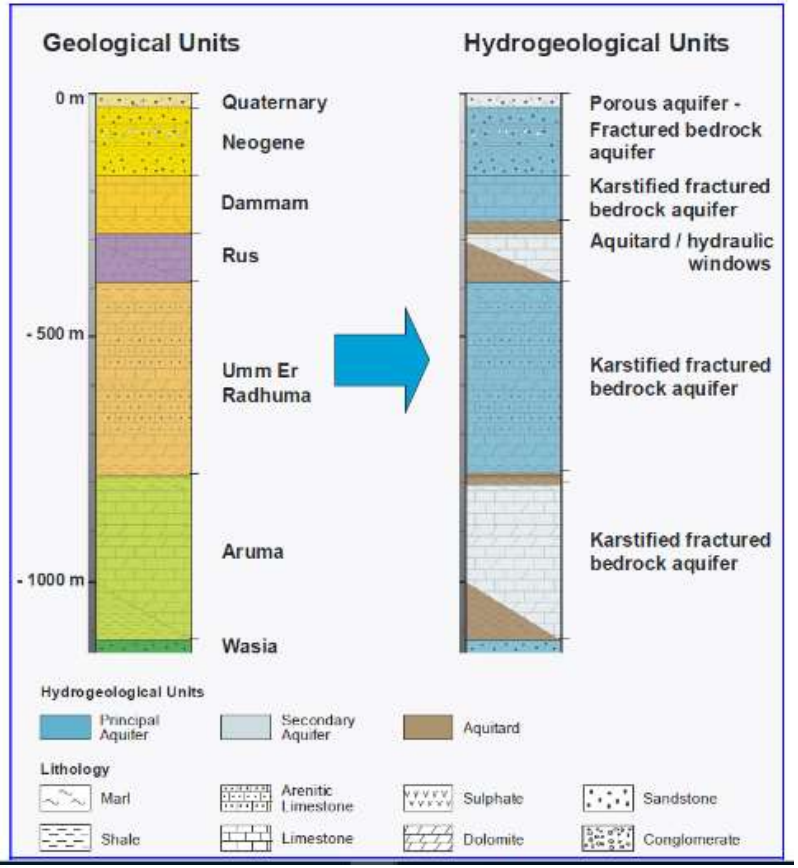
INTRODUCTION

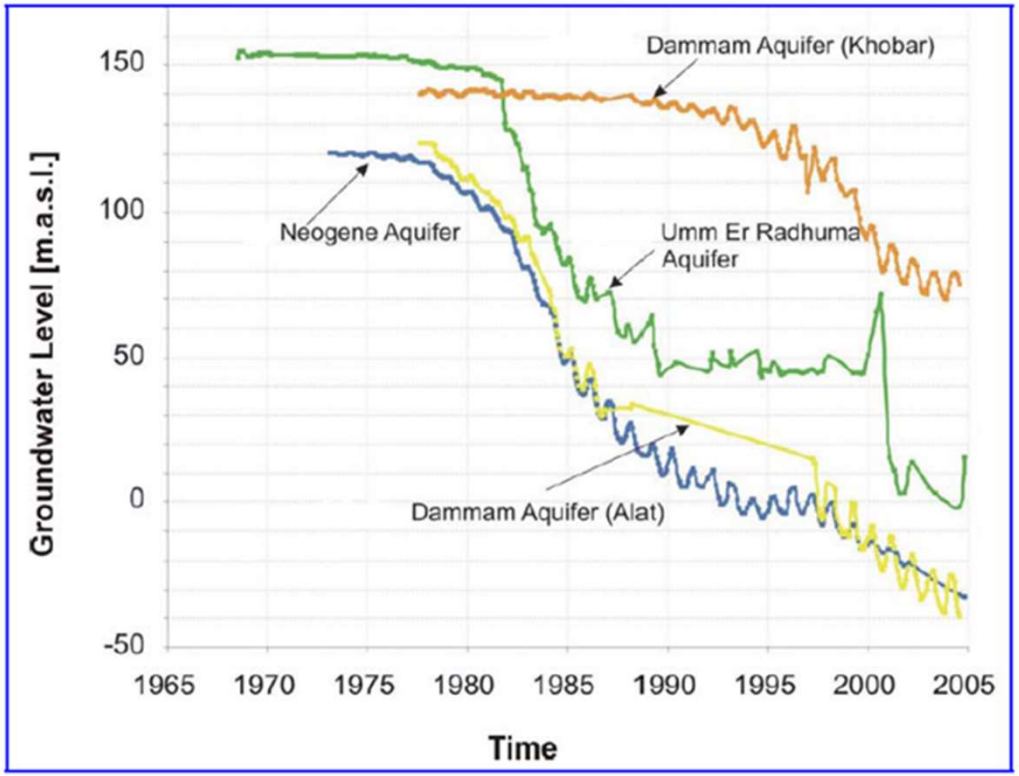
Main drainage system of Al Hassa irrigation and drainage



(El Mahmoudi et al., 2011).

INTRODUCTION





Al Tokhais, A. S., & Rausch, R. (2008)

INTRODUCTION

Why this research is important?

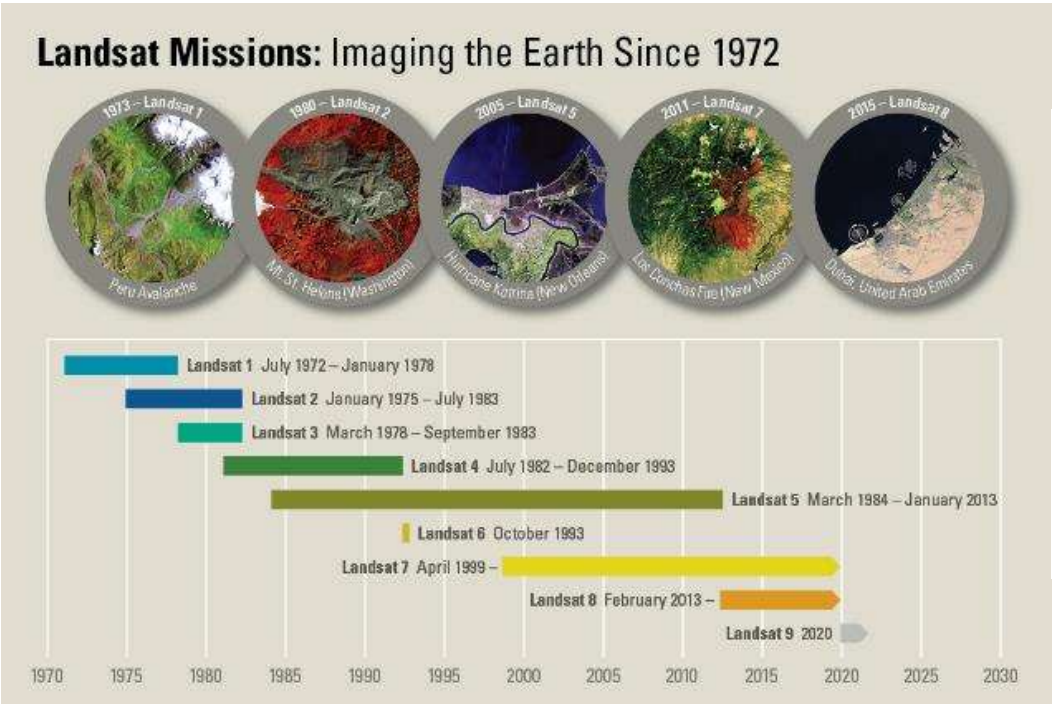
- The influence of global climate change and human activities on spatial and temporal changes of ***water quality and quantity*** have been increase very sharply during the last 25 years.
- Those changes in surface waterbodies have been affecting *agricultural* and ***industrial production***, ***ecological***, ***environment***, ***food***, **and** ***health safety***.
- Reliable information of the spatial distribution, persistence, and quality of surface water is critically important for ***regional economic development, urban planning, regional climate, assessment of future water resources, and environmental monitoring***.

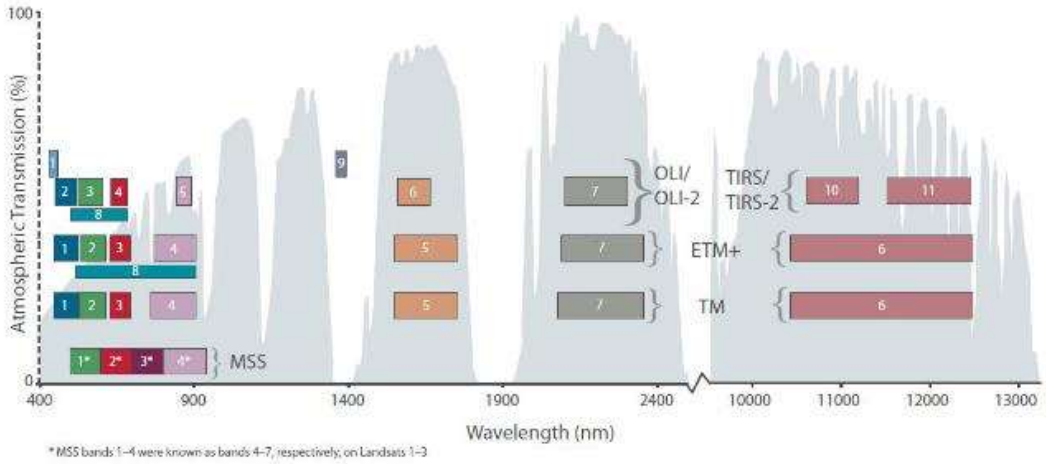
INTRODUCTION

The Main goals of this research study are as fallow:

- To map of water bodies for Al Asfar & Al Oyoun Lakes using Landsat multispectral data
- To assess the current water quality conditions for Al Asfar & Al Oyoun Lakes.

Water Body Analysis using Remote Sensing



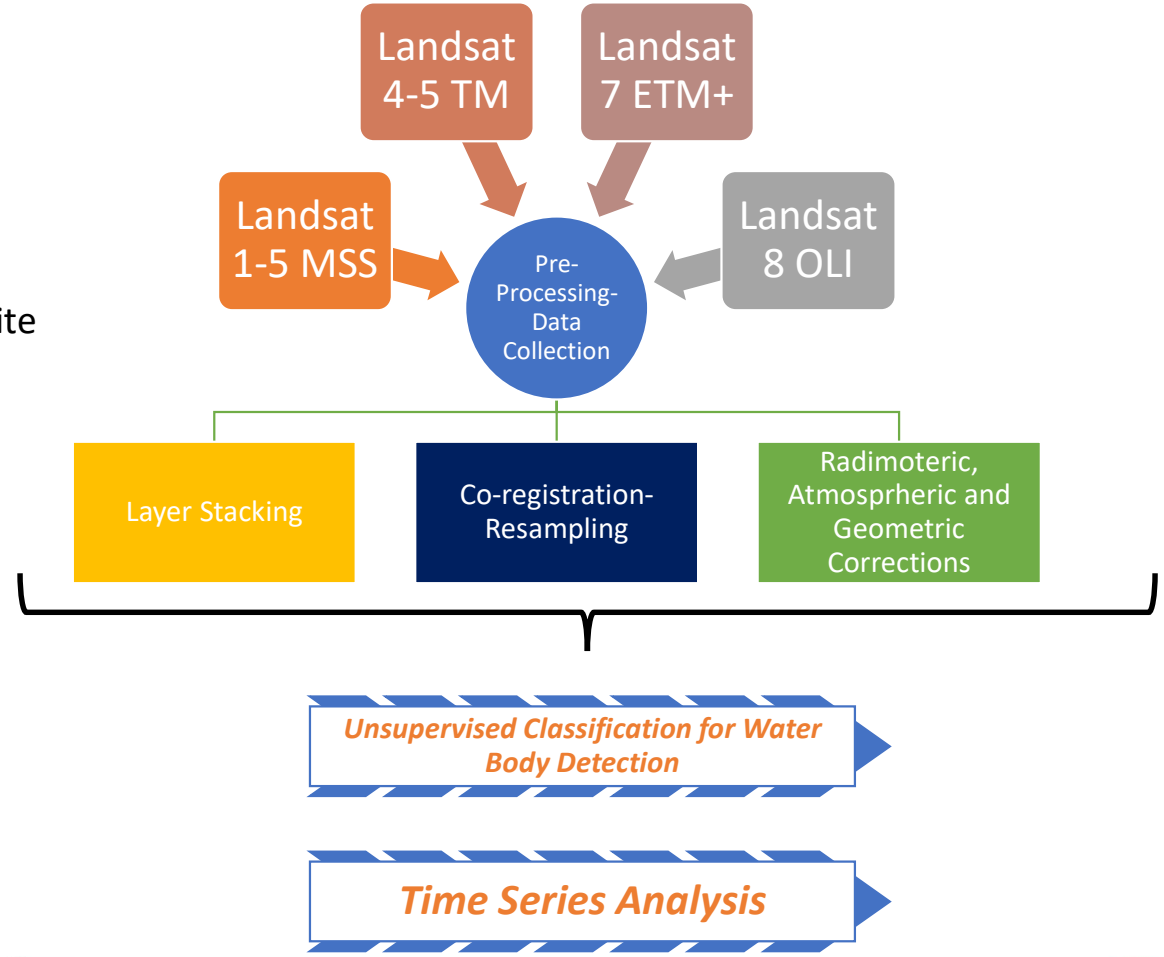


Methods | Flow Chart for Remote Sensing Analyses

LANDSAT İmage between

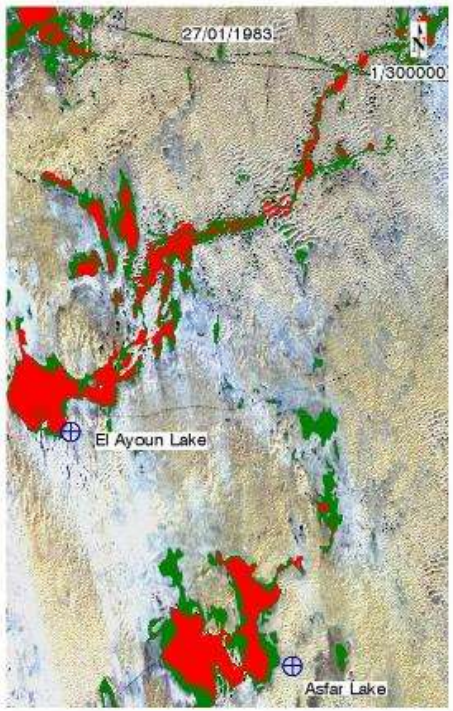
1972-2020

(48 years of Satellite image data)

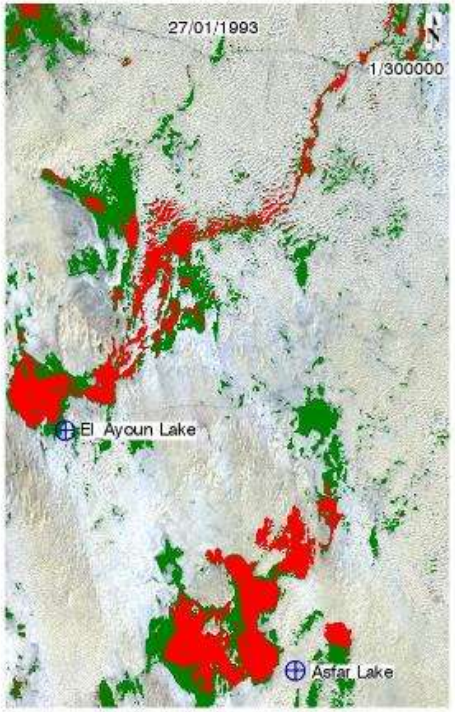


Flowchart showing the overall methods adopted in the study

Results| Water Body Change using Unsupervised Classifacation



185 km^2

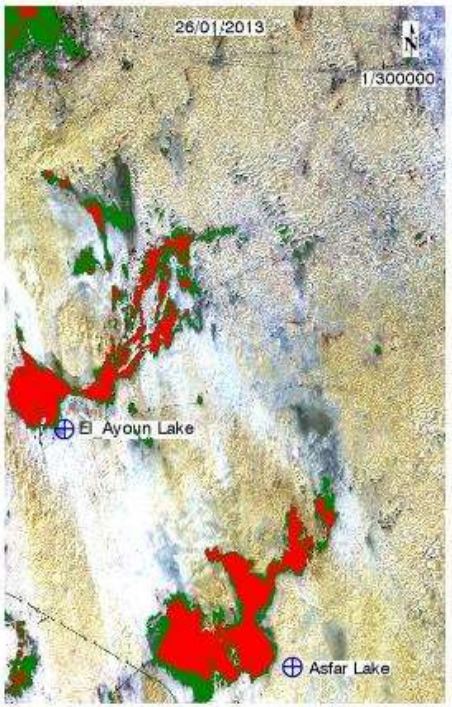


260 km^2

≈ 40% up

220 km^2

≈ 16% Down



164 km^2

≈ 25% Down

Results| Water Body Change using Unsupervised Classifacation

190 km^2

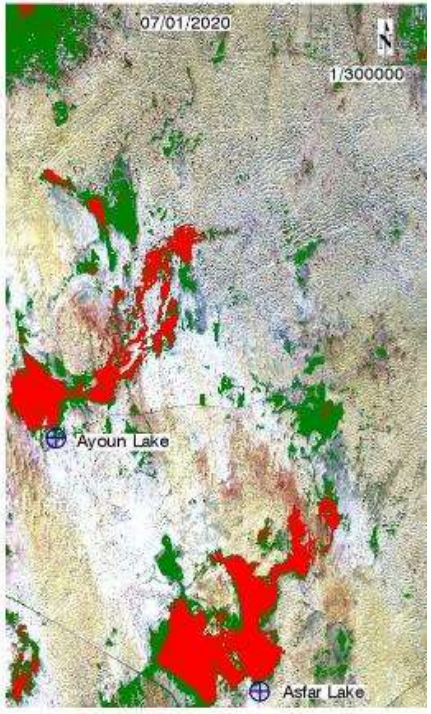
≈ 16% up

175 km^2

≈ 8% Down

230 km^2

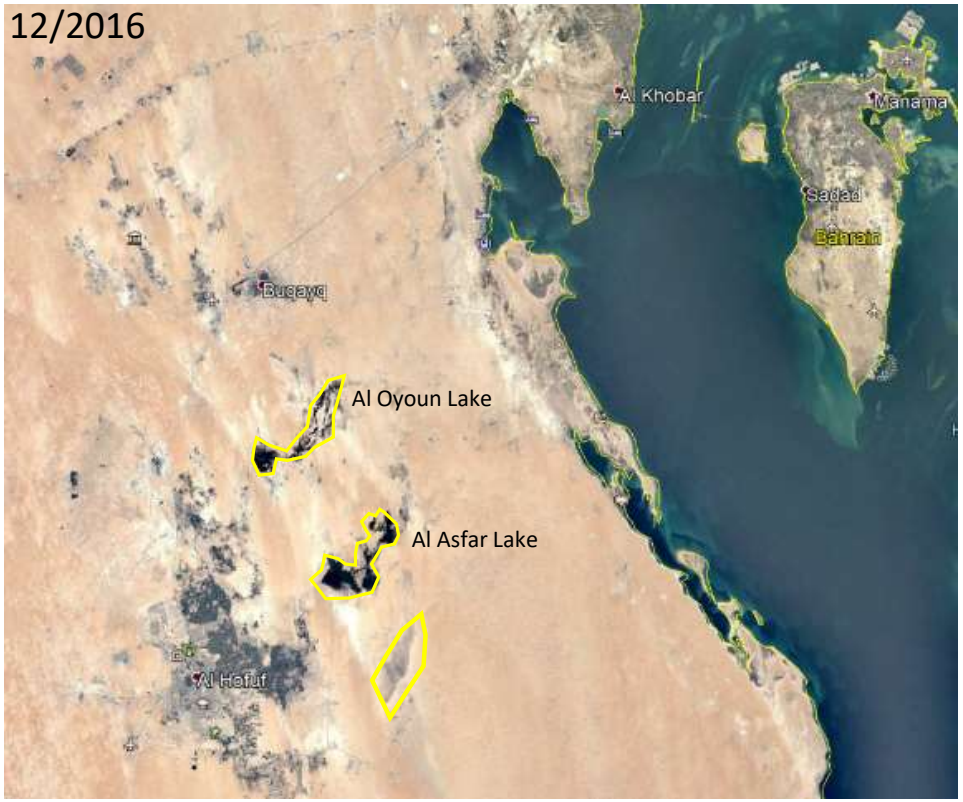
≈ 32% up



225 km^2

≈ 3% Down

Results| Water Body Change



Water Quality | On-site Measurements of Physical Properties

YSI multiparameters sonde

1. **T (°C)**
2. **DO (mg/L)**
3. **EC (µS/cm)**
4. **pH**
5. **Turbidity (NTU)**

Water Quality | Inorganic Analysis

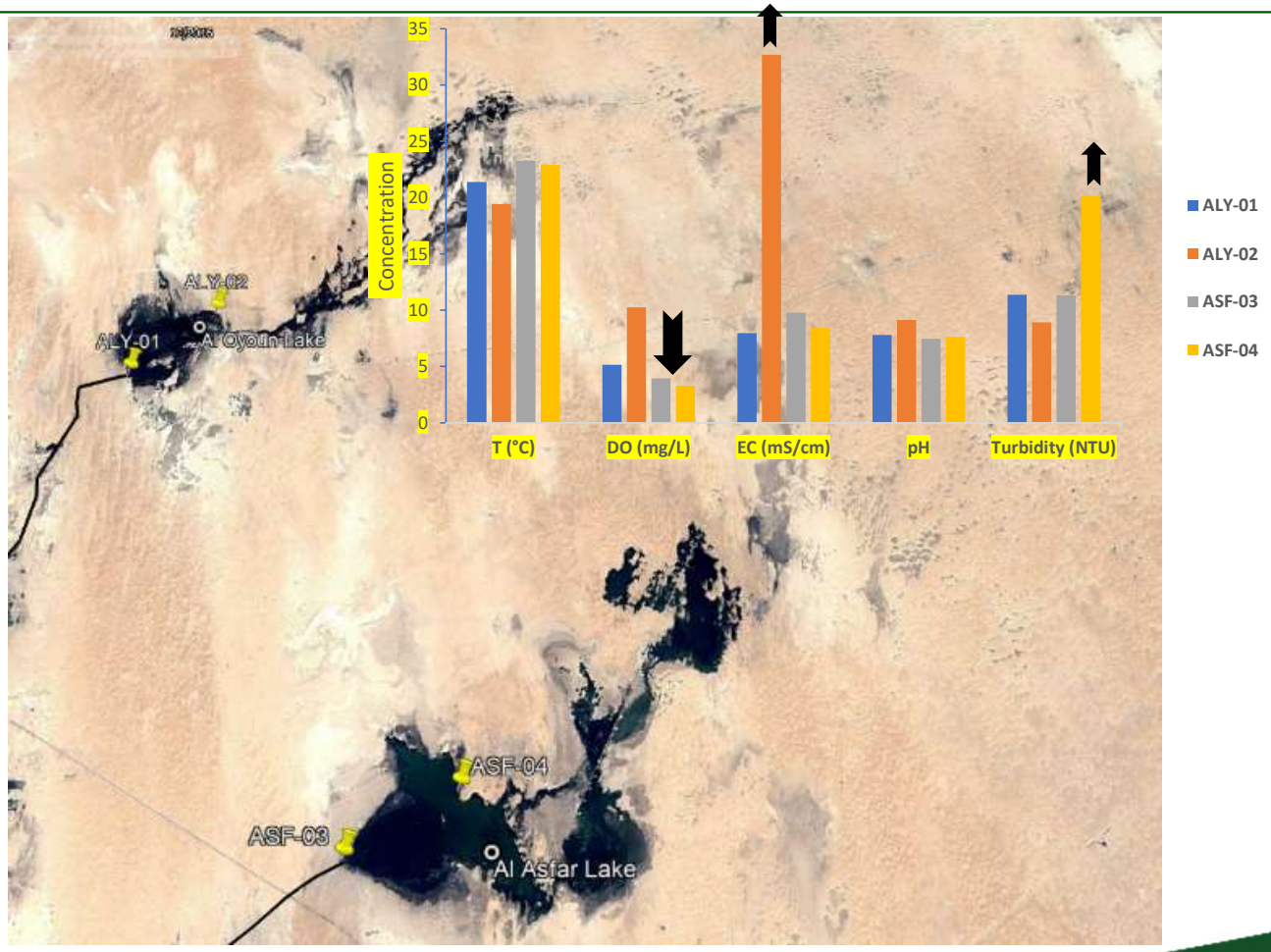
PRAMETERS	TECHNIQUES	REFERENCE METHOD
PHYSICAL		
pH	Potentiometer	US EPA 150.1
Total Suspended Solids	Filtration and Gravimetric Analysis	US EPA 160.2
Turbidity	Nephelometry	APHA 2130-B
Salinity	By Salino meter (Conductivity) YSI	APHA-2520-B
CHEMICAL		
Al & Mn	Chelation ICP-OES Analysis	US EPA 200.1
Ammonia Free (as N)	Ion Selective Electrode	US EPA 350.1
BOD_5	Incubation & Oxygen Probe	US EPA 405.1
Cd, Co, Cu, Fe, Ni, Pb, V & Zn	Chelation Extraction ICP-MS Analysis	US EPA 6020
COD	Oxidation	US EPA 410.1
Chlorine Residual	Photometry	APHA 4500-Cl-H
Cyanide	Ion Selective Electrode	APHA 4500-CN-F
F, Cl, SO_4	Ion Chromatography	US-EPA-300.1
Mercury	Direct Combustion AAS	US EPA 7473
NO_2, NO_3 & PO_4	Flow Injection Analysis (SKALAR)	APHA-4500-NO_3^--I
Total Kjeldahl Nitrogen (TKN)	Persulfate Oxidation & ISE analysis	APHA 4500-NH_3-H

Water Quality | Organic Analysis

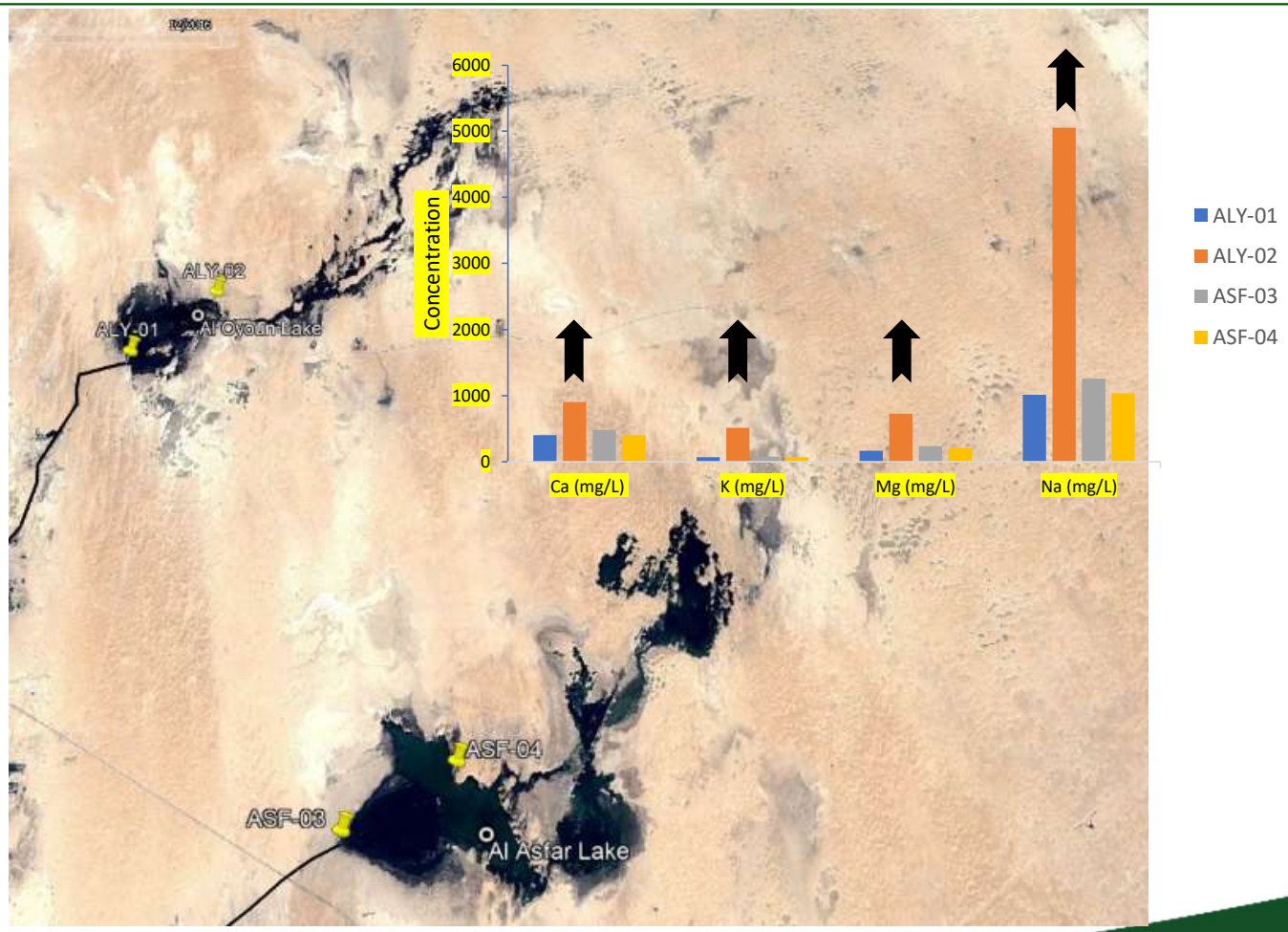
- The samples were collected in well closed vials and reserved in a refrigerator upon the analysis.
- 17 Polycyclic Aromatic Hydrocarbons (PAHs) were extracted using the USEPA method 3510C then analyzed using GC-MS/MS.
- BTEX and Chlorinated Benzene (i.e. Chlorobenzene, Dichlorobenzene, Trichlorobenzene, Chloronaphthalene and Hexachlorobenzene were analyzed using Headspace coupled with GC-MS/MS (USEPA METHOD 5021A)

- Petroleum Hydrocarbons (TPH) including C10 to C36 were extracted according to the USEPA method 3510C then analyzed using GC-FID instrument using USEPA method 8015D

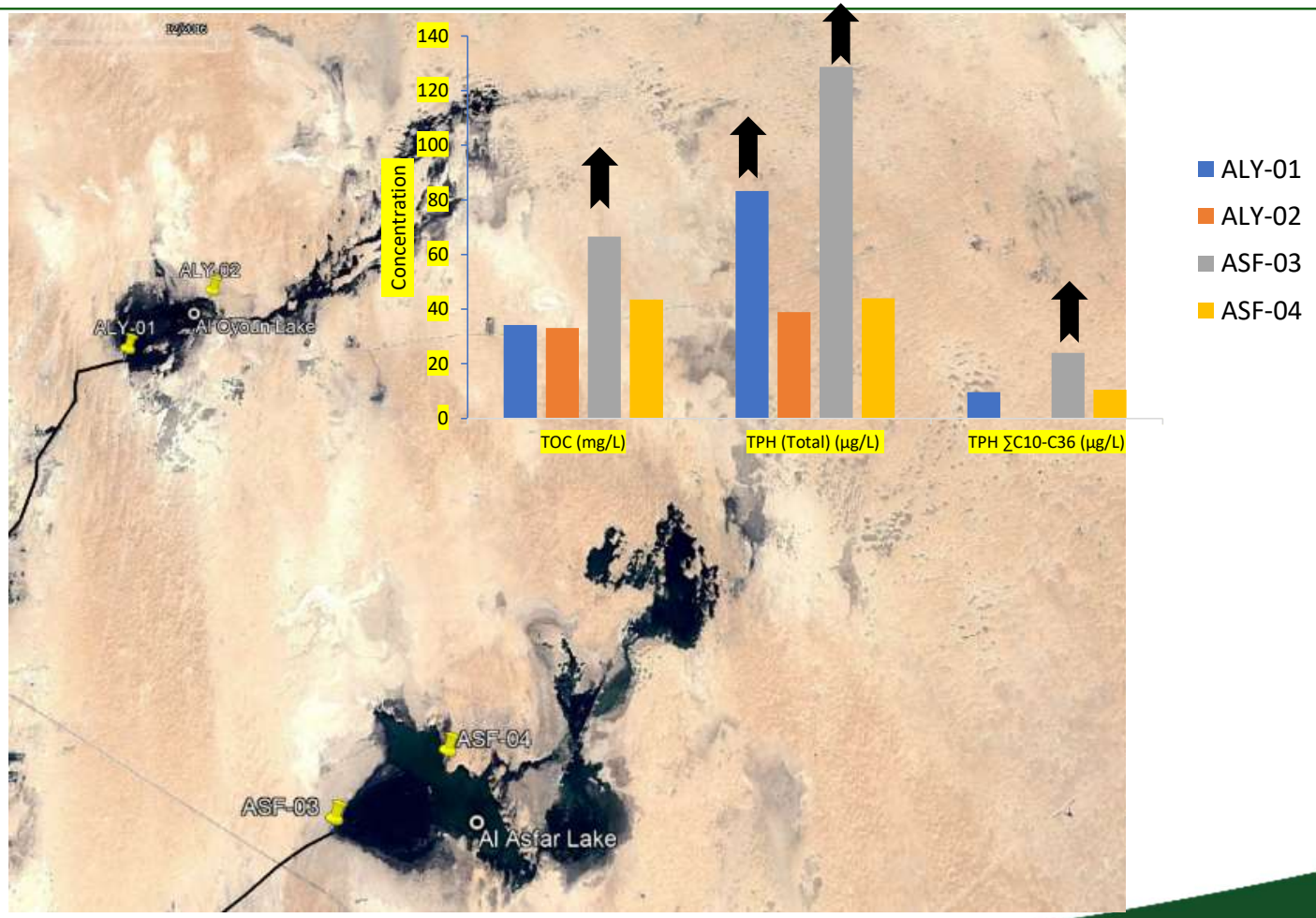
Water Quality | Results| Physical Properties



Water Quality | Results| Chemical Properties |Inorganic



Water Quality | Results| Chemical Properties |Organic



Water Quality | Results| Chemical Properties |Organic

17 Polycyclic Aromatic Hydrocarbons (PAHs) were analyzed

1. Concentrations of **BTEX** are **<0.5 ng/mL**

1. Concentrations of **Chlorinated Benzene** (i.e. Chlorobenzene, Dichlorobenzene, Chloronaphthalene and Hexachlorobenzene) are **<0.5 ng/mL**.

1. Concentrations of **Trichlorobenzene** in ASF-3 and ASF-4 from Al Asfar lake are **0.7 and 0.6 ng/mL** respectively.

According to the **ROYAL COMMISSION ENVIRONMENTAL REGULATIONS**
Maximum allowable concentration of Trichlorobenzene in DRINKING WATER is 20ng/ml

Conclusions

- The water of the two studied lakes display variation in term of water quantity and quality
- Before 1983, the lakes most probably were recharged by groundwater aquifer (Neogene Aquifer) due to high level of the water table and Al Oyoun Lake was connected to Arabian Gulf.
- Due to high extraction of groundwater from Neogene Aquifer, the water level declined, the Al Oyoun lake disconnected from Arabian Gulf.
- Al Asfar Lake has water with low dissolved oxygen and high turbidity than the Al Oyoun Lake
- The water of Oyoun Lake is saline. The abnormal change in the salinity most probably due to the salinity of the lake substrate (salt deposits).

Conclusions

- Al Asfar Lake has higher concentration of N and COD than the Al Oyoun Lake. On the contrary, Al Oyoun has concentration of Ca, K, Mg and Na.
- The concentration of TOC and TPH is higher in channels feeding Lakes than lakes themselves. Moreover, Al Asfar Canal has the higher concentration of these parameters. So, TOC and TPH were delivered from the source area (agricultural area).

Acknowledgment

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The authors would like to express their sincere appreciation to CEW-terrestrial team for their great support during the field work.

THANK YOU FOR YOUR ATTENTION!

QUESTIONS?