Madelyn Cook

Paleo-redox reconstructions:
Assessing seawater oxygen concentrations through time in Santa Barbara Basin, California

Madelyn Cook, Ph.D. Student
University of Michigan, Ann Arbor
August 9, 2019

What is Paleoceanography and why does it matter?

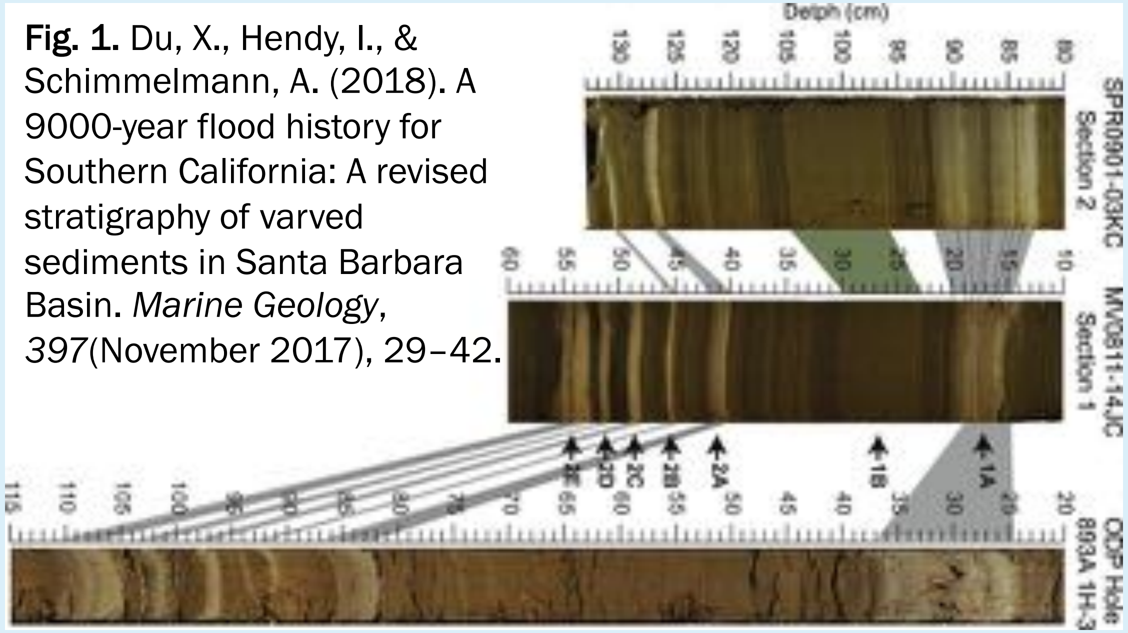


Fig. 1. Du, X., Hendy, I., & Schimmelmann, A. (2018). A 9000-year flood history for Southern California: A revised stratigraphy of varved sediments in Santa Barbara Basin. *Marine Geology*, *397*(November 2017), 29–42.

What is a redox proxy?

- Describes the potential for a chemical species to gain/lose electrons in the environment at the time of calcification
- Targets multi-valent elements that are sensitive to O_2 changes
  - *O_2 is a strong acceptor of e^-*

Santa Barbara Basin (SBB), California

- High sedimentation rates
  - *Summer – biogenic*
  - *Winter – terrigenous*
- Characteristic Oxygen Minimum Zone (OMZ)
  - *Little bioturbation in the center of the basin*
- Annual layered sediments

Fig. 2. Santa Barbara Basin, CA, featuring core location for SPR0901-06KC (591 m; 34° 16.914 N, 120° 02.419 W)

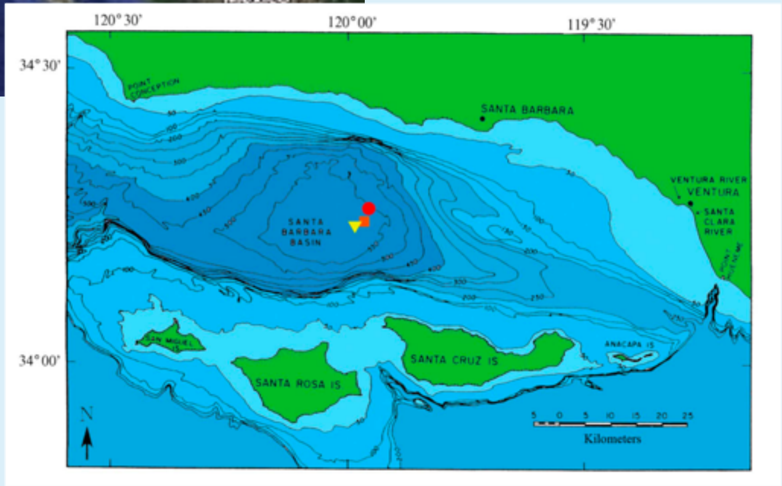


Figure 3. Map of Santa Barbara Basin with location of SBB Sediment trap indicated by yellow triangle (Osborne et al. 2016)

Reconstructions past seawater chemistry using foraminifera

- Provides information about ambient seawater chemistry at the time shell (test) formed
- Rely on the incorporation of certain ions in the place of native ions (Ca^{2+} and CO_3^{2-}) in calcite test
  - *Boron (pH)*
  - *Magnesium (temperature)*
  - *Barium (freshwater input)*
- Measured via inductively coupled plasma – mass spectrometry (ICP-MS)
  - *Ratio of trace element to calcium (X/Ca)*

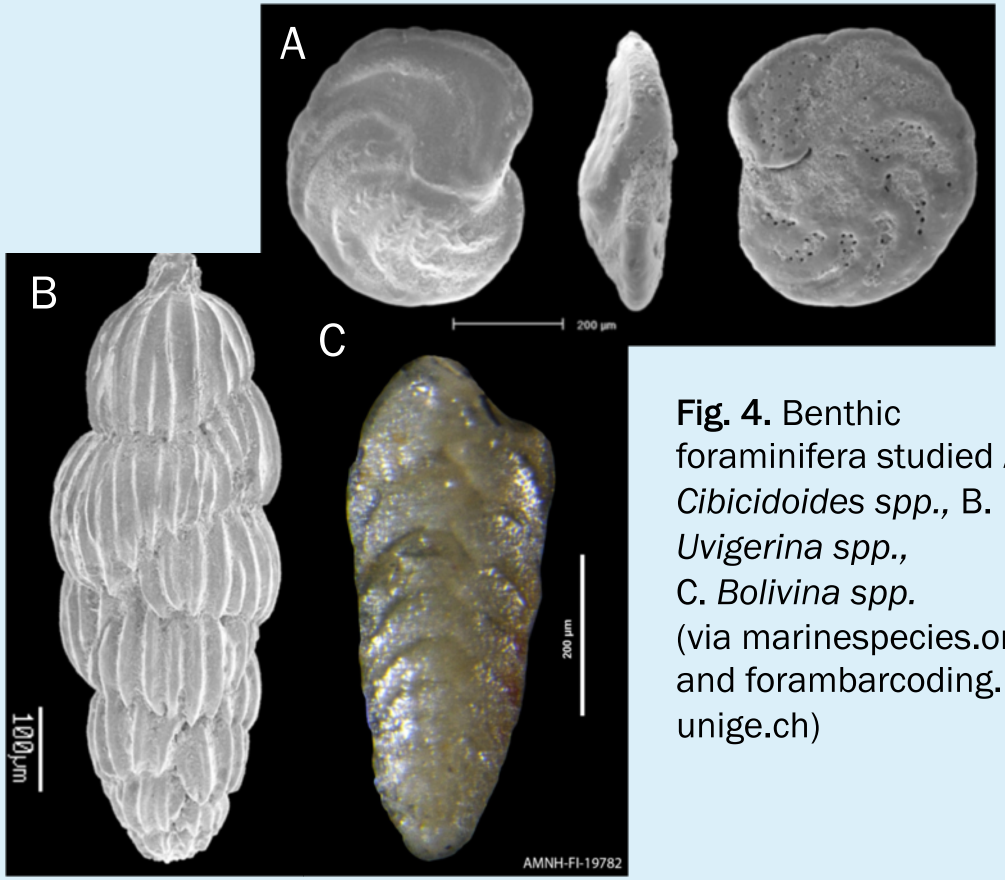


Fig. 4. Benthic foraminifera studied A. *Cibicidoides spp.*, B. *Uvigerina spp.*, C. *Bolivina spp.* (via marinespecies.org and forambarcoding.unige.ch)

I/Ca ratio in Foraminiferal calcite

- Only 2 thermodynamically stable forms of iodine in aqueous environments
  - *Iodate (IO_3^-)*
  - *Iodide (I^-)*
- Only IO_3^- is incorporated into foraminifera tests
- I/Ca ~ [IO_3^-] at time of calcification
- [IO_3^-] ~ [O_2]

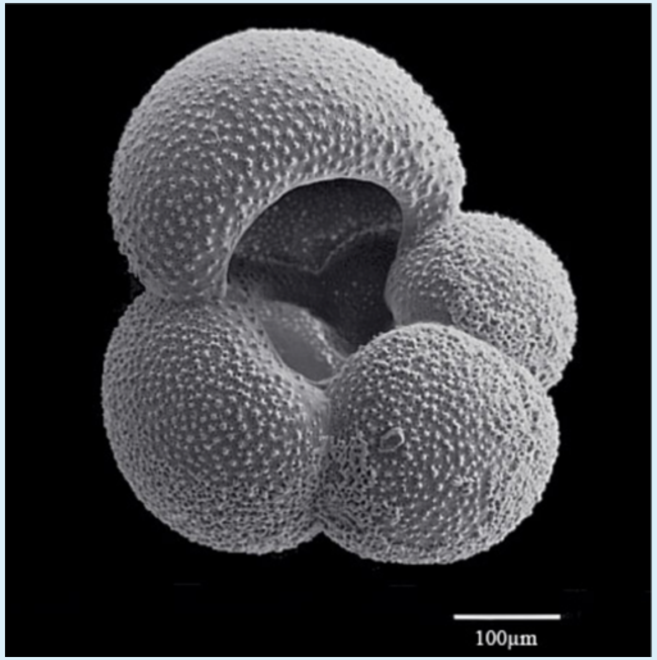


Fig. 5. *Globigerina bulloides,* a planktonic calcareous foraminifera (foraminifera.eu database)

Thank you!

COASTAL OCEAN ENVIRONMENT SUMMER SCHOOL IN GHANA

Olushina Awe

Bayesian Time Series Analysis of Change Points in Environmental Processes

Olushina Olawale Awe, Ph.D.
Assistant Professor of Applied Statistics
Anchor University Lagos

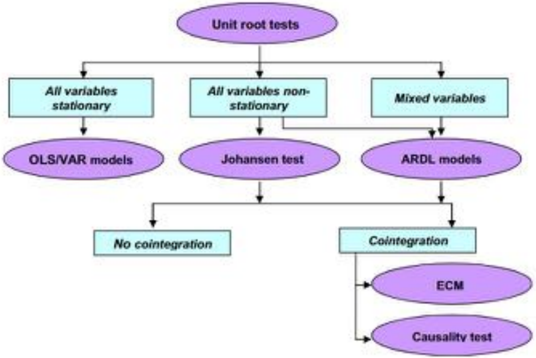
August 9, 2019

Research Talk Presented at the COESSING 2019

Outline

- Background and Motivation
- Bayesian Dynamic Model with Time-Varying Parameters
- Environmental Application
- Results/Discussions
- Summary and Future Works

Background and Motivation



Background and Motivation

- The classical linear regression model

$$y_i = \mu + \theta x_i + \eta_i \quad (1)$$

  assumes that the relationship between the explanatory variable and the explained remains constant throughout the estimation period (Petris et.al., 2009; Awe et al. 2015, Awe and Adepoju, 2018).
- This model has been found to be limited because there are situations when its assumption becomes unreasonable and impracticable (Petris et.al., 2009).
- In a lot of cases, the researcher may have little information on the dates at which parameters change, and therefore need to make inferences about the change points among certain variables.

Bayesian Dynamic Models

- The Bayesian Dynamic Model enables estimation of dynamic associations between variables across time.
- Slope parameters can be estimated on a continuous scale over time.

Bayesian Dynamic Model Specification

- Consider the dynamic linear model (DLM) of the form:

$$
\begin{aligned}
y_t &= X_t\theta_t + v_t & v_t &\sim N(0, V) & (2)\\
\theta_t &= G_t\theta_{t-1} + w_t & w_t &\sim N(0, W_t) & (3)\\
\theta_0 &\sim N(m_0, C_0)
\end{aligned}
$$

- Equation (2) is known as the observation equation while
- Equation (3) is the evolution equation.
- We assume that all v_t's are independent from the w_t's.
- Since each parameter at time t depends on results from time $t-1$, the state parameters θ_t are assumed to be time-varying and constitute a Markov chain.

Bayesian Estimation of Model Parameters

- Where y_t is the response variable.
- The matrix X_t consists of explanatory variables measured concurrently with the response, and includes a column of 1's representing a dynamic intercept term.
- θ_t are time-varying regression coefficients which describes the relationship between the regressors and the response at each time t.
- As typical in dynamic regression models (West and Harrison, 1997), the state- space evolution matrix G_t is constant and equal to the identity matrix.
- This model has the advantage of giving a natural interpretation to the evolution variance (W_t) while also allowing the estimate of θ_t to vary through time and model changes in parameter volatility.

Bayesian Estimation

- Parameters of interest to be estimated are θ_t, the error variances V and W_t, and the one-step-ahead prediction error f_t.
- Since normality is assumed, θ_t is estimated via the forward filtering backward sampling(FFBS) algorithm (Carter & Kohn, 1994).
- V is assumed to be distributed inverse-gamma a priori ($V \sim \Gamma^{-1}(a_0, b_0)$) and is estimated using a Gibbs sampler.

Gibbs Sampling Algorithm

- To sample from $V|\underline{\theta}$ we impose a gamma prior on V^{-1} and derive the posterior hyperparameters. Let $V^{-1} \sim Gamma(a_0, b_0)$, then

$$V^{-1}|\underline{\theta} \sim Gamma(a_0 + \frac{T}{2}, b_0 + \frac{1}{2}\sum_{t=1}^{T}(y_t - X_t\theta_t)^2)$$

- W_t was estimated using discount factors method of West and Harrison, 1997; Awe, et. al.,2015.
- We define

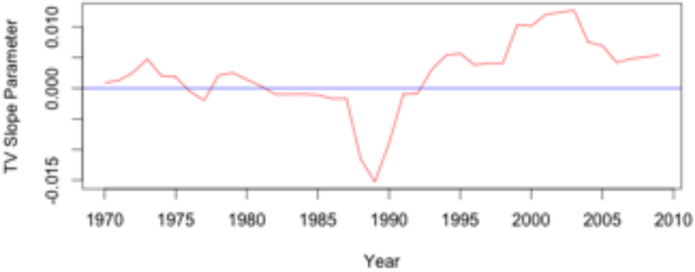
$$W_t = \frac{1-\delta}{\delta}C_{t-1} \tag{4}$$

where C_t is the variance of the state parameters at time t.

Paper 2 (An Environmental Application)

- We study the time-varying nexus between $C0_2$ Emission-Energy (Fosil Fuel) Consumption over time for Nigeria and South Africa.
- Why? Research has found that the worst form of environmental pollution is Co_2.
- The issue of global warming has become an intense debate of late. Several conferences have been held worldwide to discuss appropriate ways to reduce the greenhouse effect. Carbon dioxide or Co2, the byproduct of fossil fuel, gas, oil and coal combustion, is regarded as the main cause of greenhouse effect.

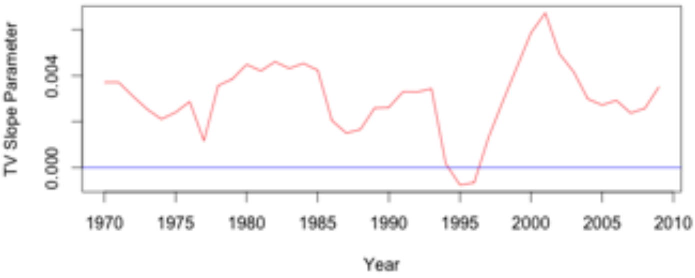
Results for Nigeria



- Results obtained reveals that time-varying slope was lowest around 1990 in Nigeria.

Results for South Africa

- Results obtained via our model reveals that time-varying slope of $C0_2$-Energy consumption was lowest around 1995 and highest in early 2000 in South Africa.



Summary/Future Works

- Our model overcomes the restrictions of differencing to overcome auto-correlation, non-stationarity and normality problems.
- Helps to understand the level of dynamic relationships among variables across time.
- Caters for missing data and small sample sizes.
- Possesses enormous potentials to address innovative research questions in oceanography.
- A lot of oceanic processes/variables like salinity, temperature, tides, current, estuary circulation, wave velocity, kinetic energy, etc which depends on time-variation can be studied/analyzed using this method.

Collaboration

- I am open to collaboration.


THANKS FOR
LISTENING

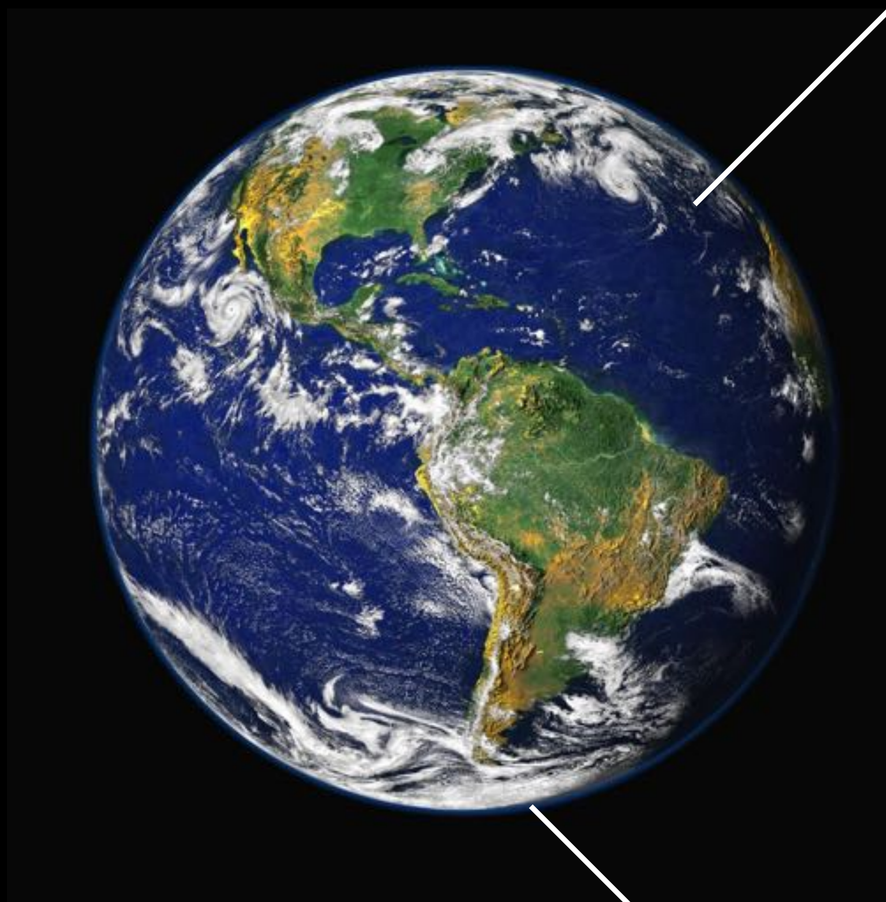
Christian Buckingham

What do I do?

Christian E. Buckingham
IUEM / Université de Bretagne Occidentale, France
British Antarctic Survey, Cambridge, UK

Accra, Ghana
August 9, 2019

OSMOSIS



DynOPO

What do I do?

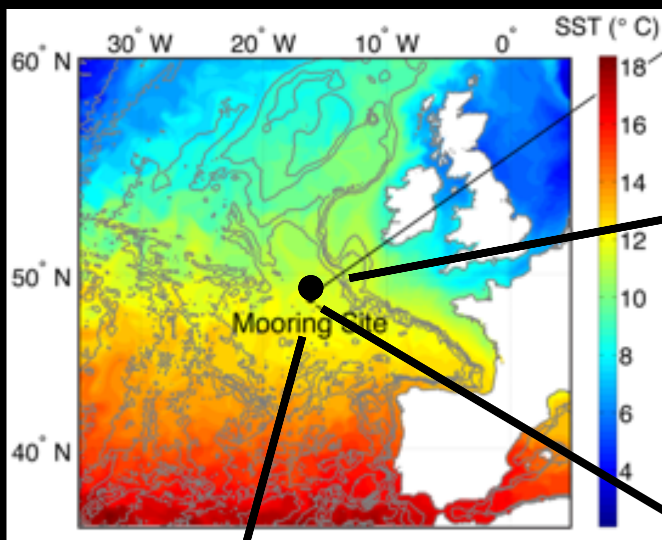
1. **Examine small-scale (1-10 km) ocean phenomena that have climate-scale impacts**

2. Use observations (e.g., from moorings, satellites, ships)

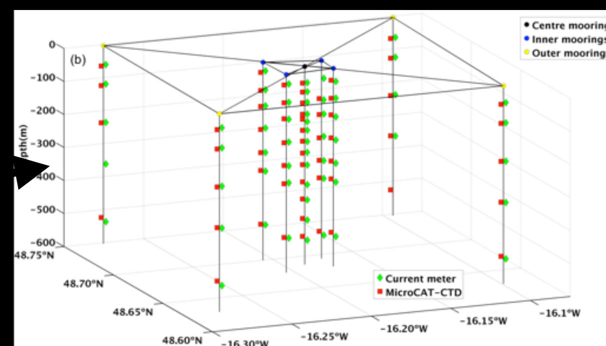
3. Test theories with these observations

Physical Oceanography

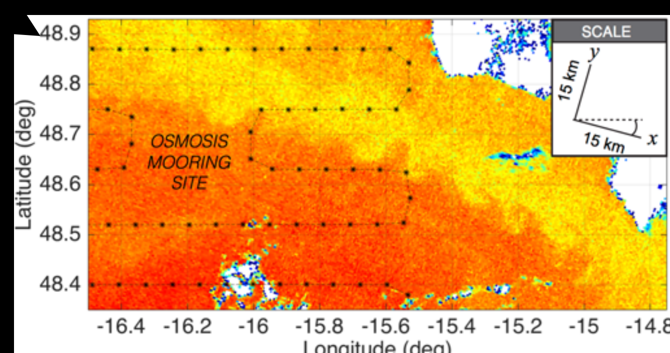
Location



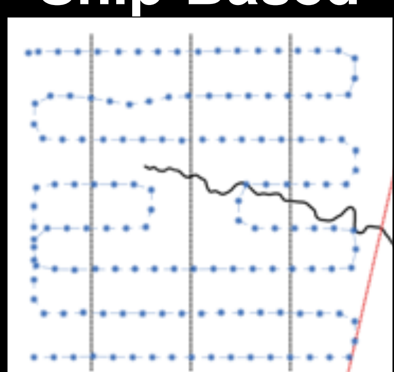
Moorings



Satellites



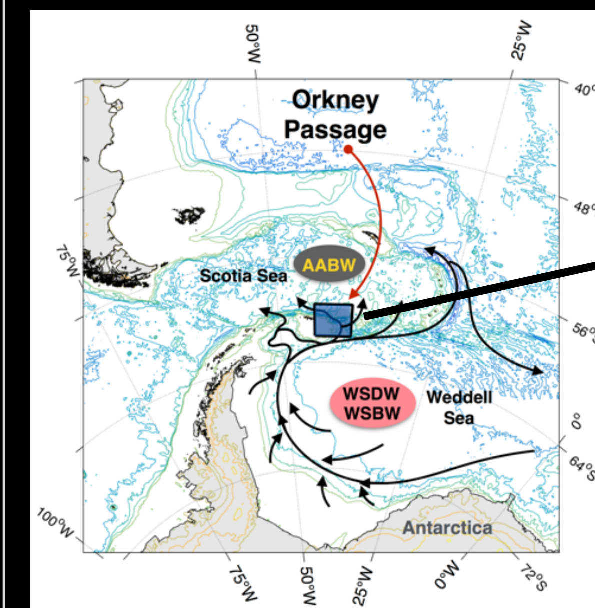
Ship-Based



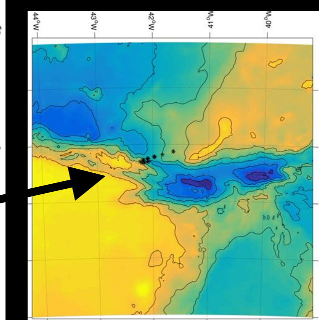
<u>Focus</u>: small-scale (1-10 km) dynamics and their impact on ocean-atmosphere fluxes

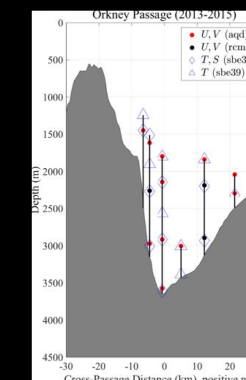
Upper Ocean

Location



Moorings





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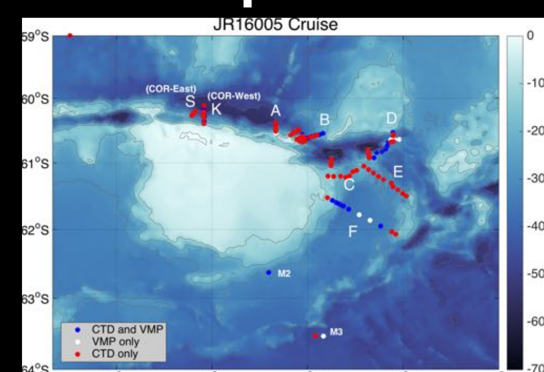
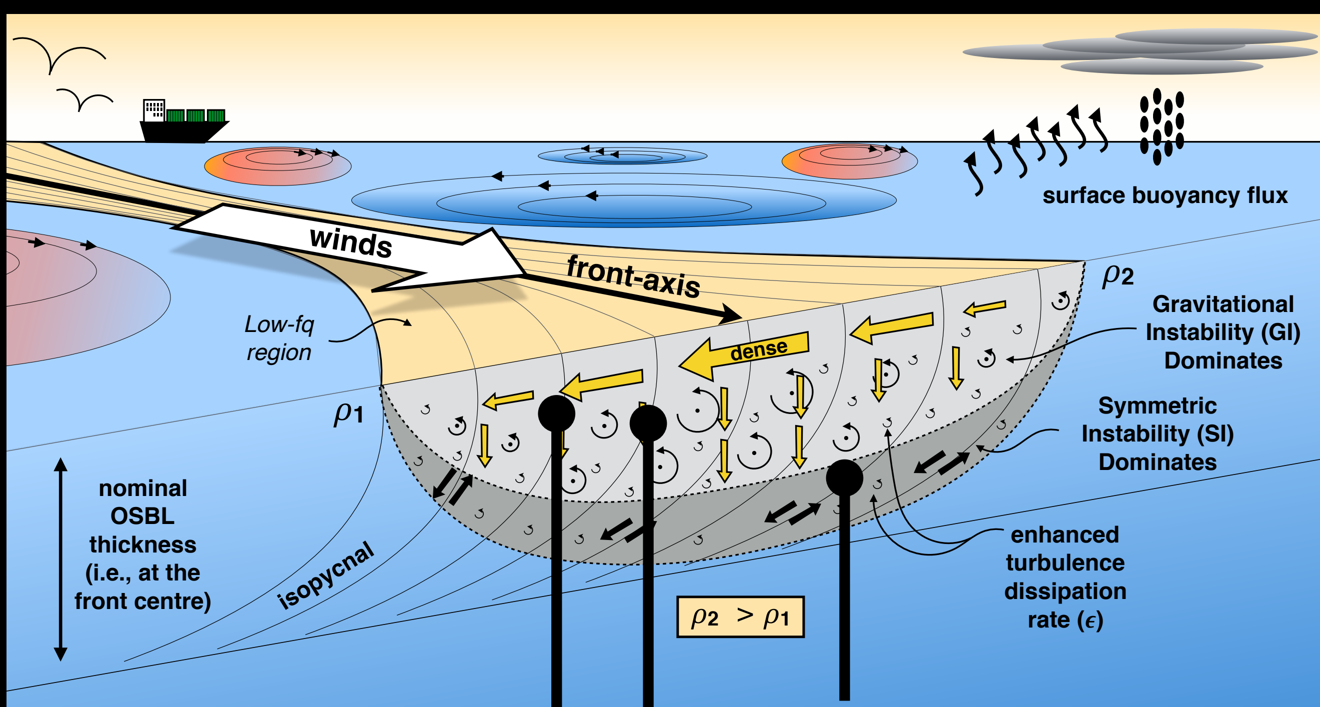


<u>Focus</u>: small-scale (1-10 km) dynamics and their impact on large-scale ocean circulation

Deep Ocean

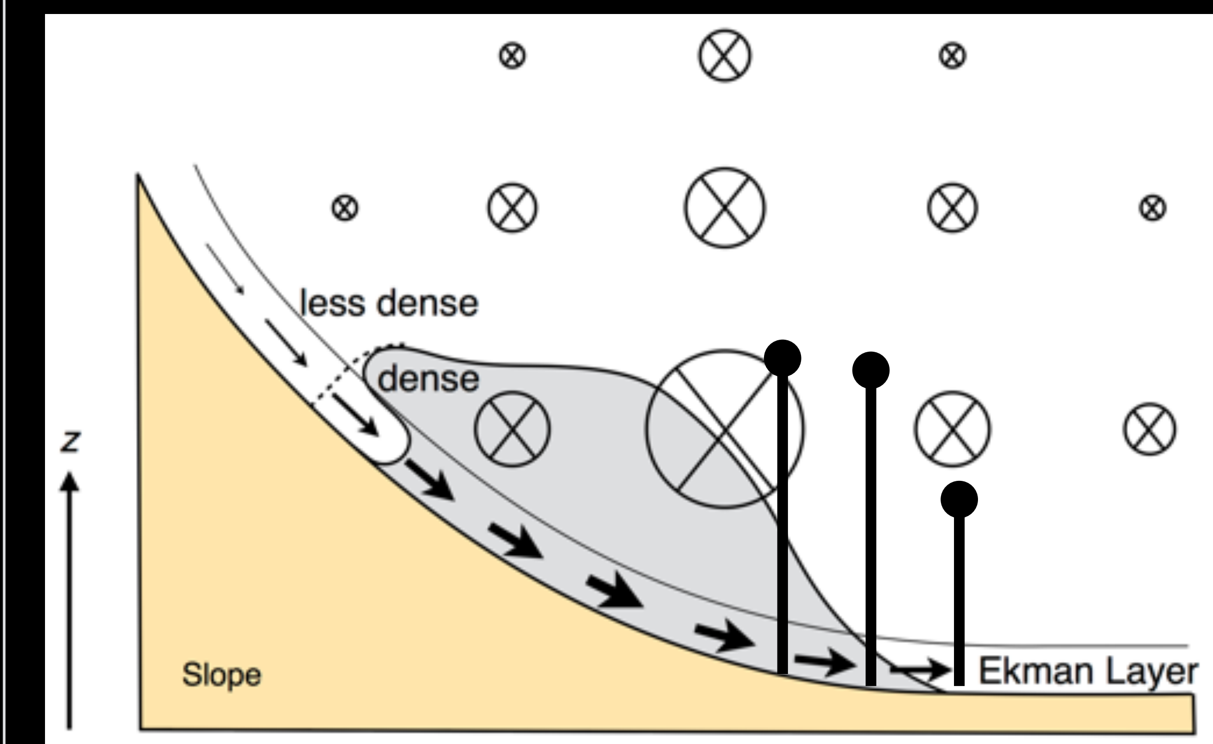
Physical Oceanography

Friction (due to winds) causes a flux of dense water over buoyant water. This reduces stratification and can cause turbulence and mixing→increased heat and air-sea gas (e.g., CO_2) exchange



Upper Ocean

Friction (due to deep currents) causes a flux of buoyant water into dense waters. This reduces stratification and can cause turbulence and mixing→changes in deep water properties (e.g., AABW)+



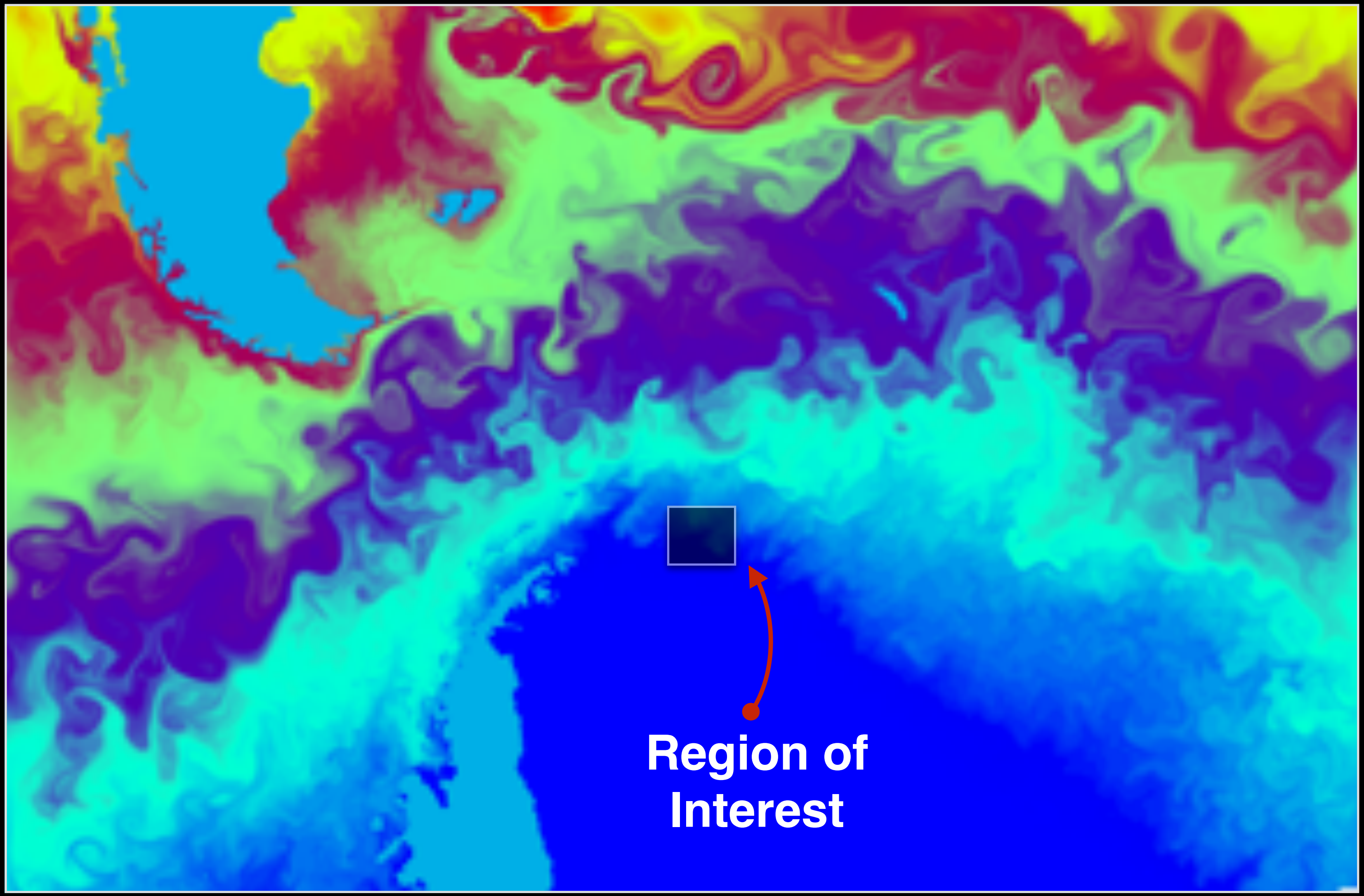
Deep Ocean

+ See for example, Umlauf

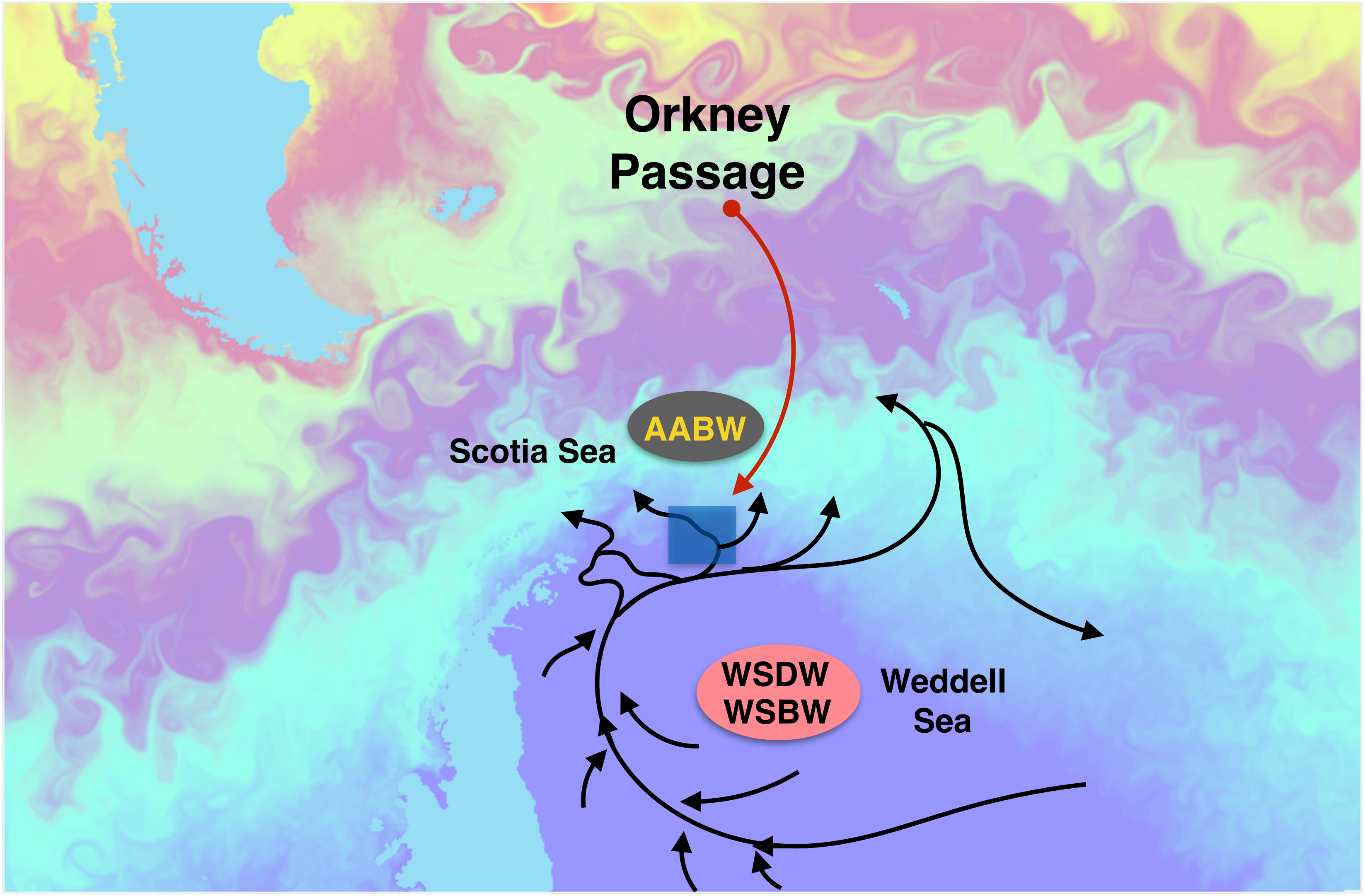
Ocean Modelling

?

Ocean Modelling



Sea surface temperature in a regional model of the Southern Ocean



Antarctica

Juliet Igbo

Toxicological Assessment of Heavy Metals and Persistent Organic Pollutants from Electronic Waste Dumpsites in South-West, Nigeria

BY

IGBO Juliet Kelechi (PhD)

COESSING, 2019

OUTLINE

- Introduction
- Objective
- Materials and Methods
- Results
- Discussion
- Conclusion

Introduction

- **What is E-waste?**

- **Waste generated from electrical and electronic equipment (Babu *et al*., 2010).**
- **Contaminates the environment and have detrimental effects on aquatic and human health (de Boer *et al*., 2006).**

- **Nigeria is the highest generator in W/A (BAN/STVC,2002).**

- **South-west Nigeria harbours the two biggest seaports in W/A**

Plate 1: Examples of e-wastes **Source: google images**

Plate 2: Retail Shops at Alaba Market, Lagos **Source: Google Images**

Objective

- this study aimed at assessing the ecotoxicological effects of indiscriminate dumping of electronic wastes in aquatic ecosystems in the South West Nigeria

Specific Objectives

1. **Identified the major electronic wastes dumpsites in all the states of South-west Nigeria.**

2. **Determined the heavy metals levels from the e-waste contaminated water bodies, biota and leachate from the e-waste dumpsite**

3. **Determined the levels of PAH congeners in the water, sediment and biota from the e-waste contaminated water bodies, and leachate from the e-waste dumpsite**

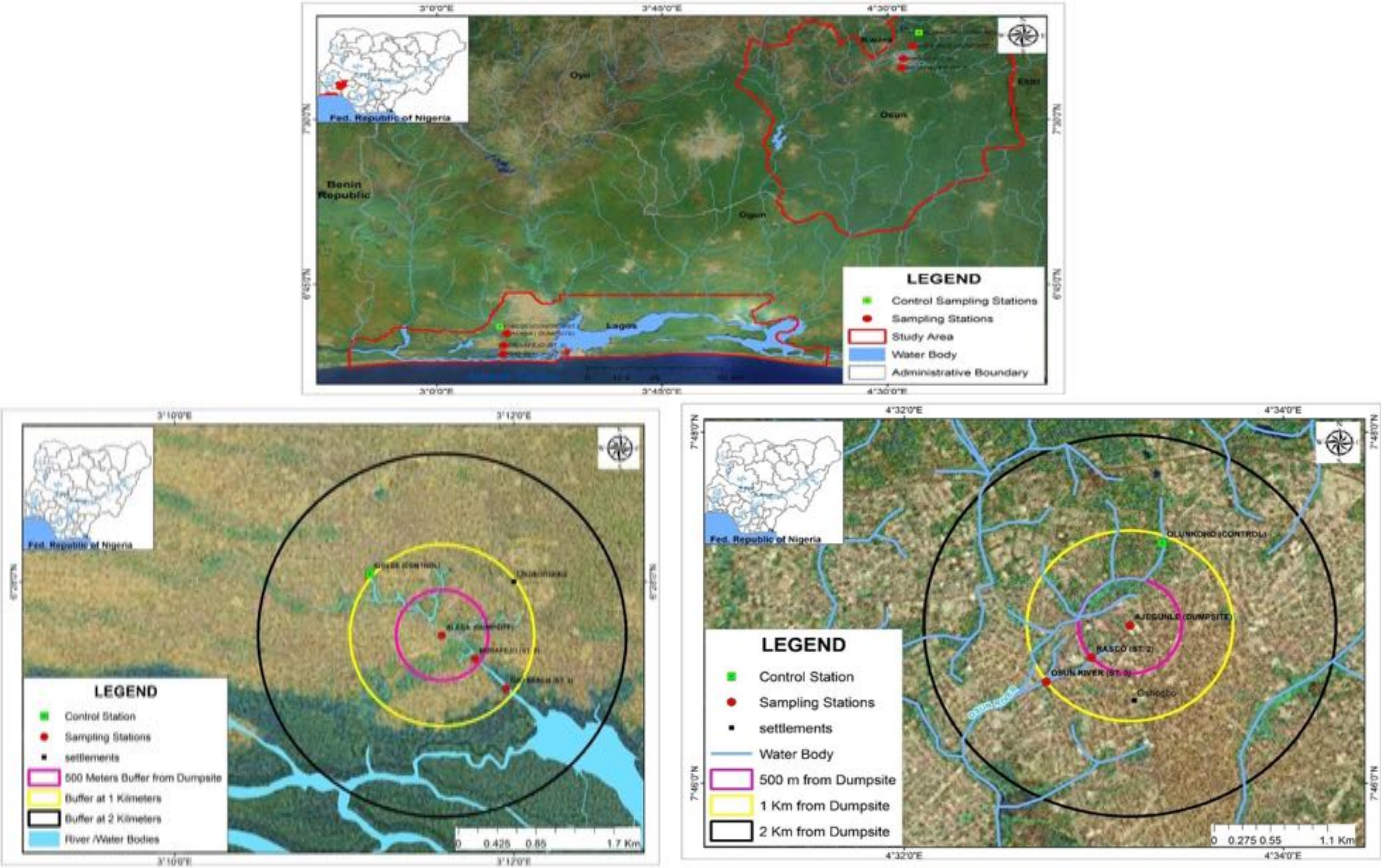


Fig 1a-c: Maps showing Study Site and Sampling points

Major E-waste Dumpsites

- A total of 5 major dumpsites (Lagos, Osun, Oyo, Ogun and Ondo) and their coordinates were identified in the six Southwest States of Nigeria .

- Larger volumes of waste were seen in Lagos than in Osun and this was attributed to a higher density market in Lagos.

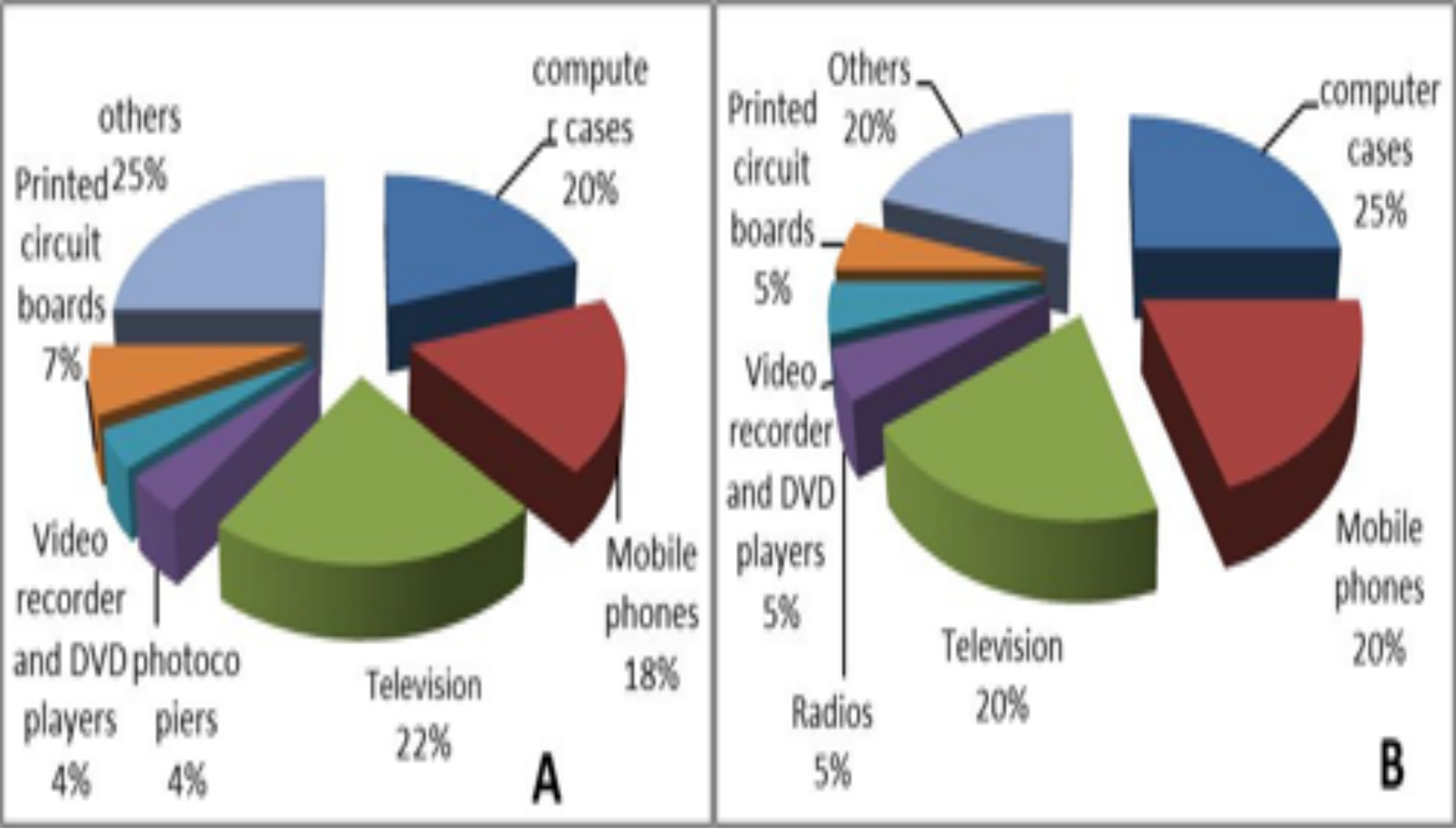


Figure 2: Composition of the wastes stream found at Lagos (A) and Osun (B) e-waste dumpsites

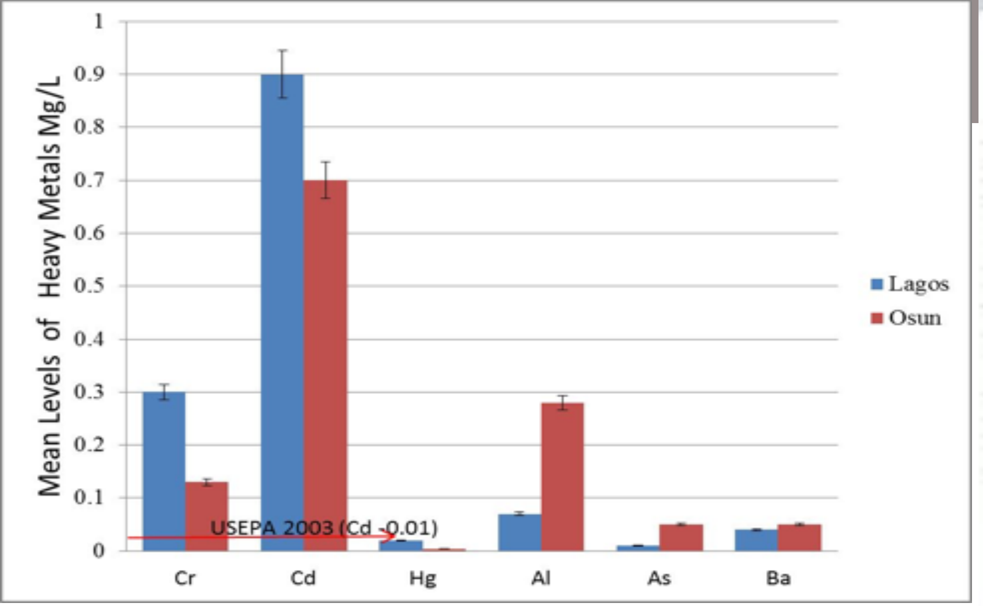


Fig 3: Mean levels of heavy metals (Pb, Cr, Al, As and Ba) in leachate from Lagos and Osun States

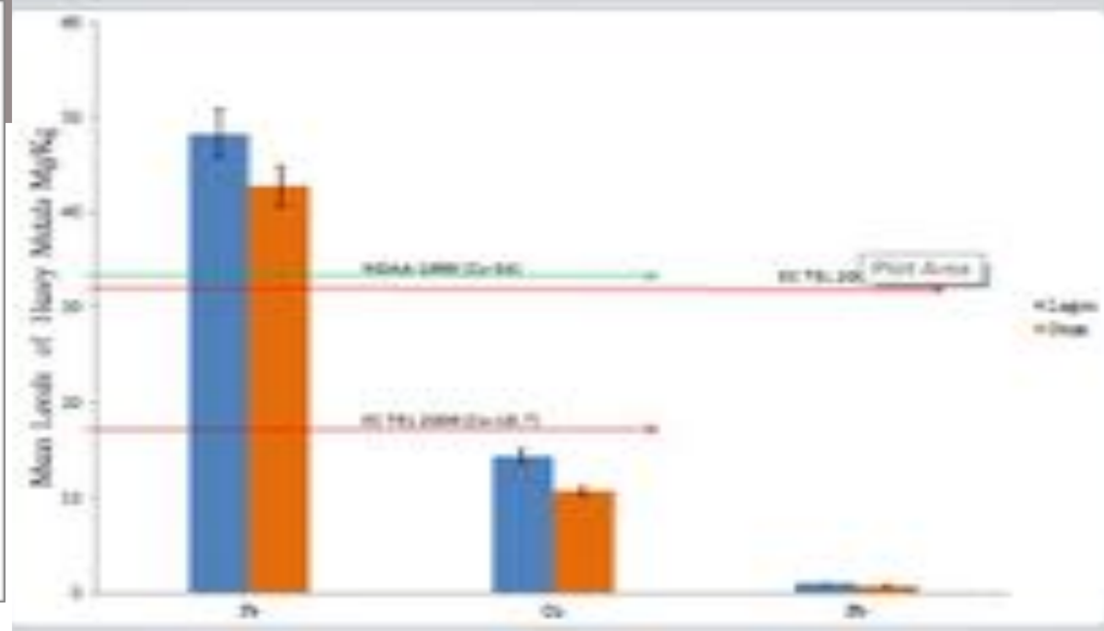


Fig 4: Mean levels of heavy metals in sediments samples from Lagos and Osun States e-waste dumpsites

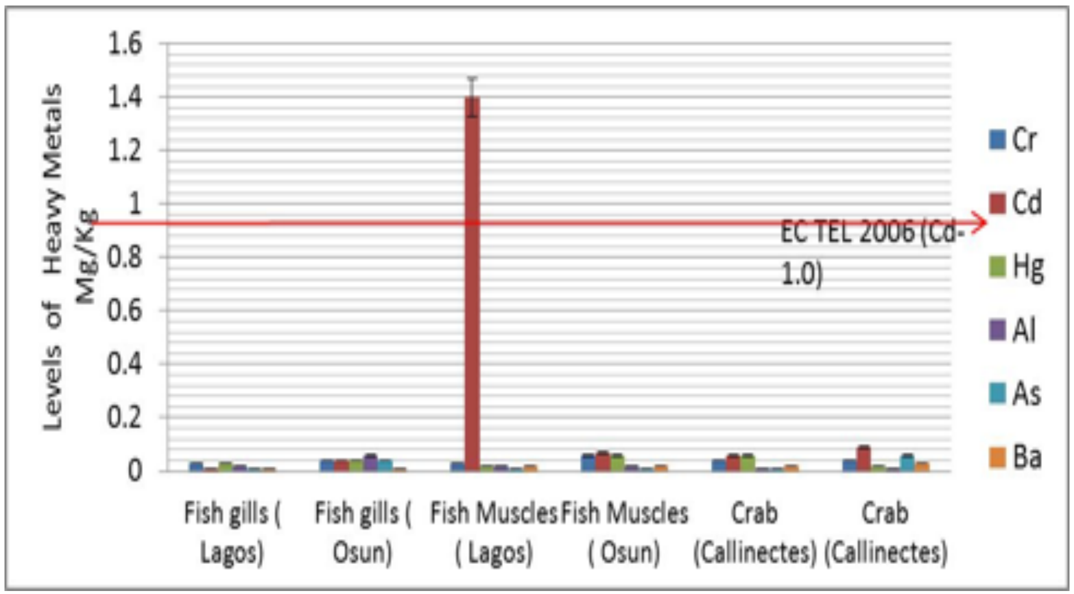
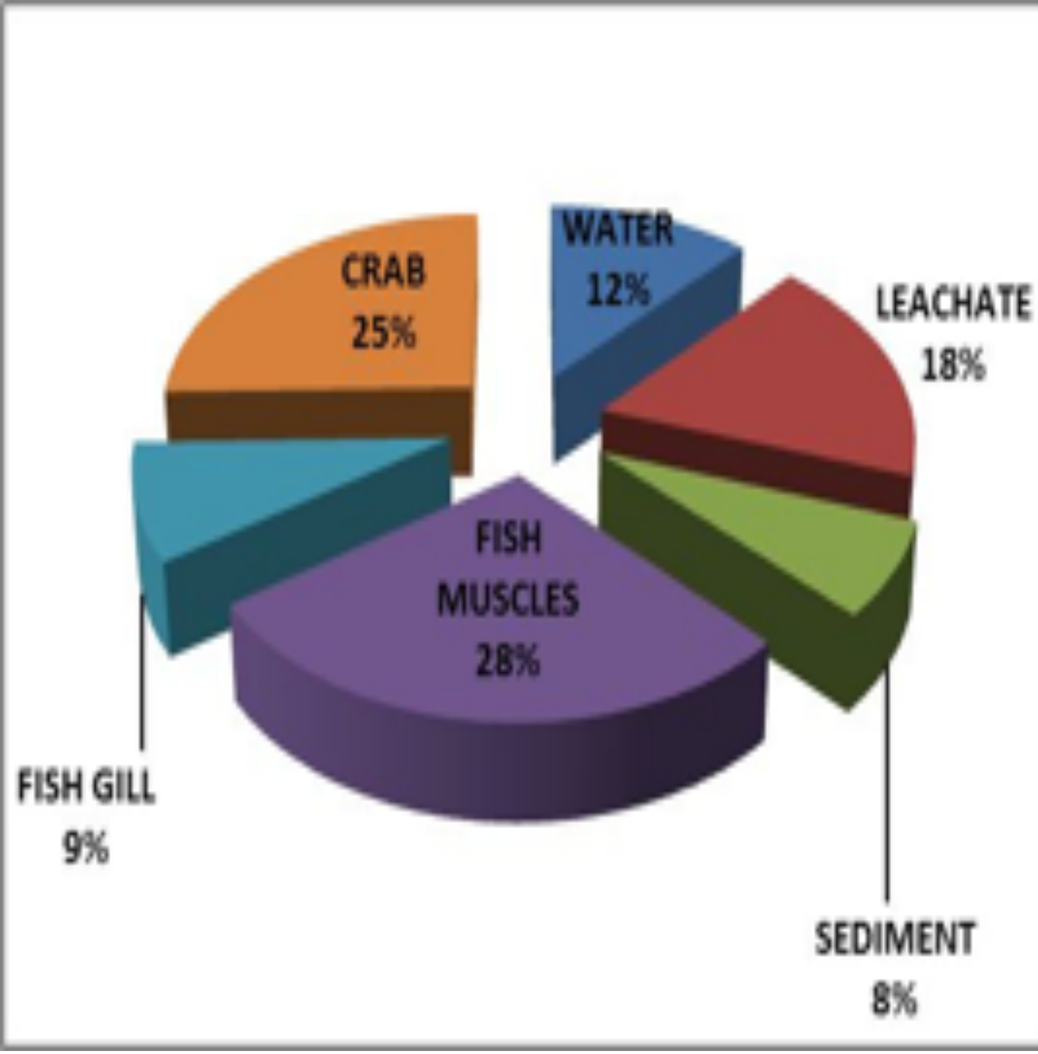


Fig 5: Mean levels of heavy metals in *Tilapia guineensis* (gills, muscles) and crabs (*Callinectes amnicola and Cardiosoma armatum*) from Lagos and Osun States.

Table 1: Levels of PAHs in Water, Leachate, Sediments and Biota

	LAGOS						OSUN					
Congeners	**Water**	**Leachate**	**Sediment**	**Fish Muscle**	**Fish Gill**	**Crab**	**Water**	**Leachate**	**Sediment**	**Fish Muscle**	**Fish Gill**	**Crab**
Naphthalene	0.59	ND	5.52	ND	ND	9.66	0.57	ND	ND	26.04	7.39	ND
∑2rings	0.59	ND	5.52	ND	ND	9.66	0.57	ND	ND	26.04	7.39	ND
Acenaphthylene	2.77	ND	36.73	1.94	2.47	10.17	9.99	ND	6.52	11.80	15.19	1.34
Acenaphthene	14.87	20.79	3.52	10.35	5.57	15.90	7.33	22.85	10.63	59.30	59.42	4.81
Fluorene	5.57	21.47	7.59	13.22	7.25	14.68	7.96	17.06	3.93	15.33	12.19	40.9
Anthracene	13.67	20.76	4.99	62.26	5.99	29.21	4.60	19.99	3.87	20.60	73.91	36.47
Phenanthrene	2.96	ND	ND	3.55	0.31	15.66	ND	ND	ND	12.18	3.77	7.37
∑3rings	39.84	63.02	52.83	138.84	21.59	85.62	29.88	59.9	21.01	119.27	164.48	90.89
Fluoranthene	6.96	32.39	3.93	3.30	2.13	14.54	4.75	2.93	4.76	7.43	16.82	22.52
Pyrene	15.13	20.45	5.29	46.32	10.22	18.36	ND	20.32	3.17	5.46	48.06	ND
Benzo(a)anthracene*	5.15	21.56	2.71	8.33	3.99	6.93	2.67	12.59	2.85	5.23	7.34	16.18
Chrysene*	1.84	11.70	0.97	56.49	2.06	26.28	0.42	24.94	1.18	2.56	27.16	1.77
∑4rings	28.81	86.1	12.9	114.44	18.4	66.11	7.84	60.78	11.96	20.68	99.38	40.39
Benzo(b)fluoranthene*	9.12	4.60	2.50	21.54	2.29	4.44	4.06	12.28	4.37	4.97	7.21	1.87
Benzo(k)fluoranthene*	9.49	24.96	5.64	2.30	1.89	12.69	4.42	12.78	3.94	5.94	12.57	4.95
Benzo(a)pyrene*	5.67	31.60	3.65	4.22	3.75	23.89	4.10	18.44	4.75	3.79	9.60	8.29
Dibenz(a,h)anthracen*	6.54	16.18	4.84	49.16	19.35	23.906	5.53	14.08	5.40	77.15	21.60	11.20
∑5rings	30.82	47.34	16.63	77.22	27.28	64.92	18.11	57.58	18.46	91.82	50.98	26.31
Indeno(1,2,3)pyrene*	27.40	12.61	19.78	10.58	16.28	39.64	9.84	6.20	14.18	11.30	25.15	21.03
Benzo(g,h,i)perylene	46.45	ND	51.11	37.83	119.82	59.33	33.3	ND	15.69	37.52	76.75	30.19
∑6rings	73.80	2.61	70.89	48.41	136.10	98.97	43.14	6.20	29.87	48.82	101.9	51.22
Total PAHs	173.23	239.07	158.77	378.83	203.37	325.28	99.56	184.46	81.30	306.63	471.65	200.81
LMW PAHs	40.43	103.01	58.35	138.76	48.59	95.82	30.47	59.9	21.01	145.31	219.39	82.89
HMW PAHs	133.43	136.06	100.42	240.07	181.78	230	69.09	124.56	60.29	161.32	252.26	117.92
*7 Carcinogenic PAHs	49.81	129.21	40.03	152.6	49.61	137.77	31.04	101.31	36.67	110.94	110.63	59.29

ND – not detected, LMW- Low molecular weight (∑2-3rings), HMW (∑4-6rings)- High molecular weight.USEPA- United States Environmental Protection Agency B2 classification (carcinogenic) : chrysene, benzo(a) anthracene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3) pyrene and dibenzo(a,h)anthracene.



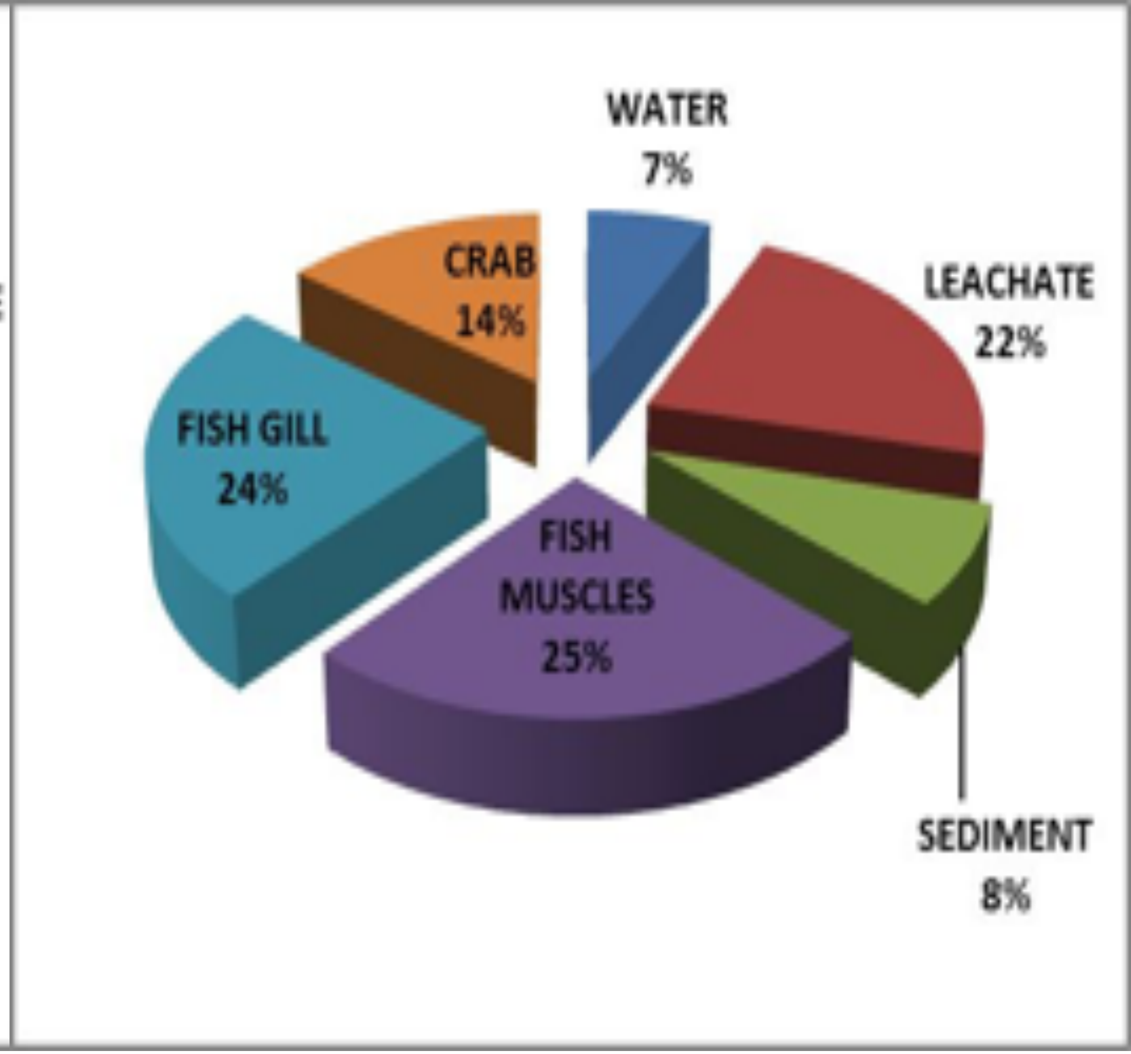


Figure 6: Percentage Concentration of

Figure 7: Percentage Concentration Carcinogenic

Table 2: Identification of PAHs Sources/ Origin

- The molecular indices used (LMW/HMW Fl/pyr, P/A and BaA/Chry.(Baumard *et al.*, 1998)
- PAHs were mainly from pyrogenic origin with petrogenic inputs indicating mainly contamination from incomplete combustion resulting from open burning of e-waste at the dumpsites.
- The petrogenic source is possibly because the dumpsites were located close to electronic shops and residential quarters where electric generators are used for electricity generation.

Lagos Samples	LMW/HMW	FL/PY	P/A	CHY/BaA
Water	0.30	0.46	0.21	0.4
Leachate	0.58	0.74	0	1.84
Sediment	0.75	1.58	0	2.7
Fish muscle	0.57	0.07	0.05	0.14
Fish gill	0.11	1.96	0.05	1.9
Crab	0.41	0.79	0.53	0.26
Osun Samples				
Water	0.44	0	0	6.35
Leachate	0.30	1.5	0	0.50
Sediment	0.48	0.14	0	2.41
Fish muscle	0.90	1.36	0.59	0.27
Fish gill	0.87	0.34	0.05	2.0
Crab	0.78	0	0.20	9.14

Ecological Risk Assessment

- The level of ∑-PAHs congeners in sediment from Lagos (158.77 μg/kg) exceeded the National Oceanic Atmospheric Administration (NOAA TEL) threshold effect level of 6.55 μg/kg

- indicating that adverse biological effects would occur frequently to the benthic community in the ecosystem.

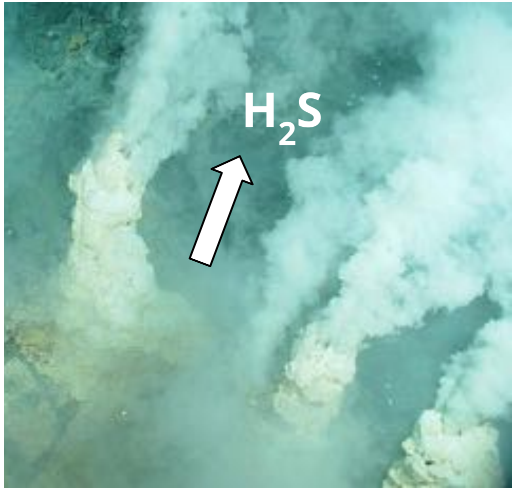
THANK YOU FOR LISTENING

Jackie Wrage

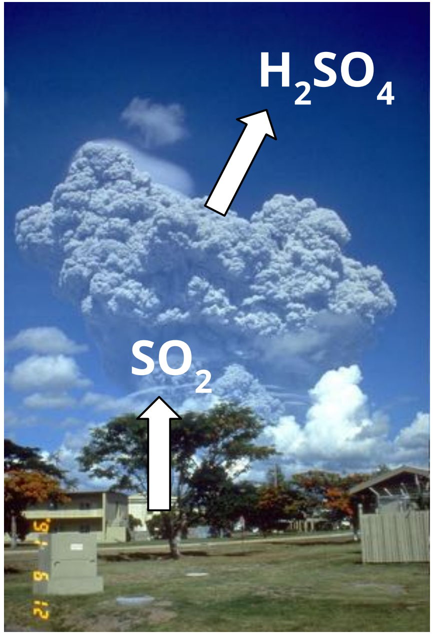
Sulfur in magma chambers

Jackie Wrage
Graduate student in geology
at University of Michigan, USA

Importance of sulfur



Hydrothermal vents & evolution of life

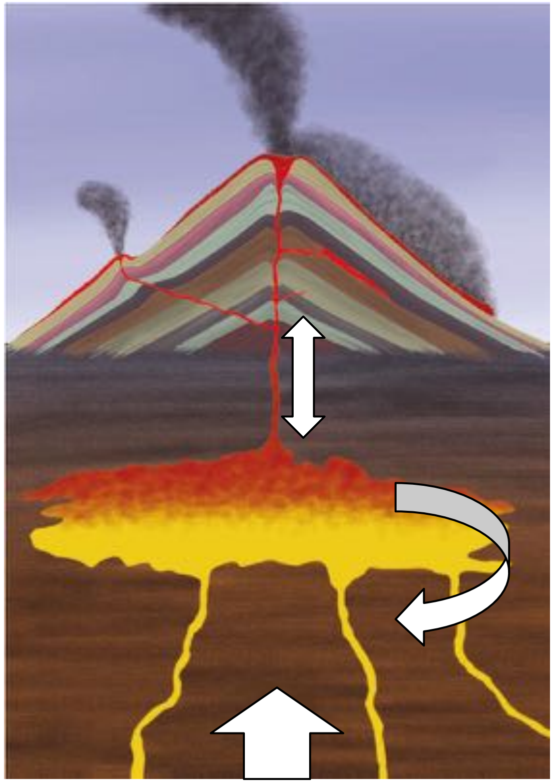


Volcanic eruptions

Ore deposits

Bacteria

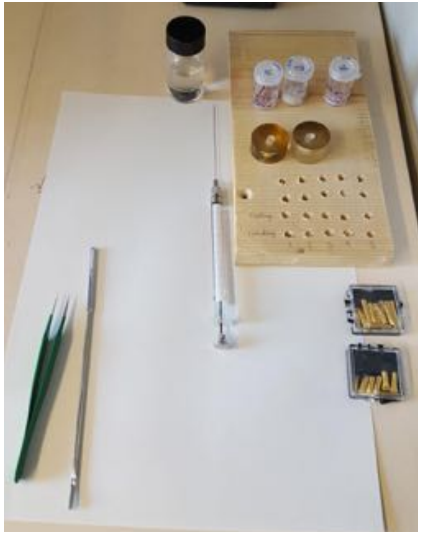
I study sulfur in magmas



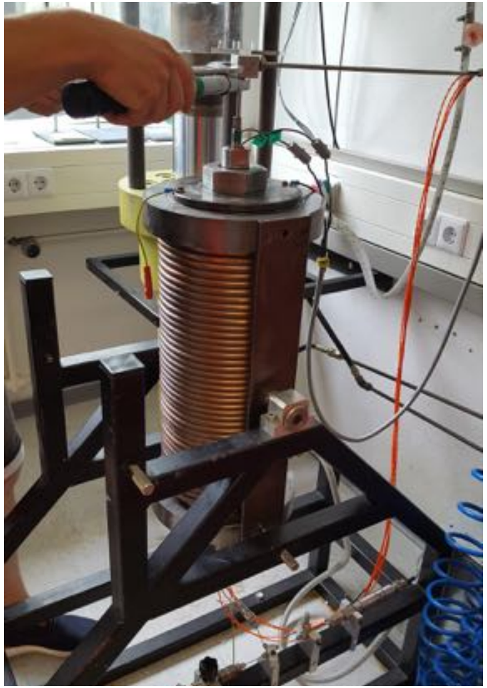
?

Rock experiments to study sulfur

Understanding how sulfur moves between melt and minerals



Experiment equipment



Conditions:

Temp = 1000 C

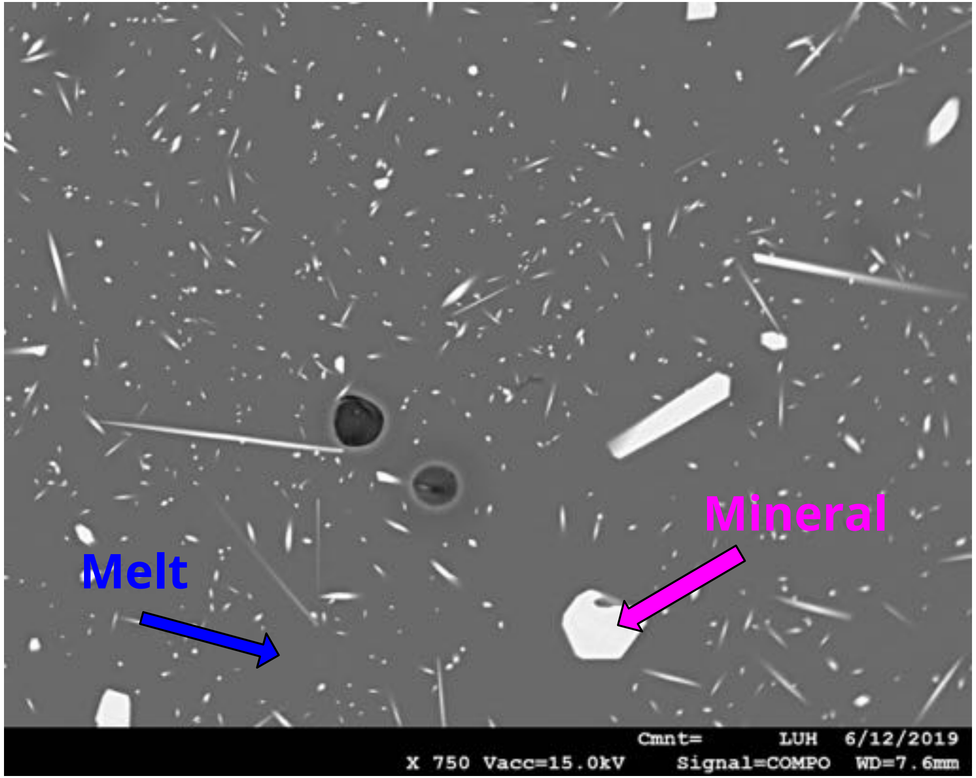
Pressure = 3000 bar

Duration = 3 days

Analyses of experiments

➔ Measure amount of sulfur in
  - Melt
  - Minerals

➔ Understand sulfur behavior and how it moves from magma chamber to the Earth's surface



Adams Azameti

COLLEGE OF BASIC AND APPLIED SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

Title:
IMPROVING INTELLIGENT TRANSPORTATION SYSTEMS (ITS) THROUGH ANALYTICAL INVESTIGATION OF MACROSCOPIC TRAFFIC FLOW MODEL IN VEHICULAR AD HOC NETWORKS (VANETS)

By

Adams Addison Kobla Azameti

(MPhil, PGCE, BSc)

Email: aakazameti@st.ug.edu.gh

OUTLINE

- Problem Statement
- Methodology
- Results
- Summary of the results

Problem Statement

The traffic congestion and the intermittent connectivity problems can be attributed to two main factors which may be classified as predictable and unpredictable events. The predictable events refer to the nature of the road construction (i.e. rural road, urban road, and highways) together with the number of vehicles on the road at any moment.

These unpredictable events refer to weather, accident and the attitude of drivers on the road.

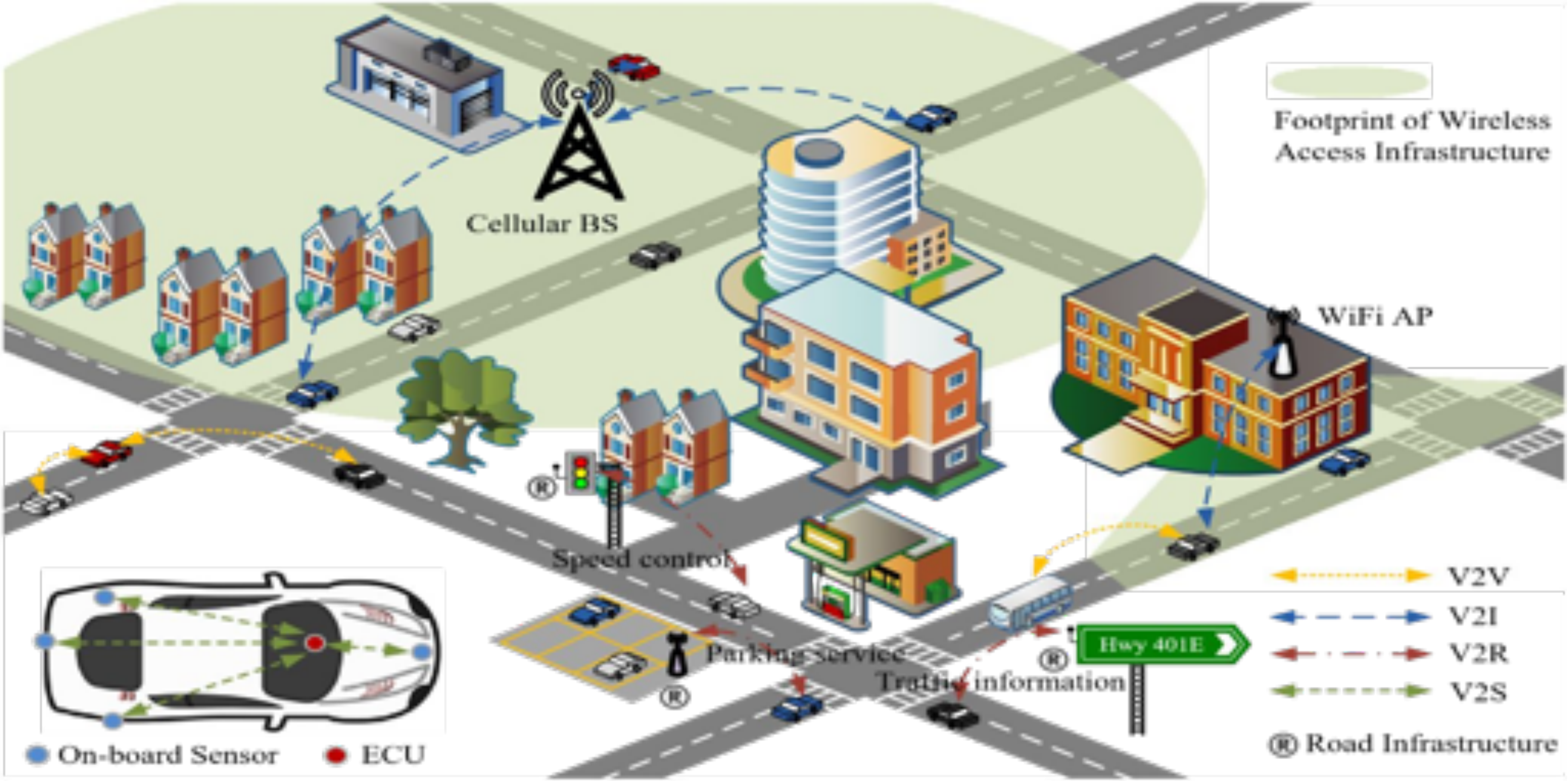
When the drivers are not aware of pending congestion and traffic flow conditions ahead, it will be difficult to pre-determine the severity of the congestion but eventually add up to the situation without knowing **(Schrank et al., 2012).**

Problem Statement

This phenomenon requires a lot of effort to mitigate the congestion and intermittent connectivity in VANETs.

The ability of the driver to pre-determine the traffic conditions ahead on the road will aid them to take an alternate route to save time, fuel and avoid the accident and improve traffic alert information dissemination.

(Balasubramanian et al., 2008; Chitra & Sathya, 2013; Lai, 2016)



(Faezipour et al , 2012; Qu et al., 2010)

Methodology

The macroscopic traffic flow models

$$P(X=n)=\frac{(x\lambda t)^{n}}{n!}e^{-\lambda tx} \quad (3.\ 1)$$

$$f_T(t)=\begin{cases}\lambda te^{-\lambda t(t-\tau)}, & t\geq\tau \\ 0, & t<\tau\end{cases} \quad (3.\ 2)$$

$$D=\frac{V}{\nu} \quad (3.\ 3)$$

Methodology

λ_t = indicates that the arrival process of vehicles has a highway density and modelled as Poisson process with arrival rate λ_t

t = represent the probability that **n** vehicles arriving in a time t.

χ = represents vehicles migrating to a highway in a time interval ***x.***

V = represents traffic volume measured in the vehicle per hour (veh/hr)

D = density is measured in the vehicle per mile per lane in (veh/mile/lane)

ν = represents the space mean speed in (m/hr) λ

Results

Figure 4.3a The effect of traffic flow when λ = 3

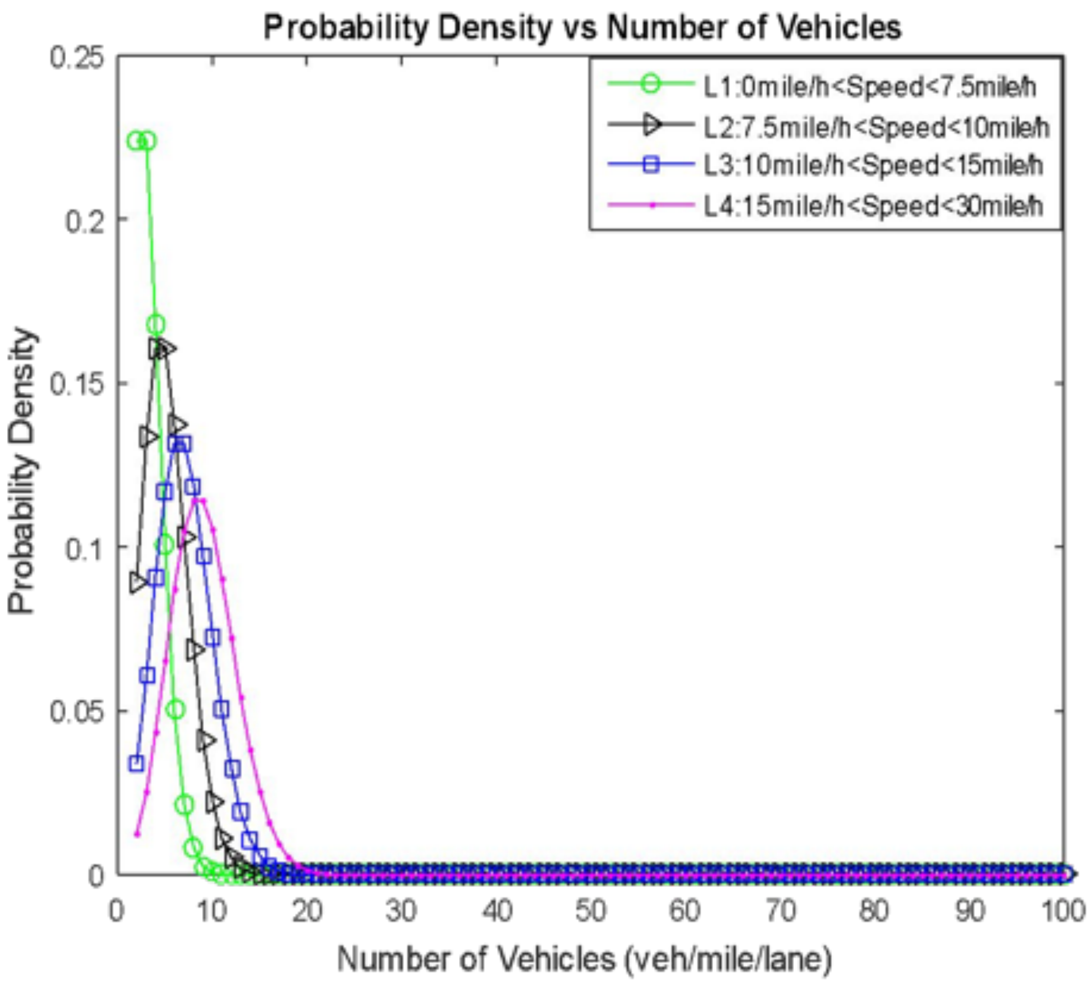
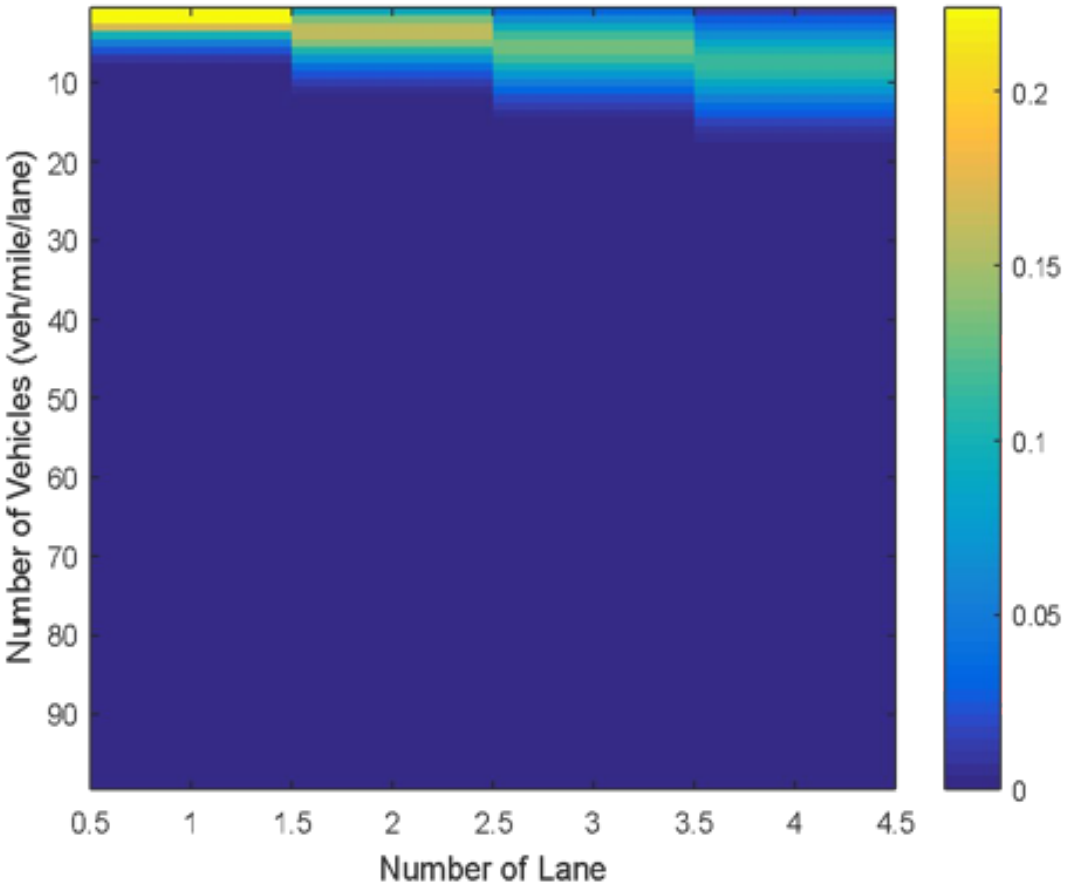


Figure 4.3b Vehicle trajectories in each lane



(Azameti et al., 2018).

λt

Results

Figure 4.6a The effect of traffic flow when λ = 6

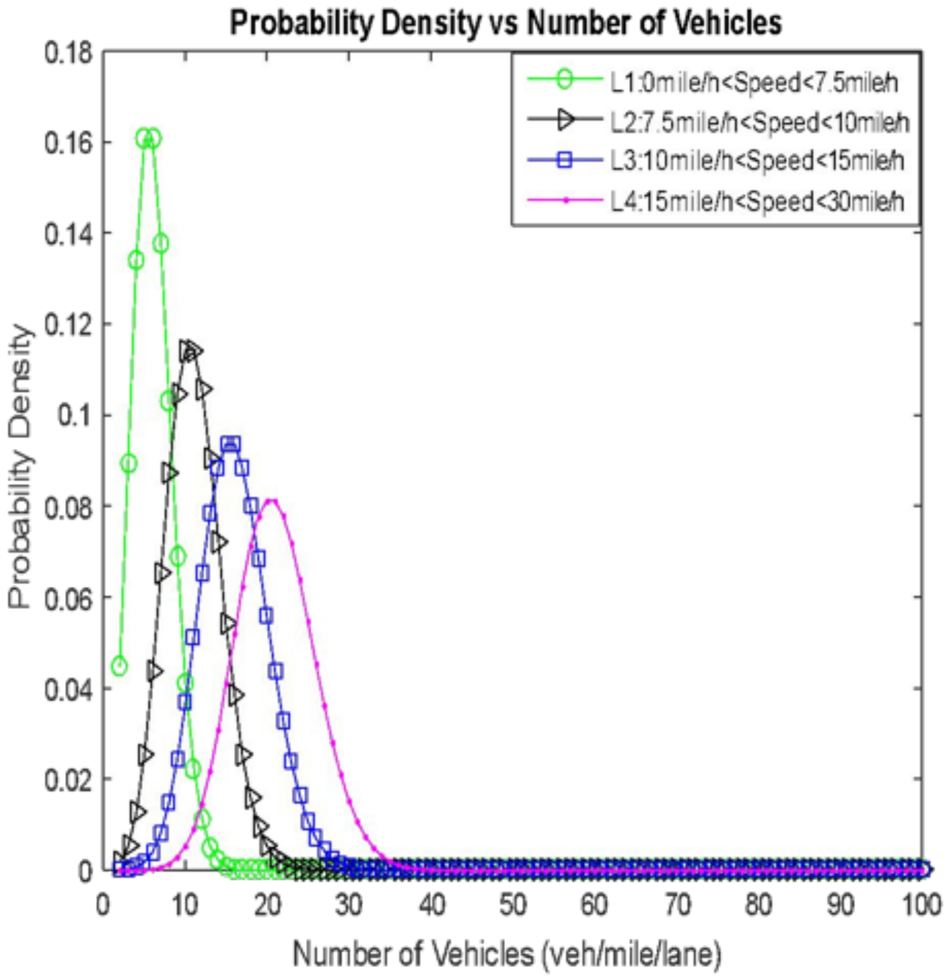
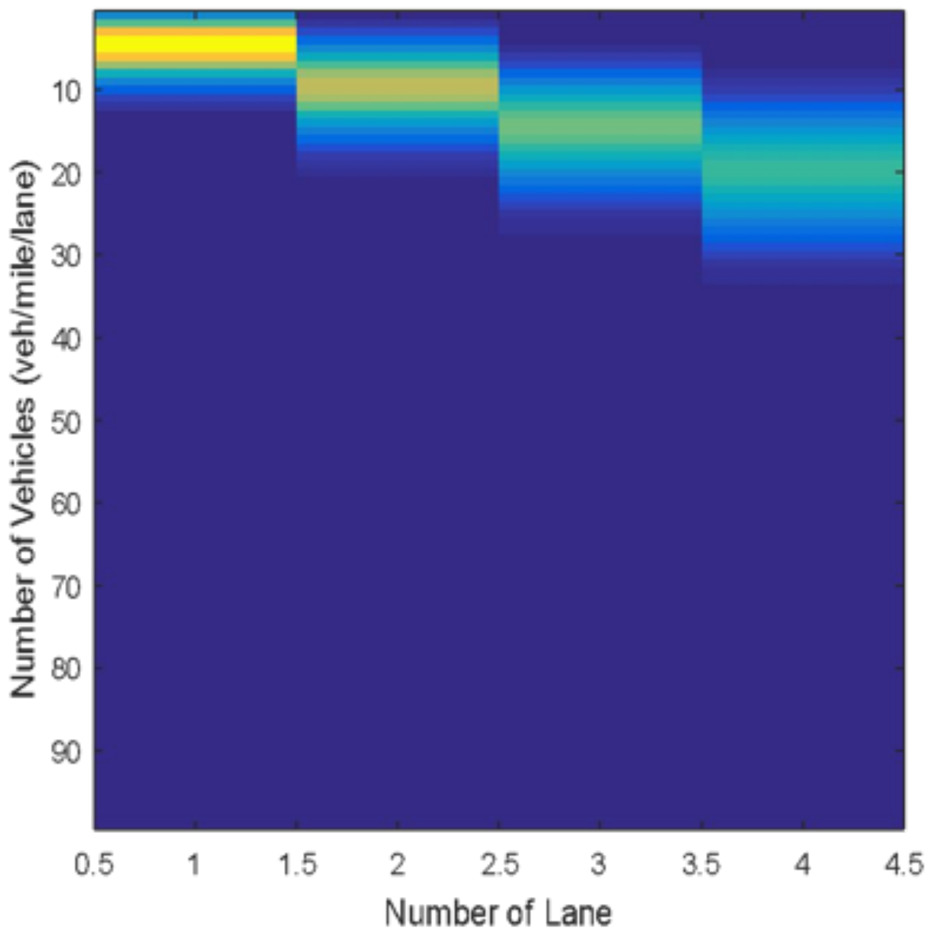


Figure 4.6b Vehicle trajectories in each lane



(Azameti et al., 2018).

Results

Figure 4.10a The effect of traffic flow when λ = 10

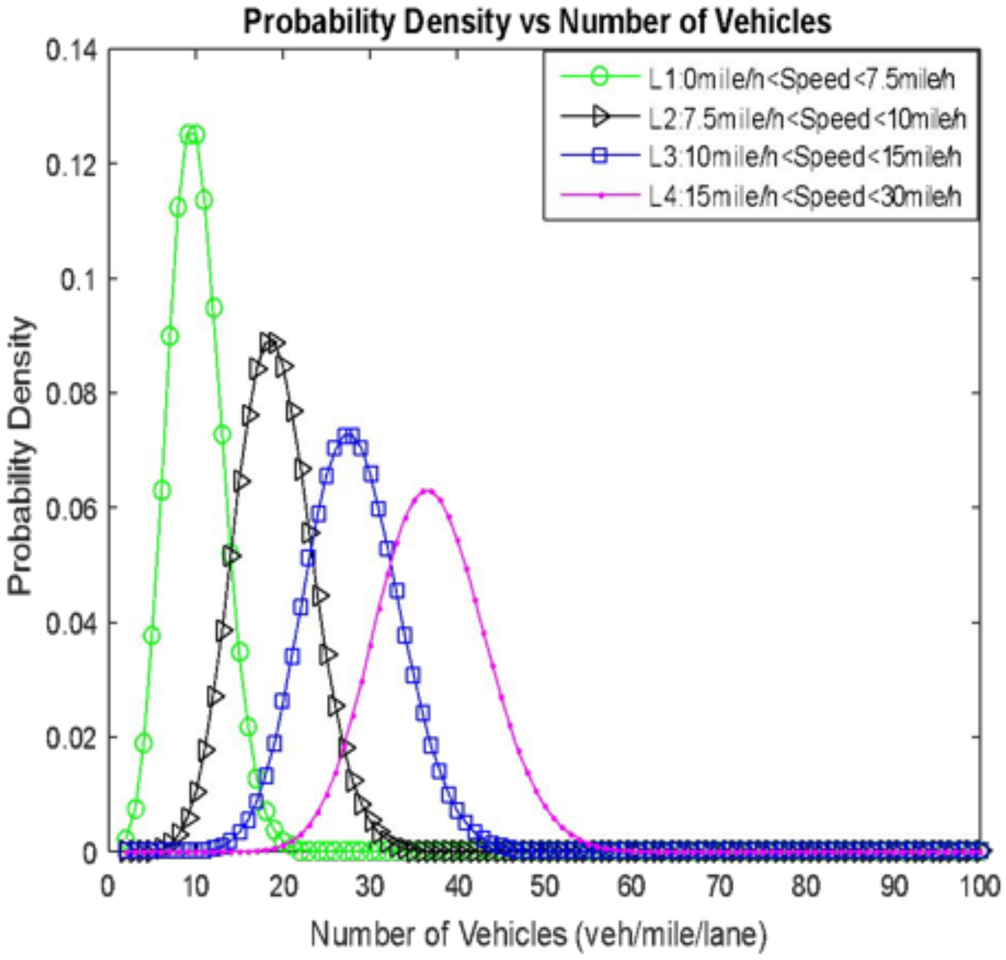
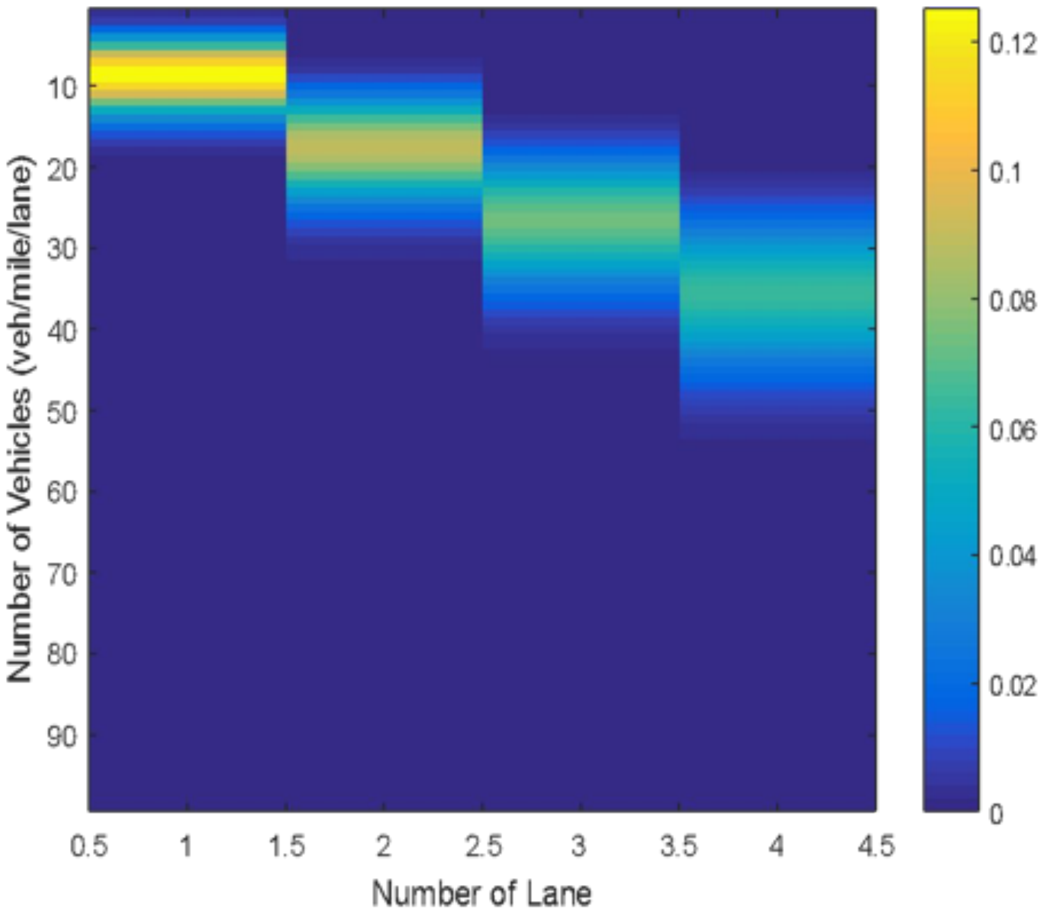


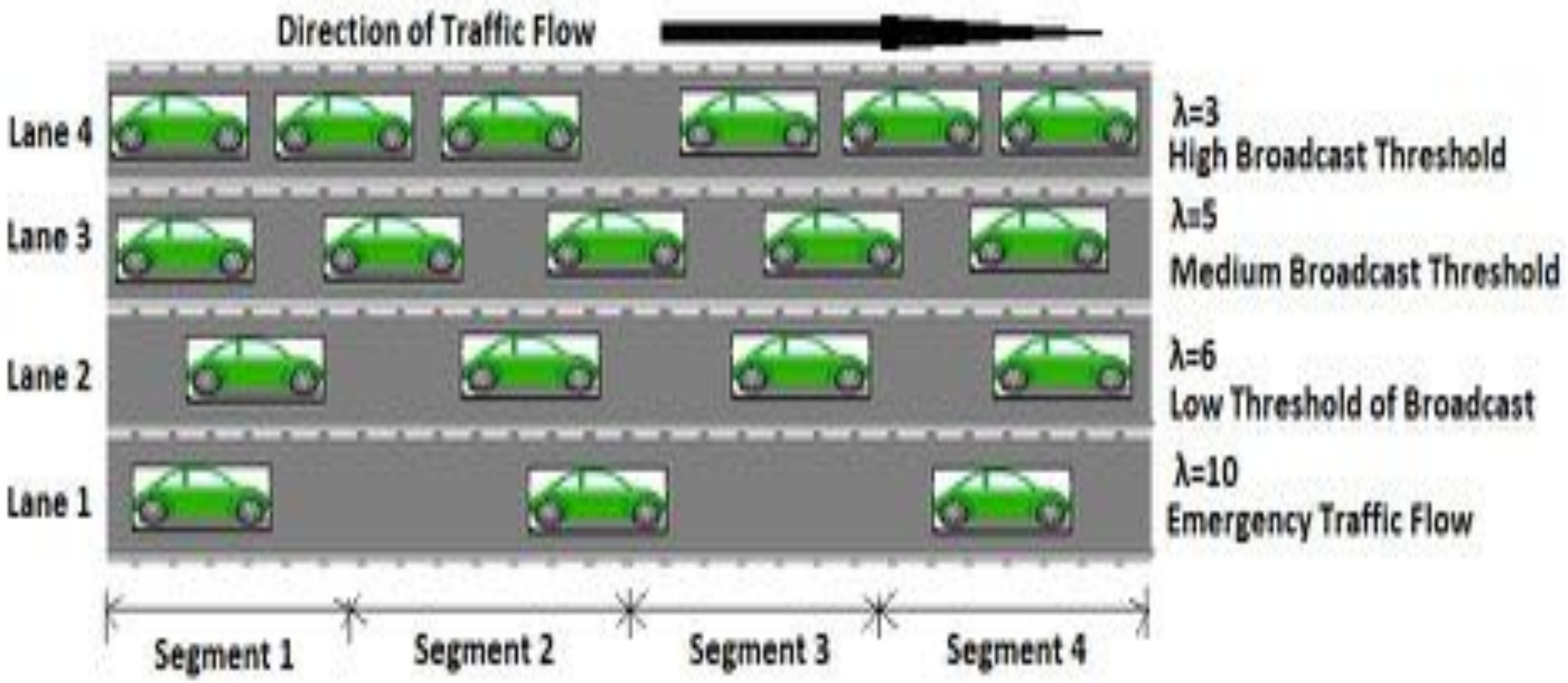
Figure 4.10b Vehicle trajectories in each lane



(Azameti et al., 2018).

4.3 The congestion control models using four-lane networks

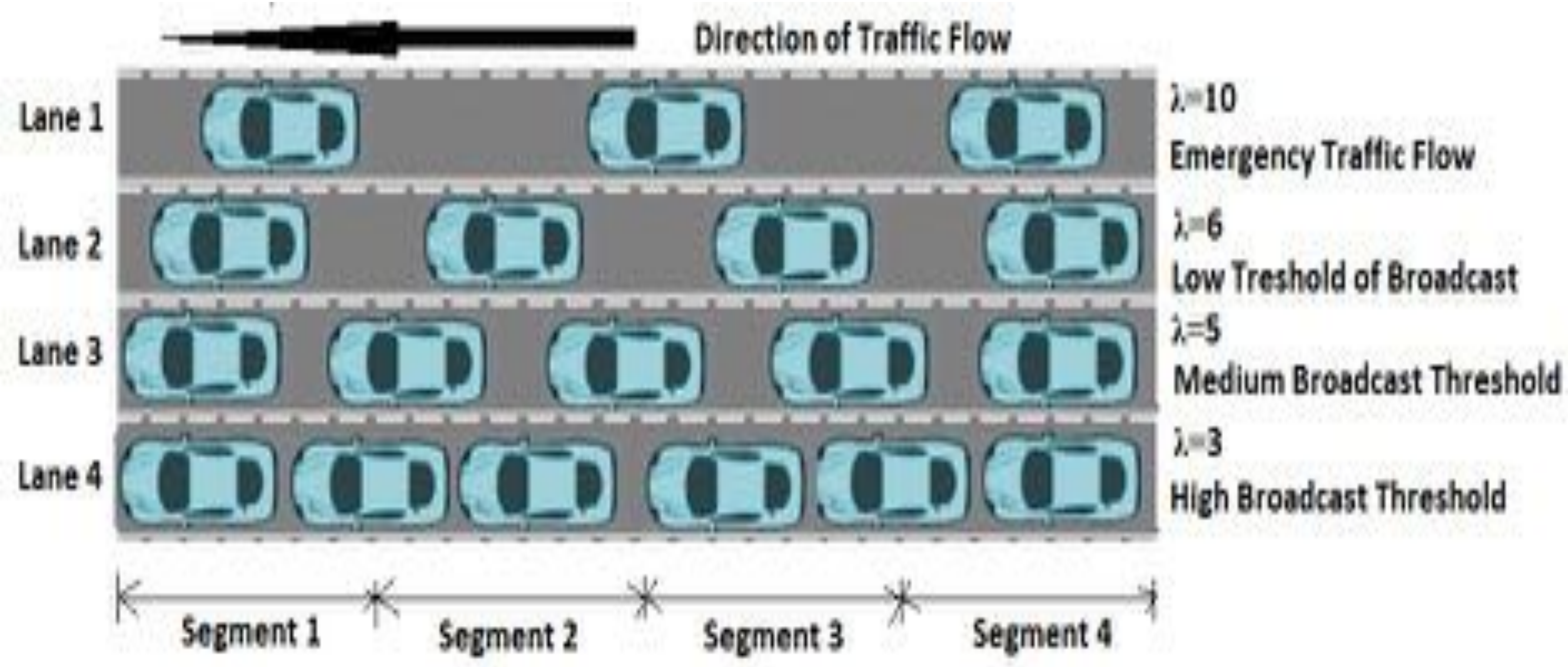
Figure 4.11 Four-Lane at the right side of the road showing the direction and movement of vehicle



(Azameti et al., 2018).

4.3 The congestion control models using four-lane networks

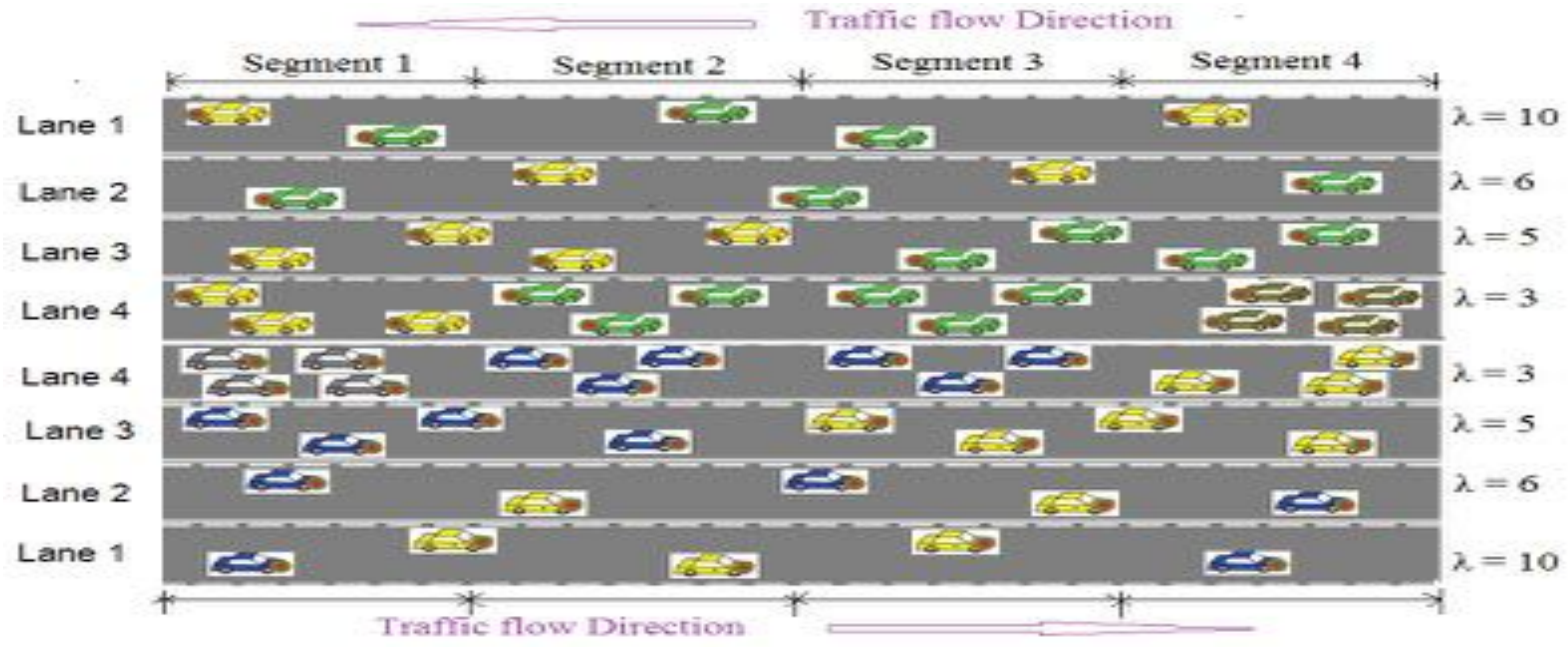
Figure 4.12 Four-Lane at the left side of the road showing the opposite direction and movement of vehicles



(Azameti et al., 2018).

4.3 The congestion control models using four-lane networks

Figure 4.13 Two-way Congestion Control Model showing different threshold of λ



(Azameti et al., 2018).

Summary of the results

- **Figure 4.3a, 4.3b** shows the average packet penetration distance as a function of λ, when lane 3 and lane 4 have seen normal distribution around nodes 10 (veh/mile/lane) and therefore experiences faster packet delivery and more efficient as indicated on the Congestion Control Model (CCM)

- **In Figure 4.6a and 4.6b,** have seen an increased node between 10 and 26 nodes as the value of λ increases with time than in lane 1. The packet penetration distance as a function of λ is greatly enhanced since lane 2, lane 3 and lane 4 have seen increased packet penetration rate under the normal distribution while lane 1 experiences fewer packet penetration rate.

(Azameti et al., 2018).

Summary of the results

- **Figure 4.10a and 4.10b** depicted a complete normal distribution within all the lanes. The nodes are distributed between 10 and 55 nodes as the value of λ increases to 10. This phenomenon shows the average network overhead for a single broadcast as observed by each vehicle (node) within lanes.

- This network overhead seems to scale very well as the value of λ increases with time; especially in heavy traffic conditions in which broadcast storm is likely to occur. The result from the analytical investigation also indicates that the amount of overhead is also about four times less than in lane 2 and lane 1.

(Azameti et al., 2018).

Thank You

Daniel F. Korfeh

Magnetite as a Tool to Fingerprint the Availability of Ore Deposits

Daniel F. Korfeh Jr. (M.Sc. Economic Geology)

Faulty, Department of Geology

University of Liberia

COESSING 2019, Ghana

August 8, 2019

Objective

- ❖Factors that determine the availability of minerals, and magnetite is one of the tools for determining mineral availability
- ❖How magnetite crystal is important in trace elements' absorption
- ❖How magnetite chemistry is an important indicator in ore deposit exploration
- ❖Techniques used to characterize the chemistry of magnetite

Existence of a mineral ore is no guaranteeing that it can be exploited

Mineral Availability

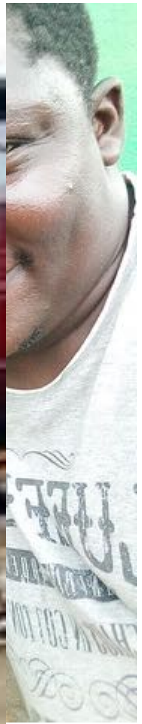
Primary Availability (virgin Materials)

Secondary Availability (previously processed materials)

- ***Geologic***
- ***Technical***
- Environmental and Social
- political
- Economical

Minerals, Critical Minerals, and the U.S. Economy (2008)

Ex: The availability of Fuel Obtain from plastic waste



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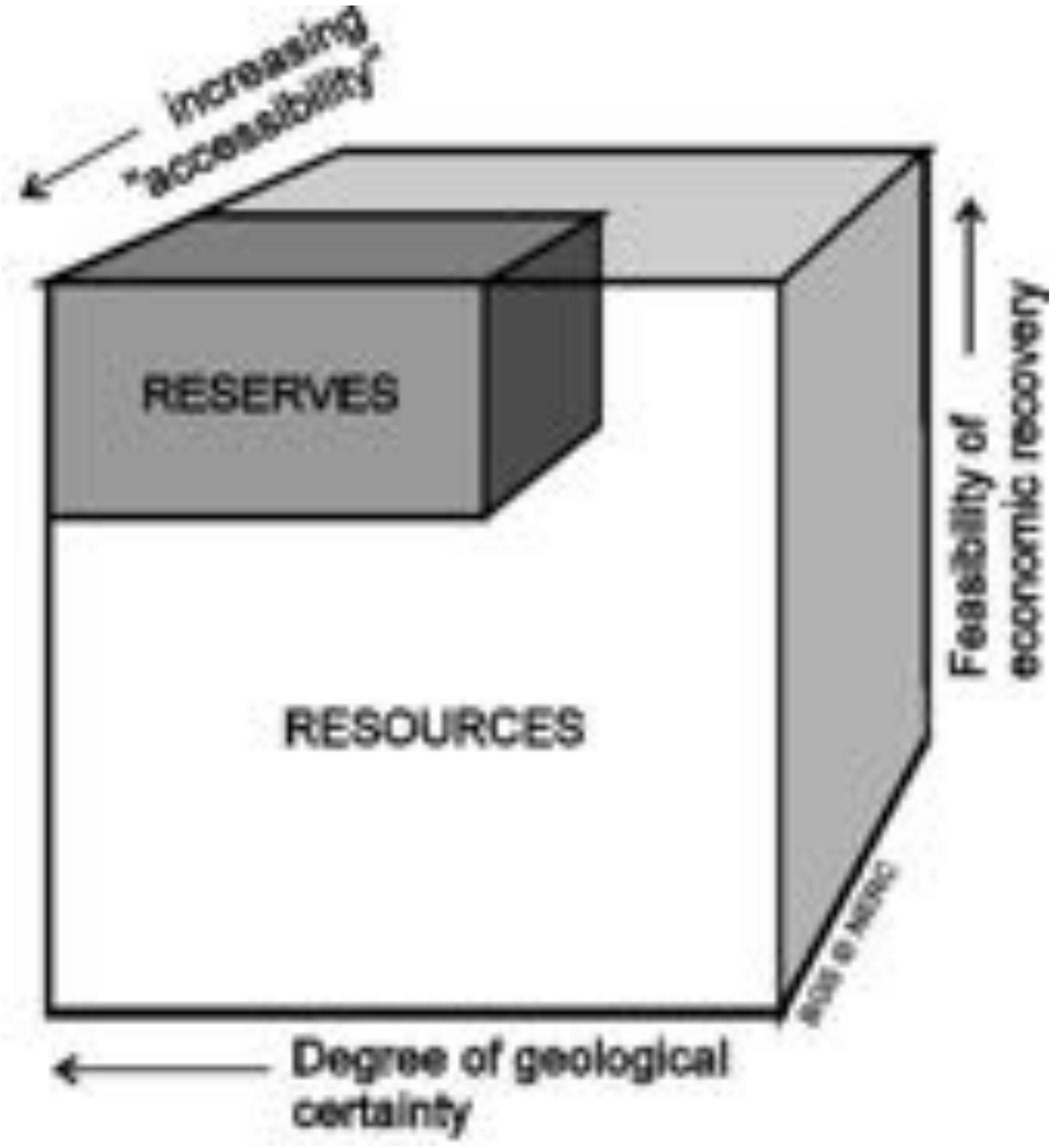
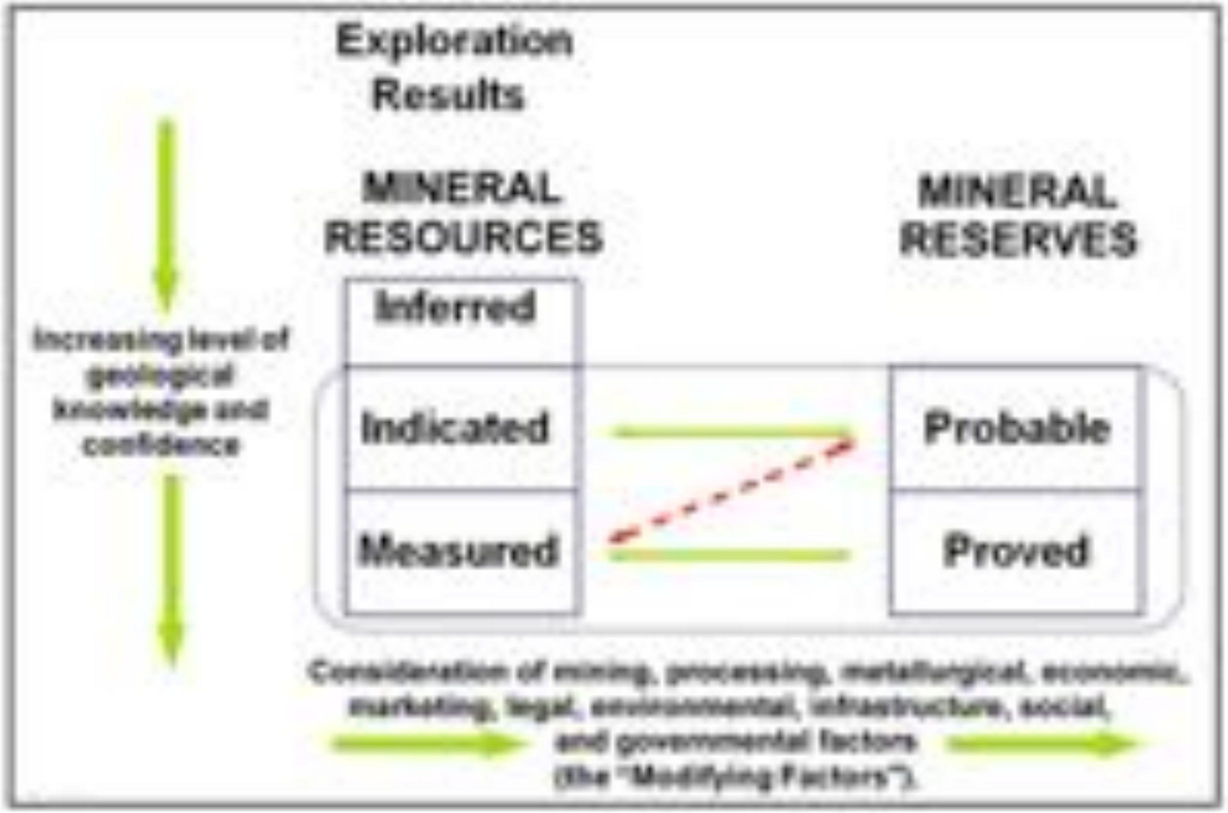
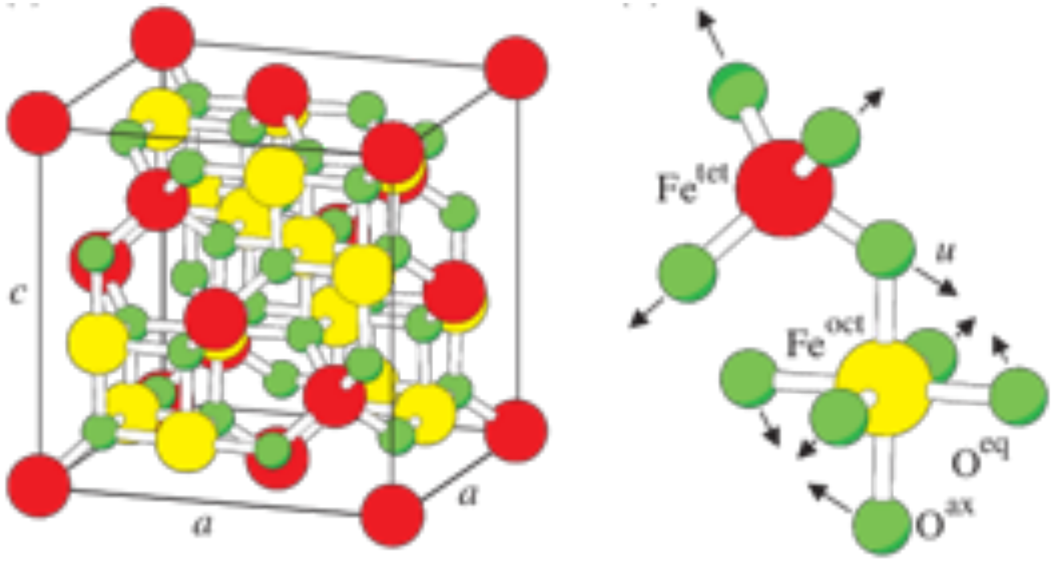
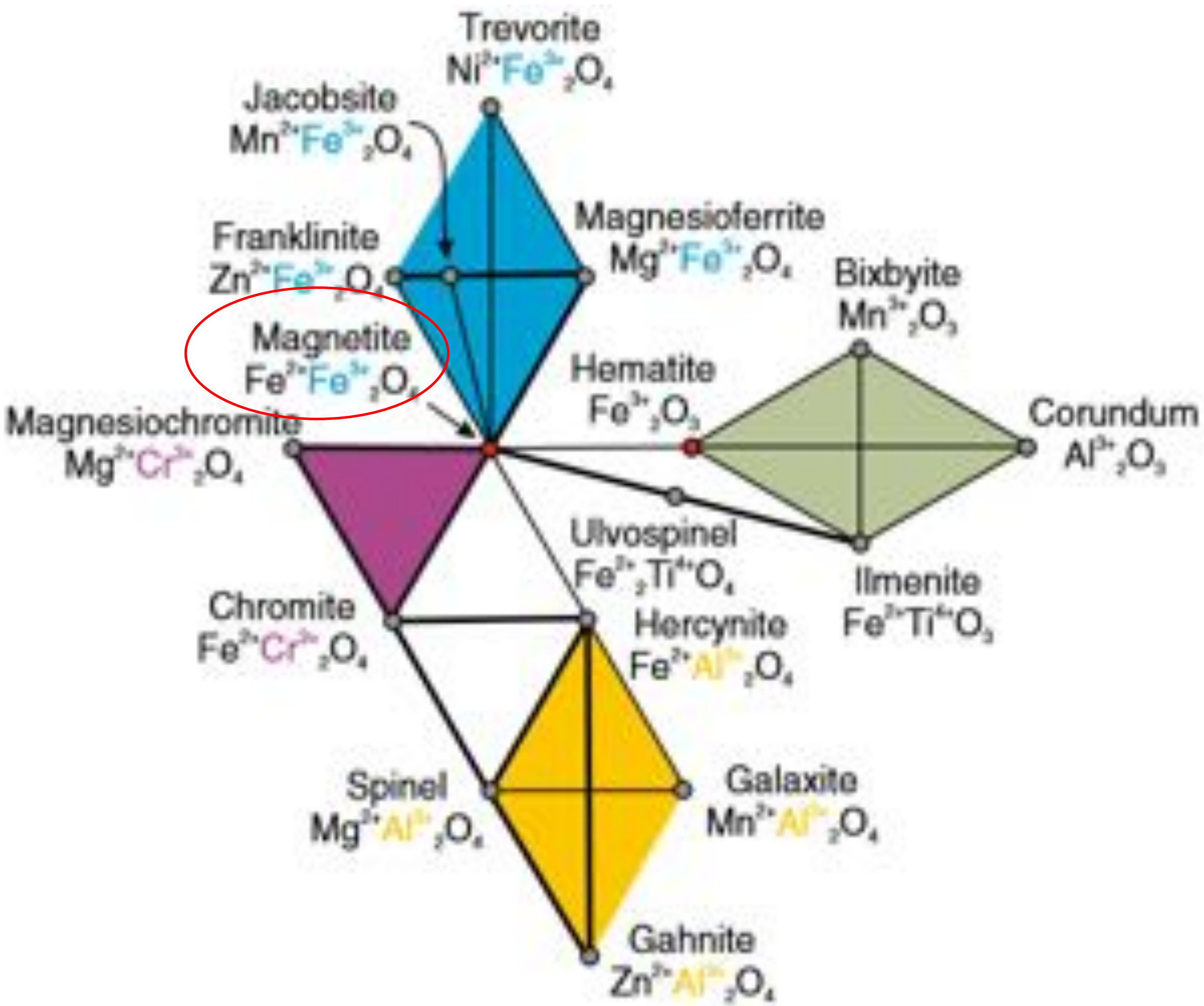
Existence of a mineral ore is no guaranteeing that it will be exploited



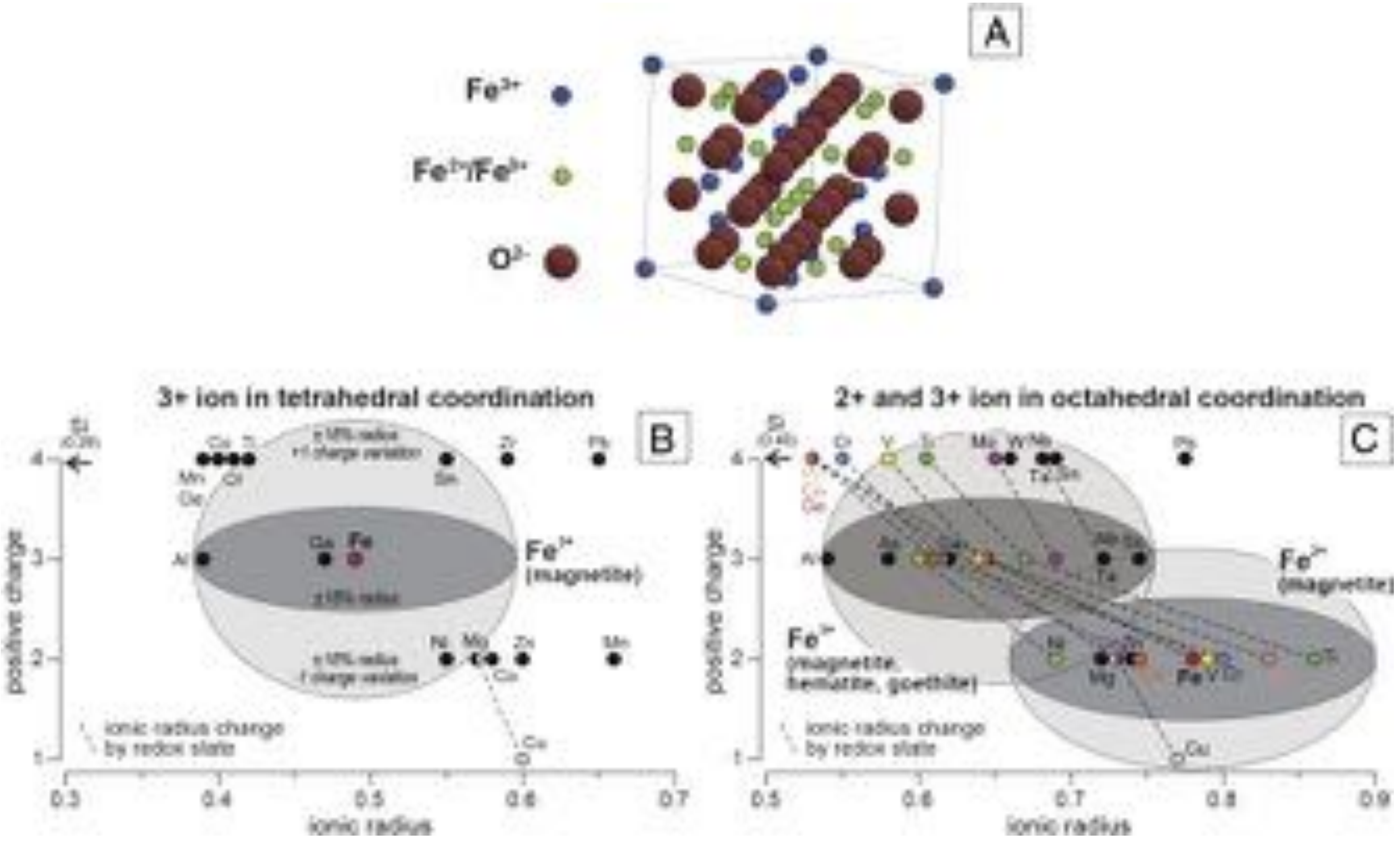


Why magnetite is an important mineral indicator?

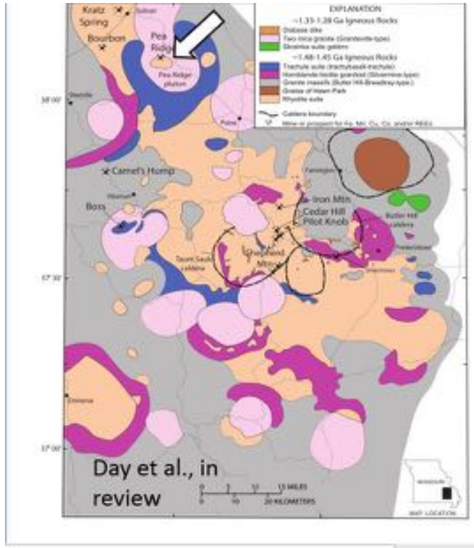




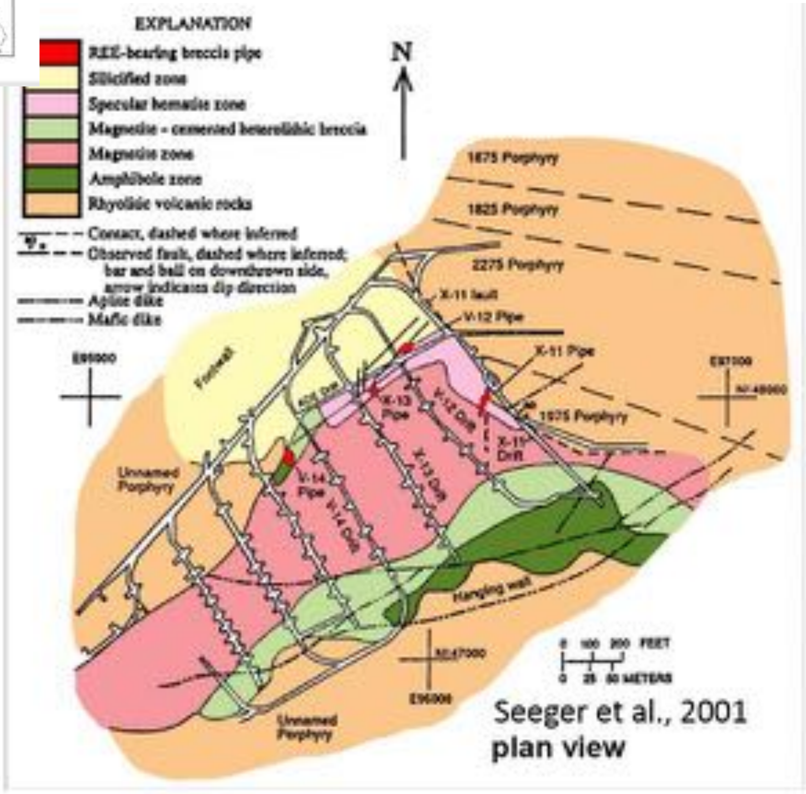
Why magnetite is an important mineral indicator?

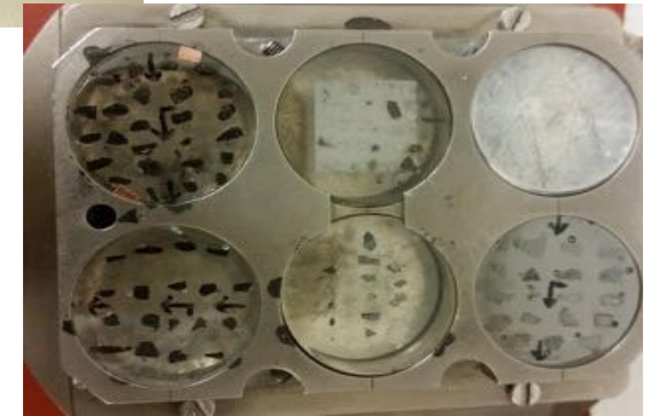


How do we evaluate these trace elements in Magnetite?



Sample collection
and preparation

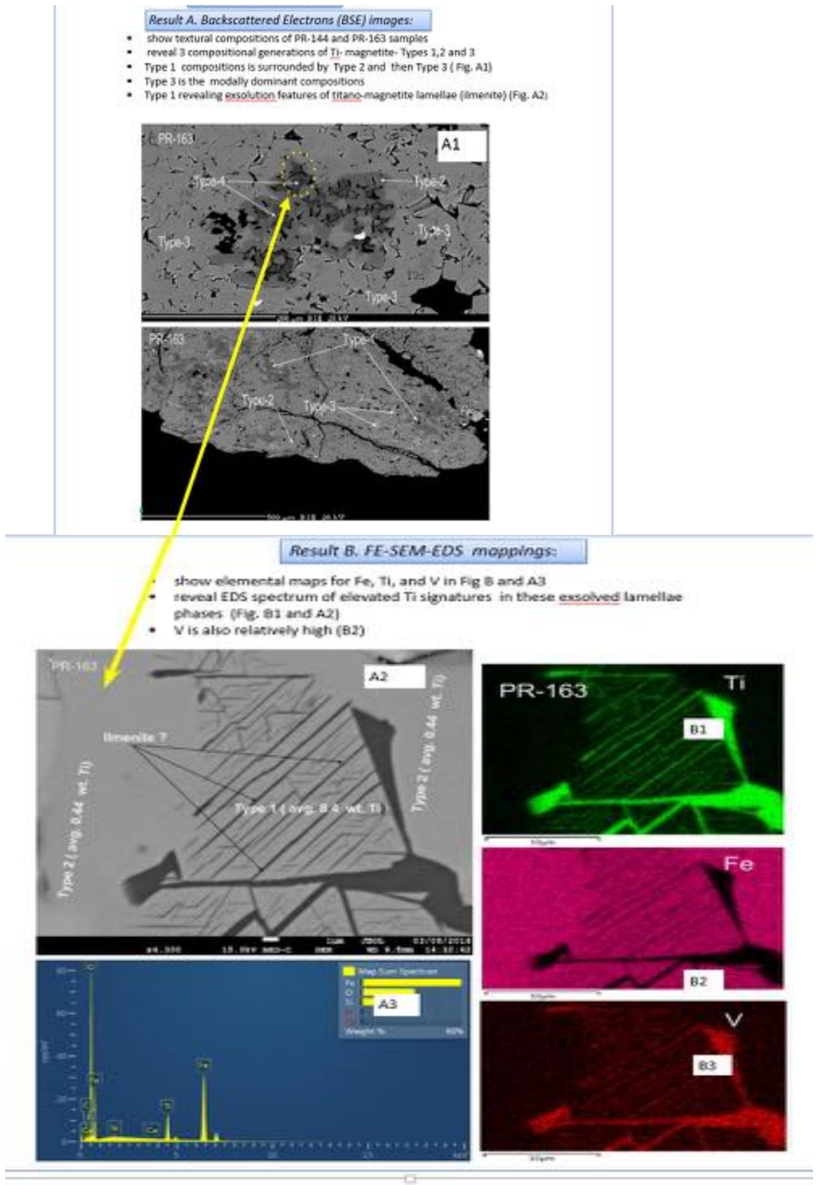




How do we evaluate these trace elements in Magnetite?

Textural Analysis

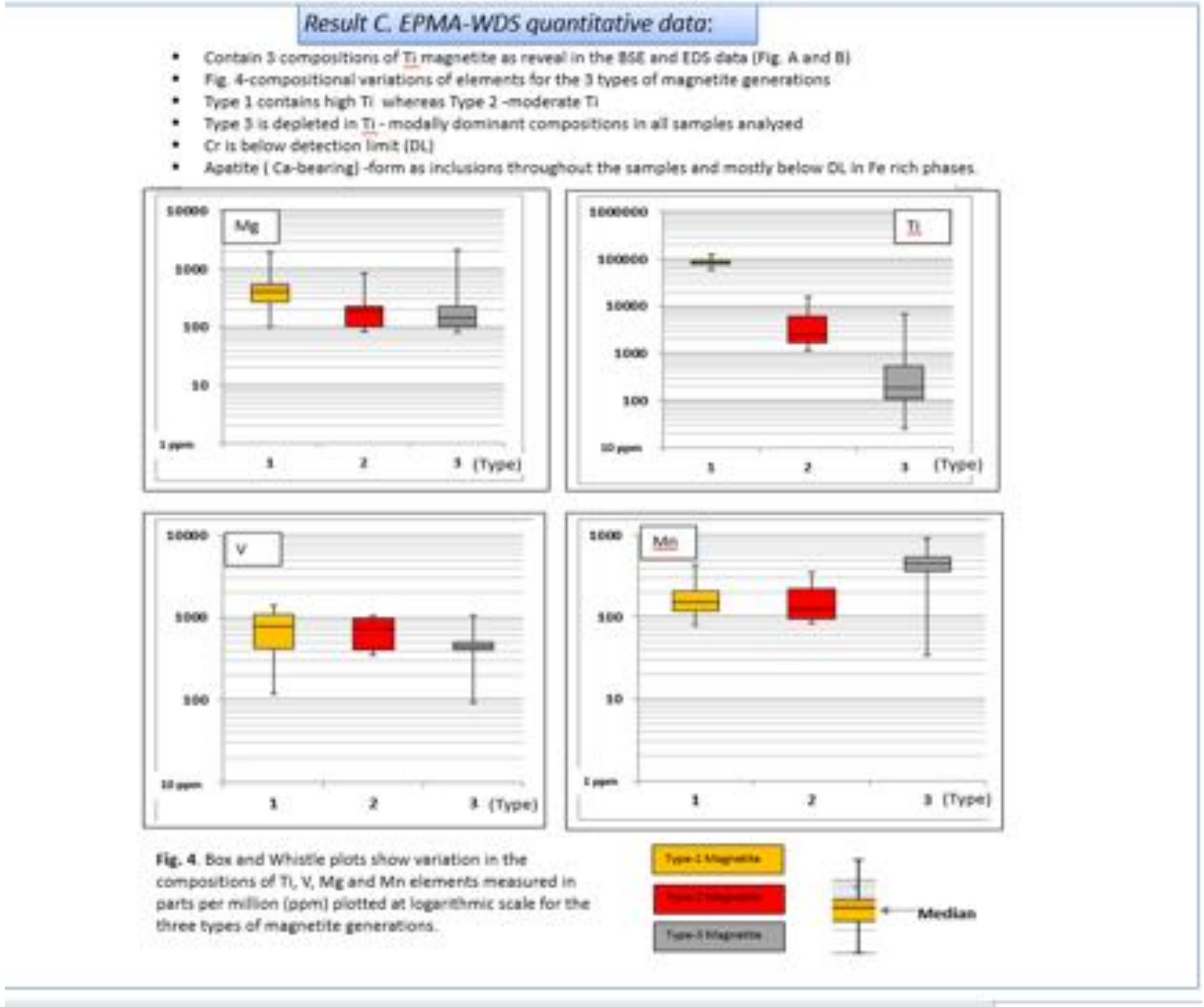
FSEM



How do we evaluate these trace elements in Magnetite?

Elemental analysis

EPMA



Result C. EPMA-WDS quantitative data:

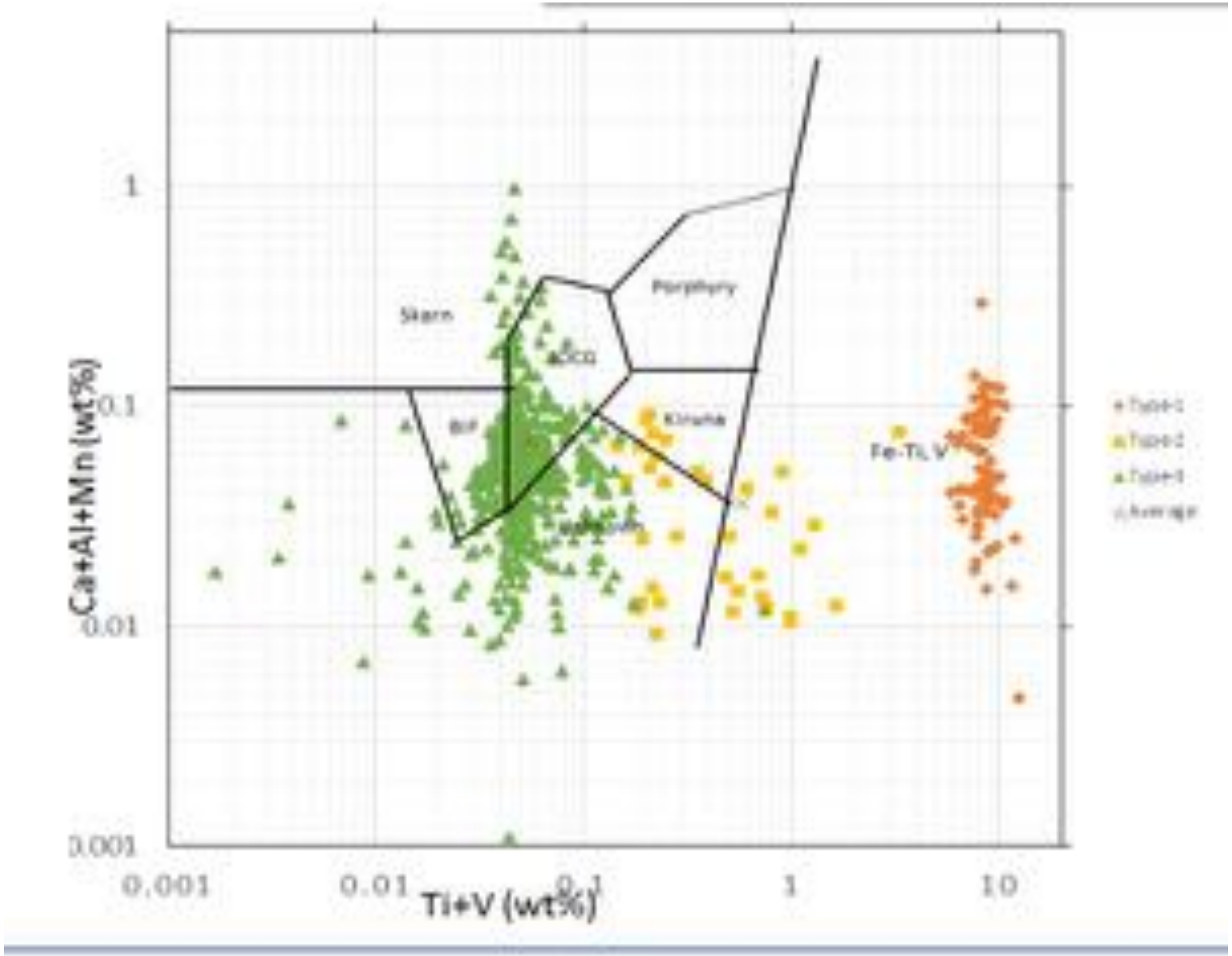
- Contain 3 compositions of Ti magnetite as reveal in the BSE and EDS data (Fig. A and B)
- Fig. 4-compositional variations of elements for the 3 types of magnetite generations
- Type 1 contains high Ti whereas Type 2 -moderate Ti
- Type 3 is depleted in Ti - modally dominant compositions in all samples analyzed
- Cr is below detection limit (DL)
- Apatite (Ca-bearing) -form as inclusions throughout the samples and mostly below DL in Fe rich phases

Fig. 4. Box and Whistle plots show variation in the compositions of Ti, V, Mg and Mn elements measured in parts per million (ppm) plotted at logarithmic scale for the three types of magnetite generations.

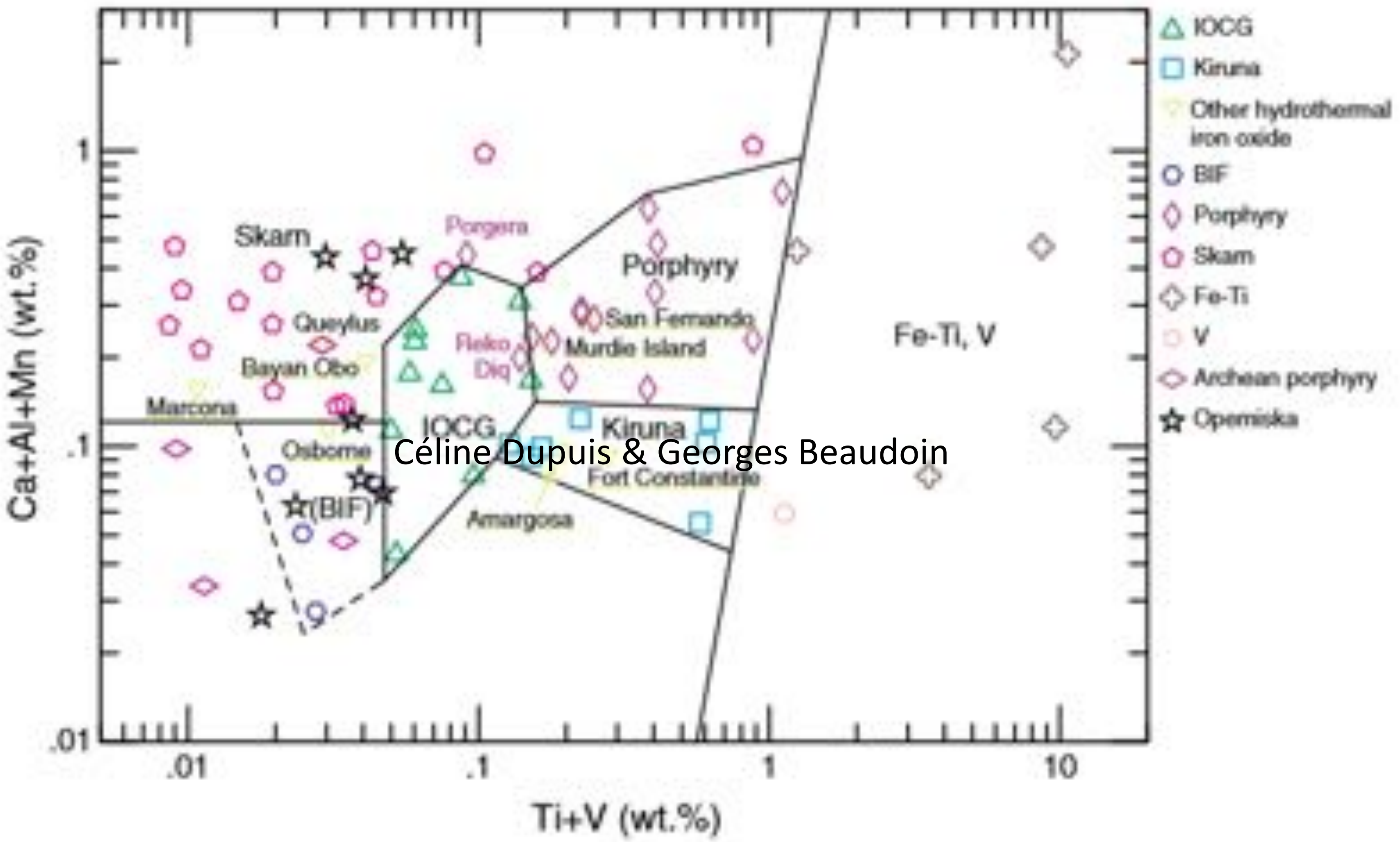
How do we evaluate these trace elements in Magnetite?

Elemental analysis

EPMA



How do we evaluate these trace elements in Magnetite?



Céline Dupuis & Georges Beaudoin

Ca+Al+Mn vs. Ti+V discriminant diagram
(Dupuis and Beaudoin, 2011)

Thanks

Teaching and Lab materials

- Physical samples for many d

Mfonobong Essang

CHARACTERIZATION OF HEAVY METALS AND POLYCYCLIC AROMATIC HYDROCARBON ON SURFACE AND GROUND WATER IN THE COASTAL AREAS OF MBO LGA, AKWA IBOM STATE, NIGERIA

ESSANG MFONOBONG SHAINEZE

Background of the Study

- The coastal areas of Mbo Local Government Area of Akwa Ibom State had witnessed active

- ports activities,
- oil drilling,
- coastal fishery,
- agricultural activities,
- tourism-related projects,
- industrial activities,
- urbanization
- and other socioeconomic activities over the years.

Our oceans had become the dumping ground of trash and refuse which accumulate on our shores to the point of saturation and becoming an eyesore (Ashiru et. al., 2017).

- Anthropogenic activities contaminate both surface and groundwater resources through discharge of pollutants related to the nature and degree of such activities (Akporido and Onianwa, 2015).

- This work investigates the impact of anthropogenic activities on the quality of surface and ground water in coastal areas of Mbo, Akwa Ibom State, Nigeria.

Significance

This research will provide useful information to the public, government and private bodies

- on the effects and dangers of the pollution on the coastal region and how it degrades the quality of ground and surface water.

Aim: To determine the heavy metal and polycyclic acromatic hydrocarbons quality of surface and ground water resources in Mbo LGA, Akwa Ibom State.

Specific objectives

- To determine biogeochemical responses to seasonal changes in coastal water in Mbo LGA, of Akwa Ibom State.
- To analyse the physio-chemical parameters of the surface and ground water quality.
- To assess heavy metals concentration of the water samples.
- To evaluate TPH and PAH levels of the water samples.

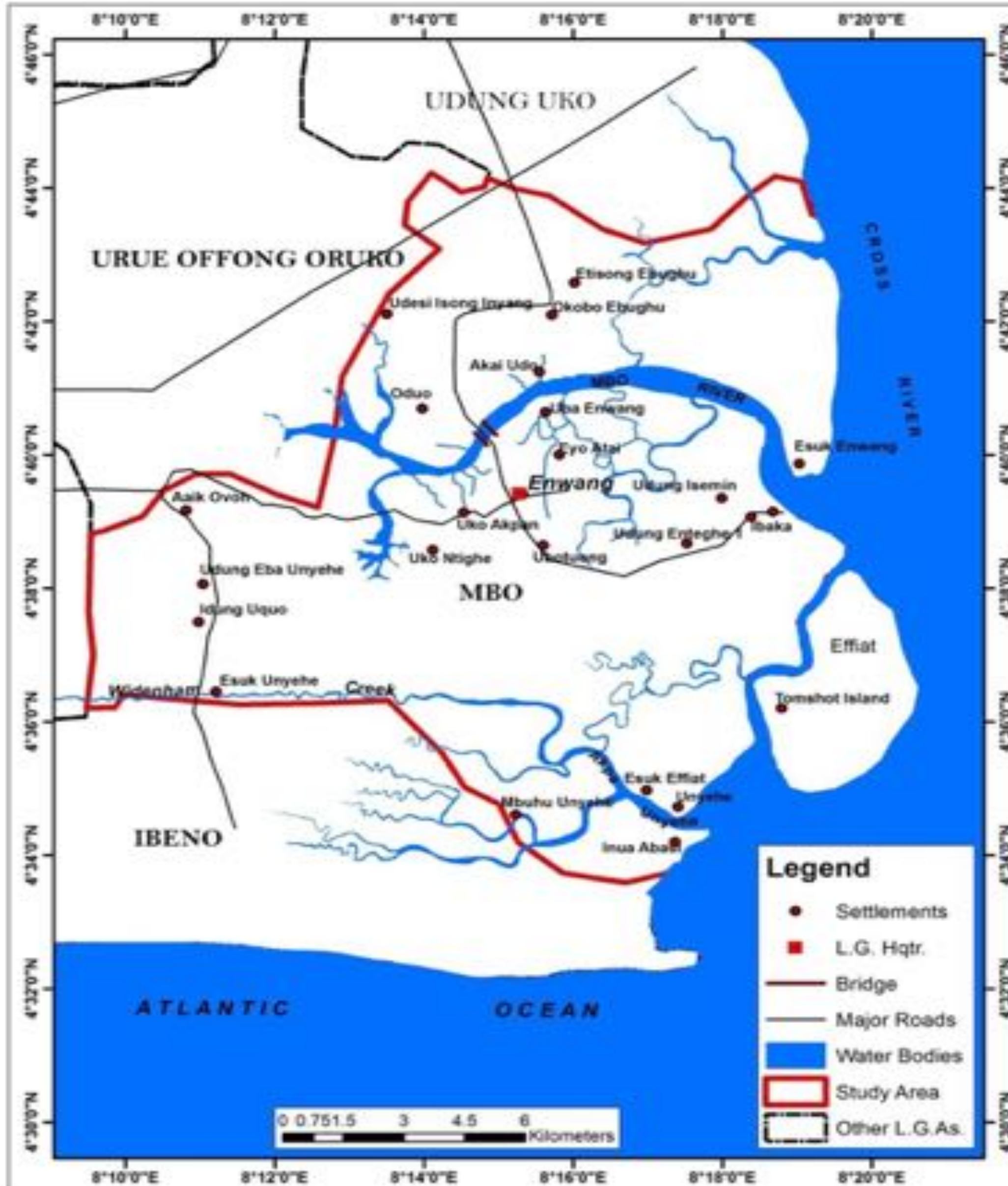
?

Do anthropogenic activities affect the quality of surface and ground water in the study area?

Study area

- The Mbo LGA of Akwa Ibom State lies approximately between latitude 4° 39´ 0˝ North and longitude 8° 19´ 0˝ East with an area of 365 km².

- The area has a rich water resource where oil exploitation and exploration is taking place.



Research design and methodology

- The study will be geared towards conducting biochemical analysis on the effect of pollution, heavy metals and hydrocarbon on surface water and ground water in Mbo LGA.
- Field and laboratory based analytical procedures will be adopted to generate the data required.

Sampling site

Twenty sampling site will be selected randomly across Mbo LGA.

Sampling of water

- Water sample will be collected during the rainy and dry seasons for 24 months using plastic containers.

- Surface water will be collected from streams and rivers.

- Groundwater: will be collected from bore holes and hand dug well

Determination of physicochemical parameters

- pH and Temperature will done *in situ*
- Electrical Conductivity (EC)
- Total Dissolved Solid (TDS)
- Chemical Oxygen Demand (COD)
- Dissolved Oxygen (DO)
- Biological Oxygen Demand (BOD)
- Salinity
- Alkalinity
- Cl^-, NO_3^-, NO_2^-, SO_4^{2-}, F-
- Turbidity
- Total Hardness

These will be done using standard procedures (APHA, 1992).

- **Analyses of heavy metals**

Heavy metals contents including lead, zinc, copper, manganese, iron, calcium, aluminium, cobalt, sodium and nickel, cadmium, mercury will be analysed using atomic absorption spectrophotometer.

- **Analyses of total petroleum hydrocarbon and polycyclic aromatic hydrocarbons**

TPH and PAH analysis will be done using GC-FID.

Data Analysis

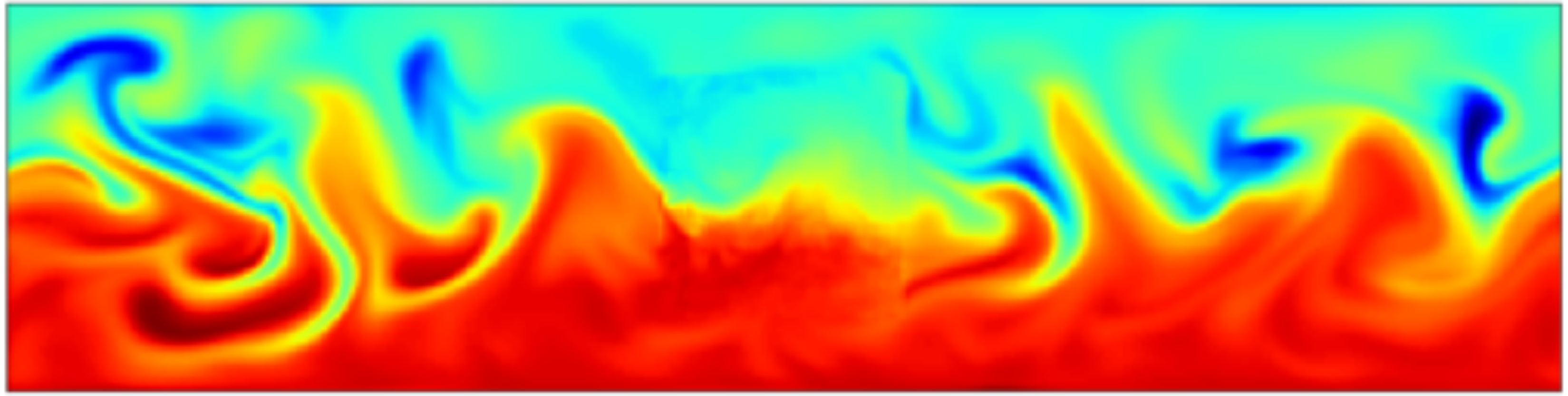
- Results will be presented in tables and data will be analyzed using SPSS version 23

Thank you !!!

Paige Martin

Idealized Ocean-Atmosphere Modeling

Dr. Paige E. Martin
Department of Physics
University of Michigan



Mini-conference
COESSING 2019

The Big Picture

The Big Picture

The Ocean

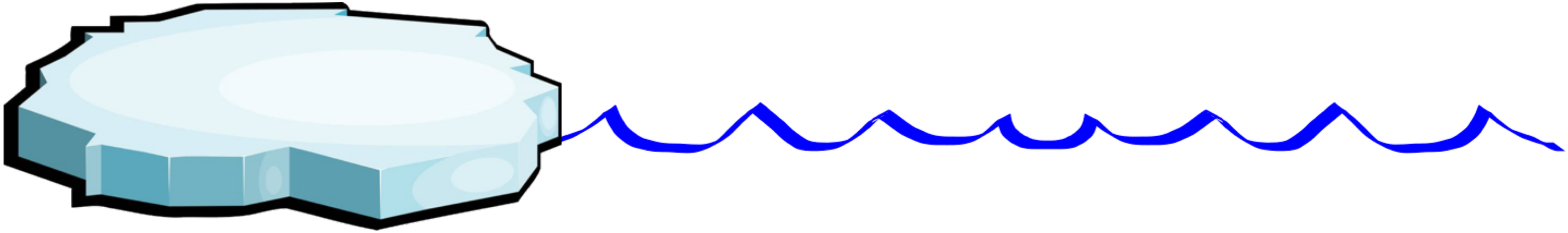
The Big Picture

The Atmosphere

The Ocean

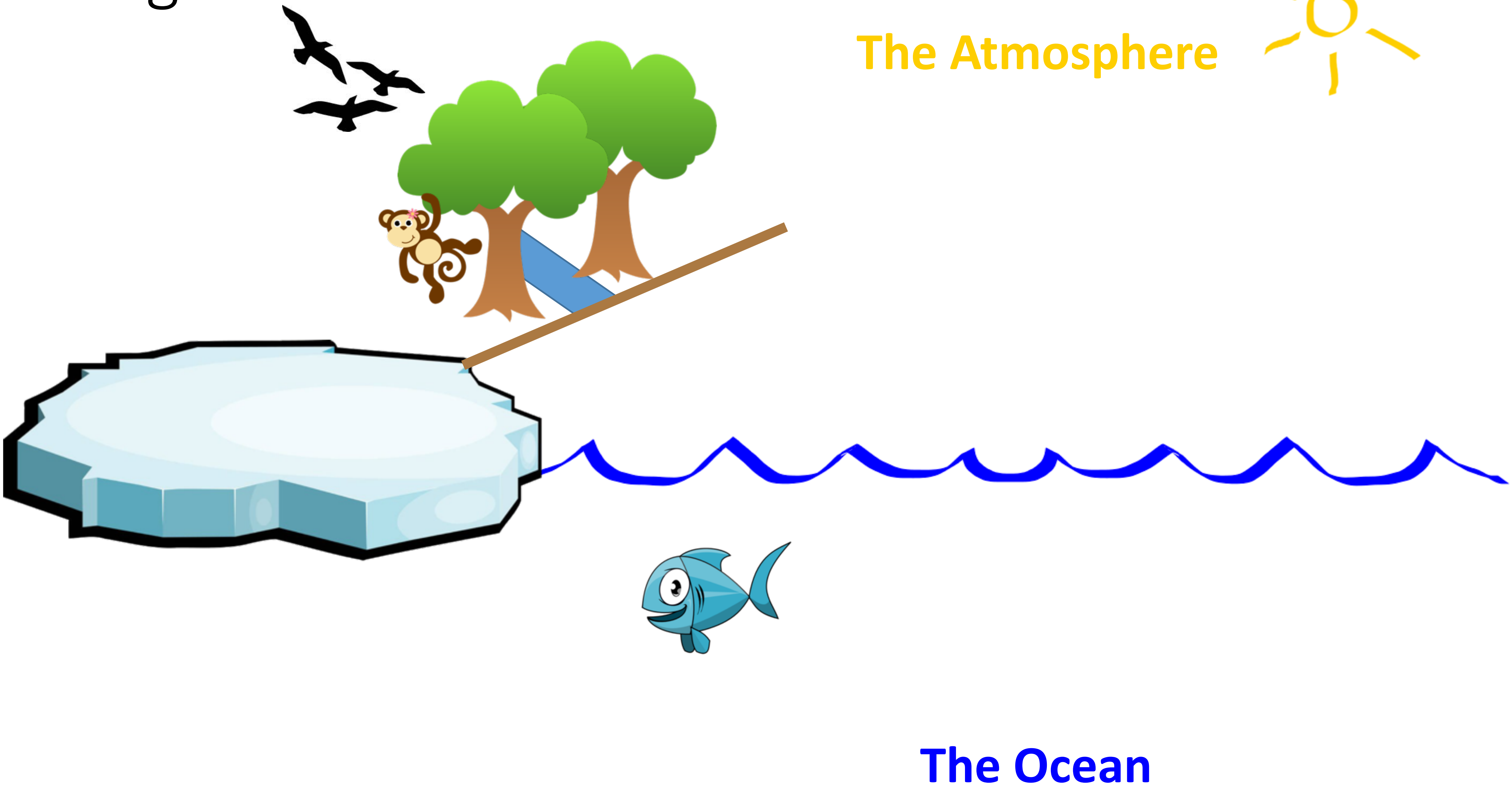
The Big Picture

The Atmosphere

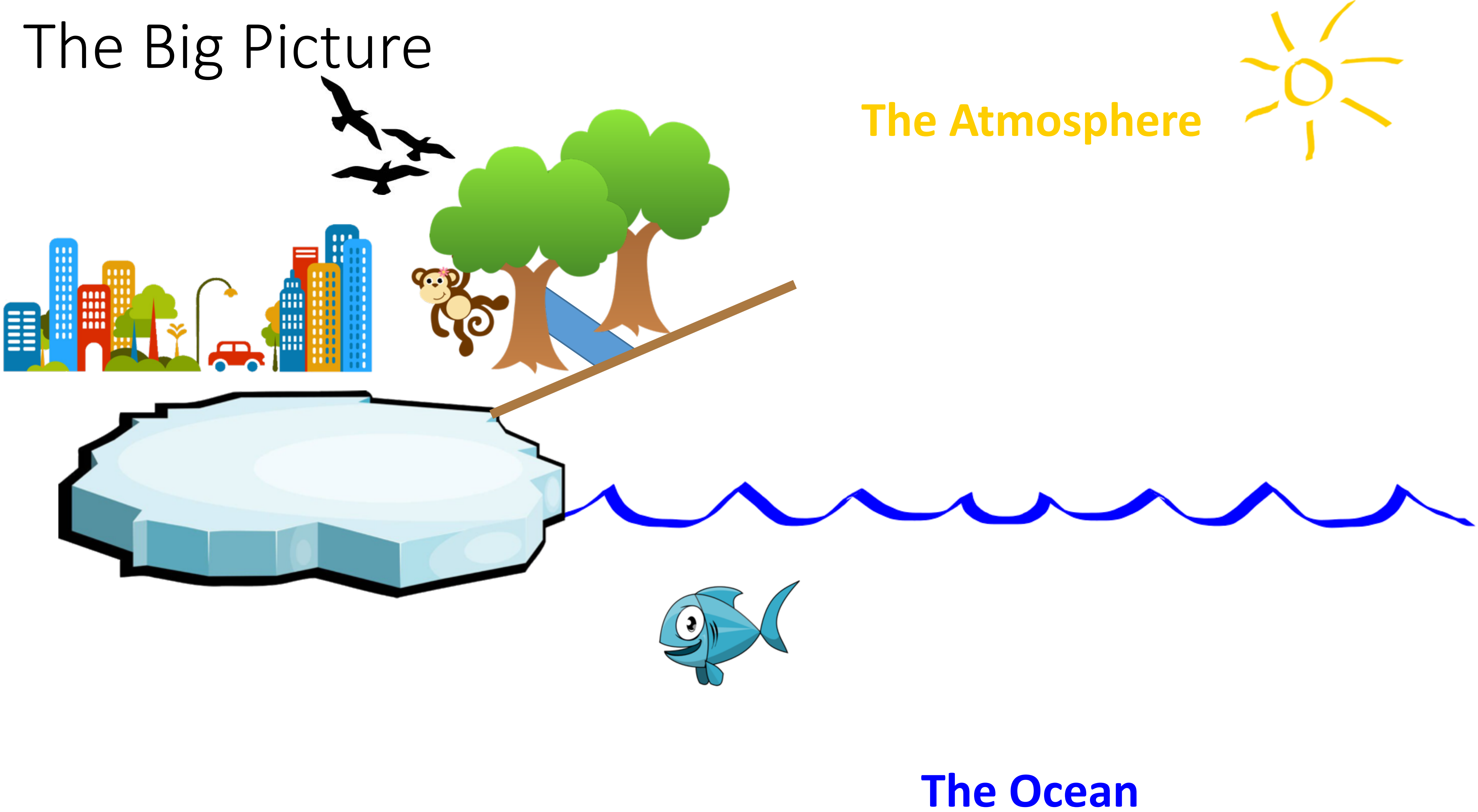


The Ocean

The Big Picture



The Big Picture



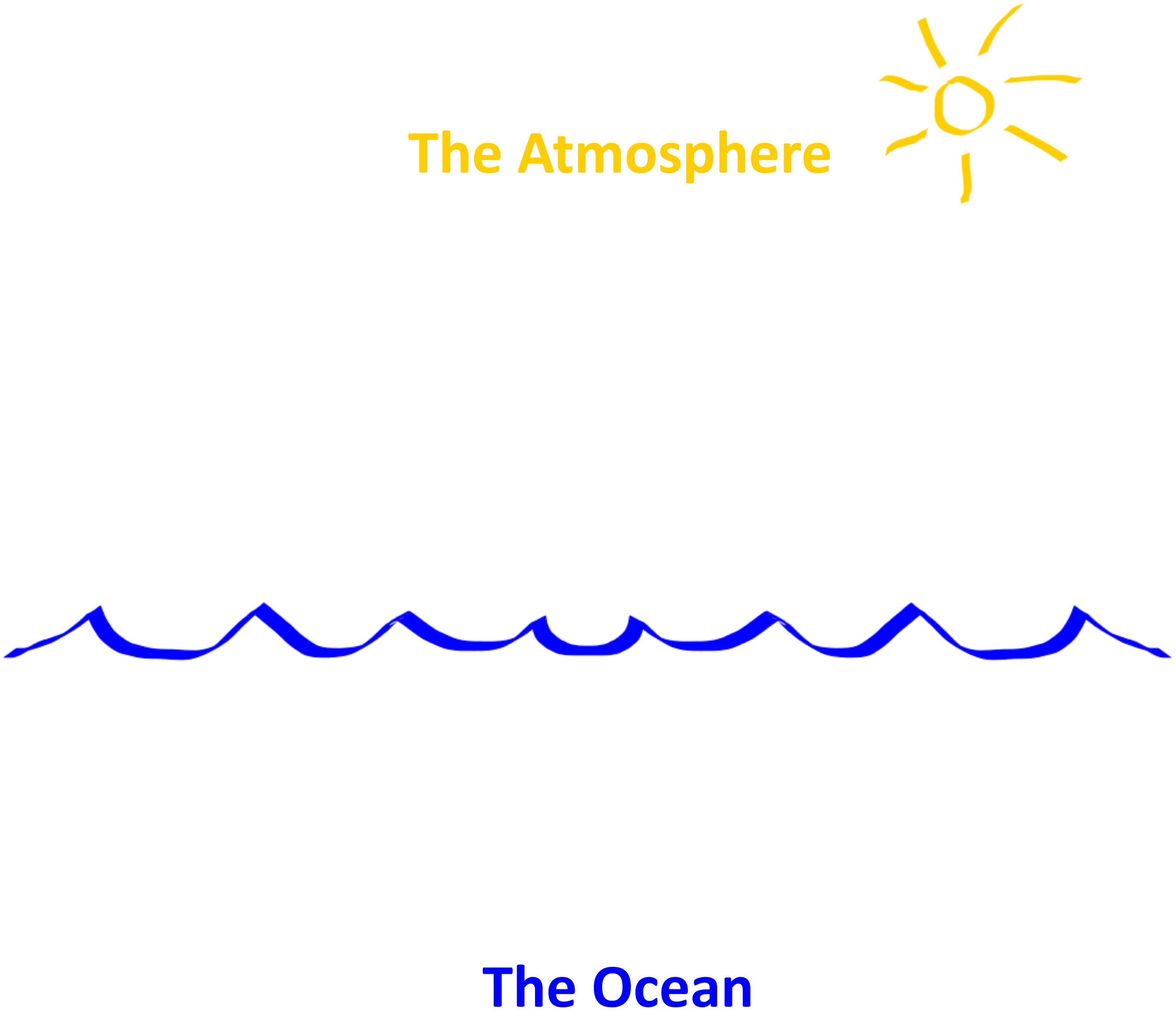
The Big Picture

The Atmosphere

The Ocean

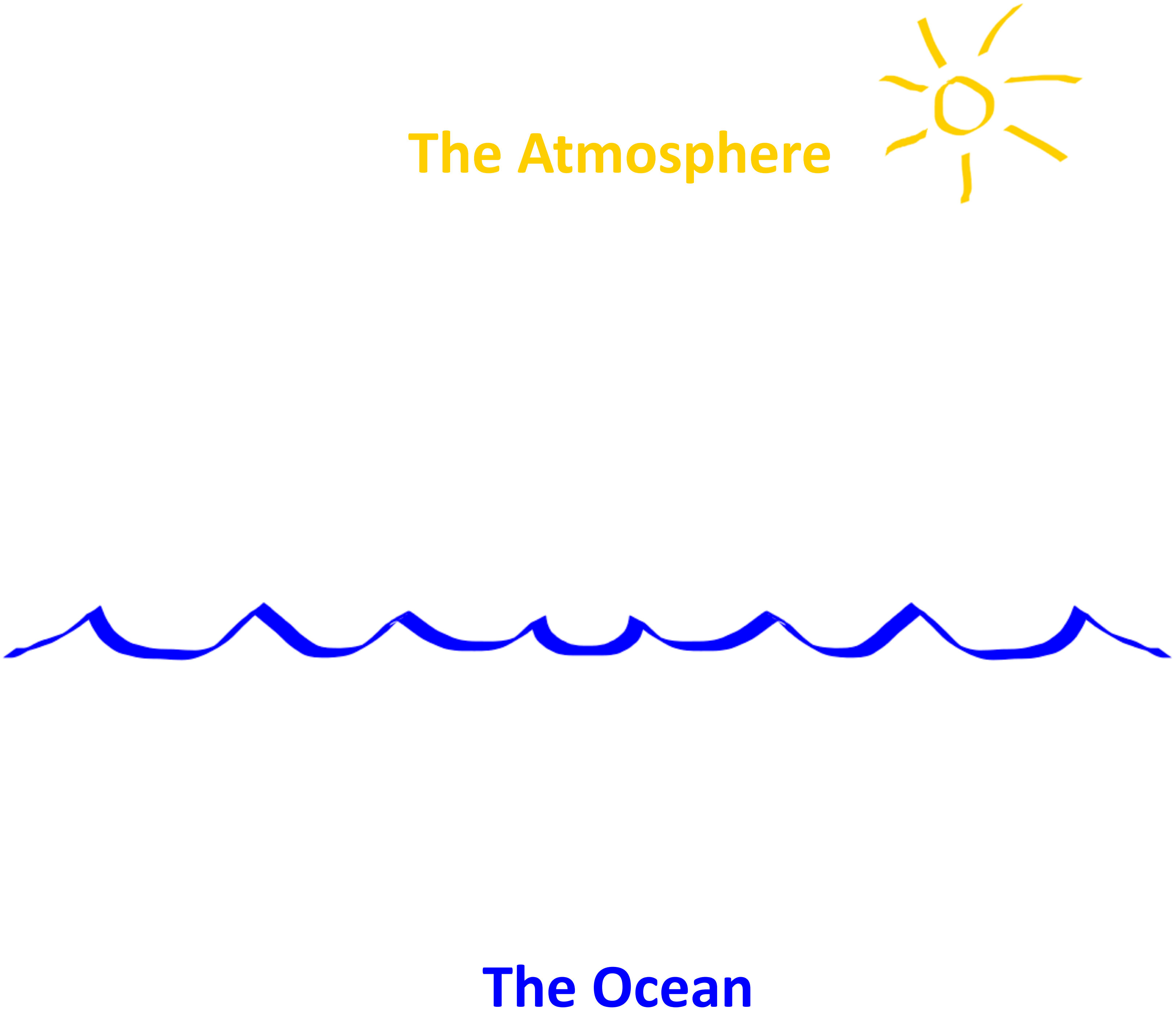
The Big Picture

- Ocean-atmosphere variability



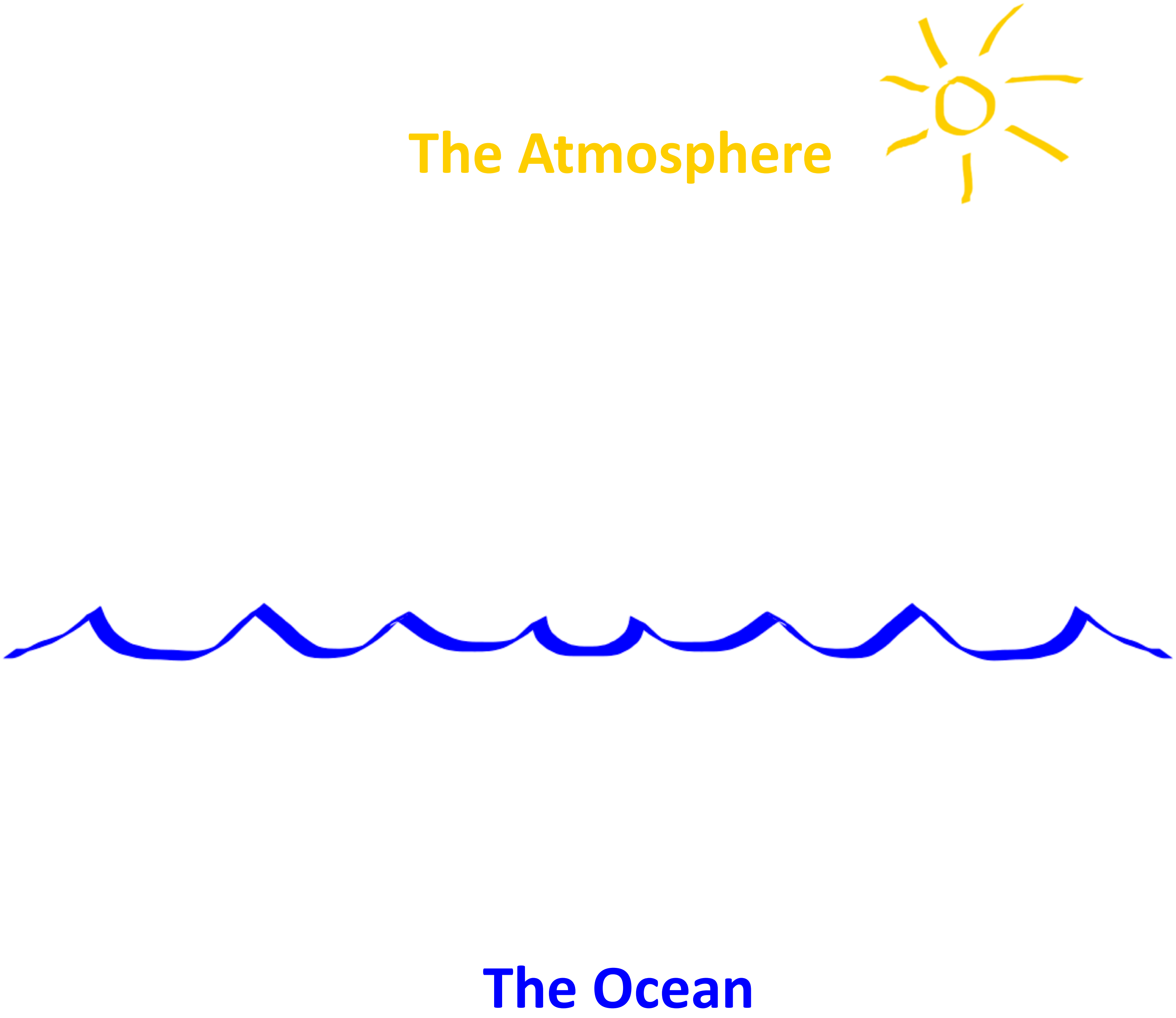
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:



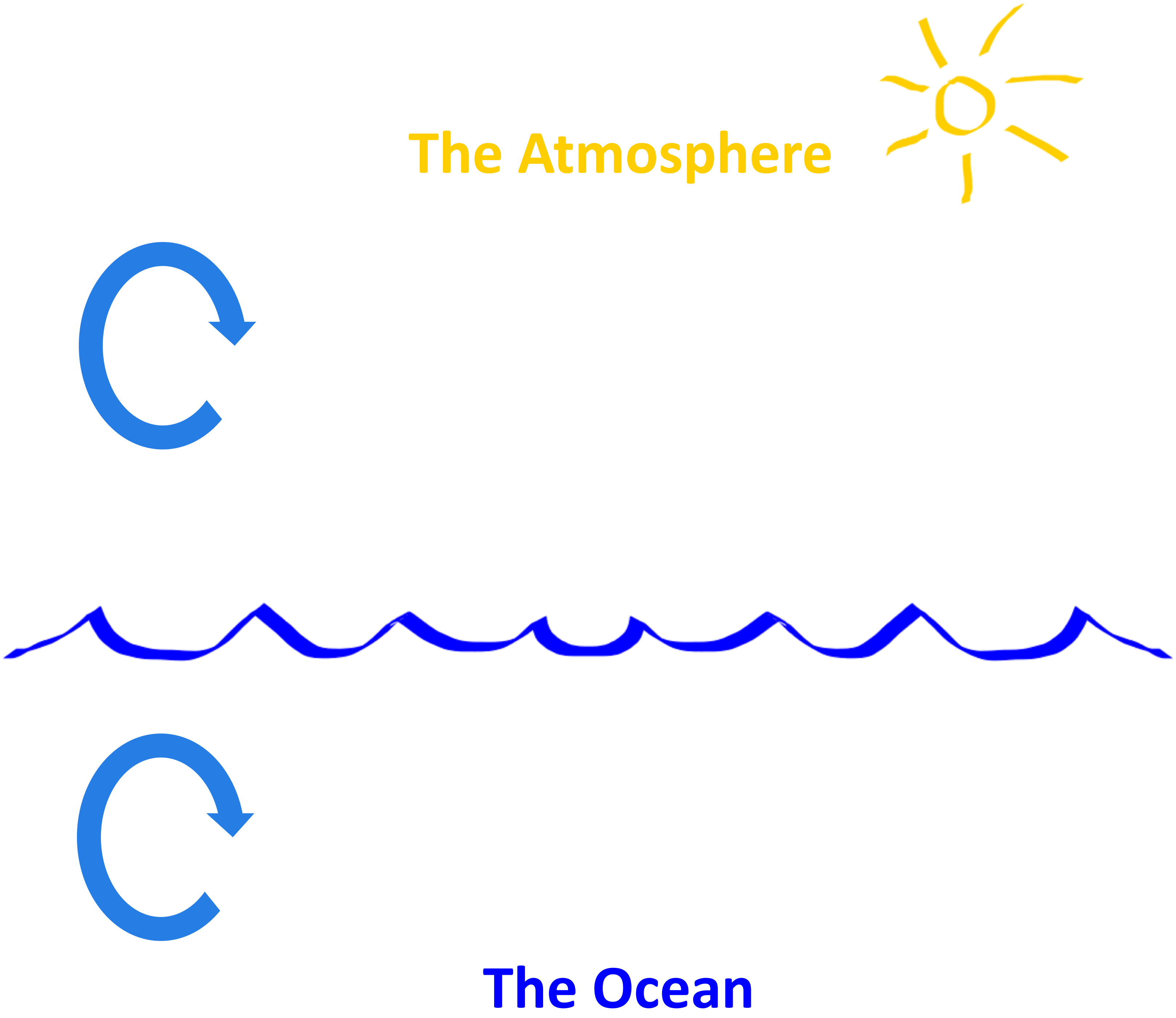
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven



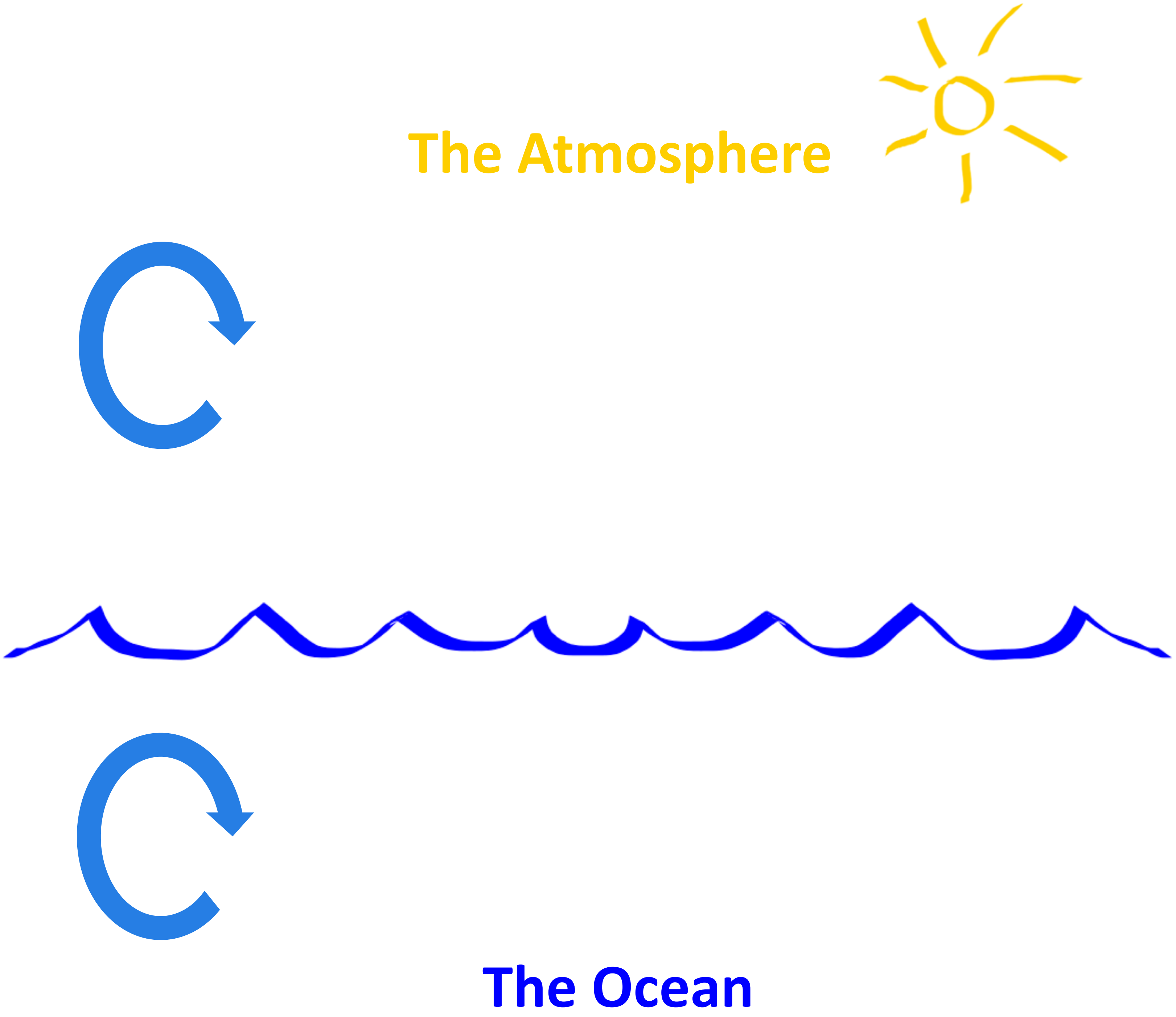
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven



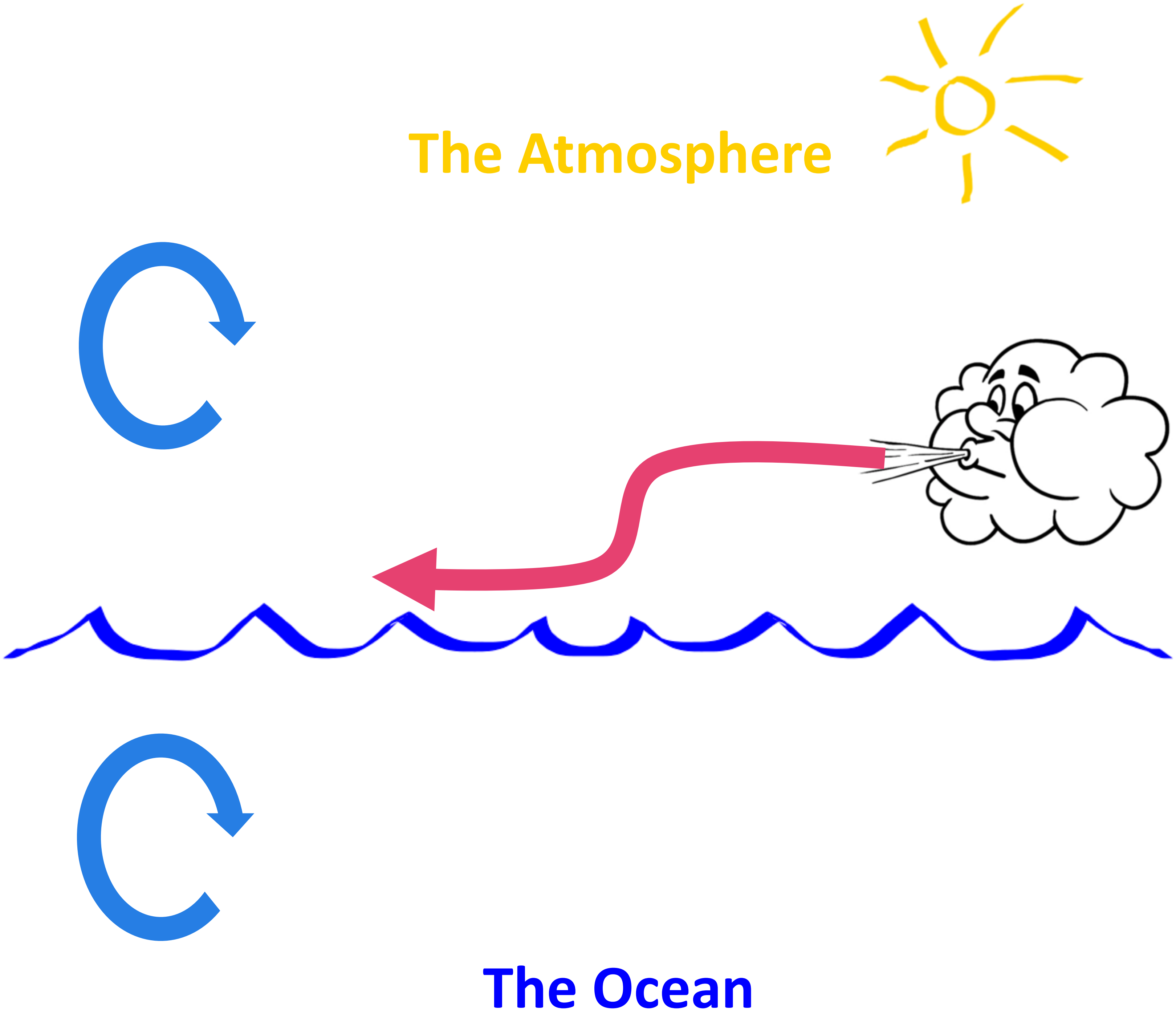
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
    - Intrinsically-driven
    - Forced by the other fluid



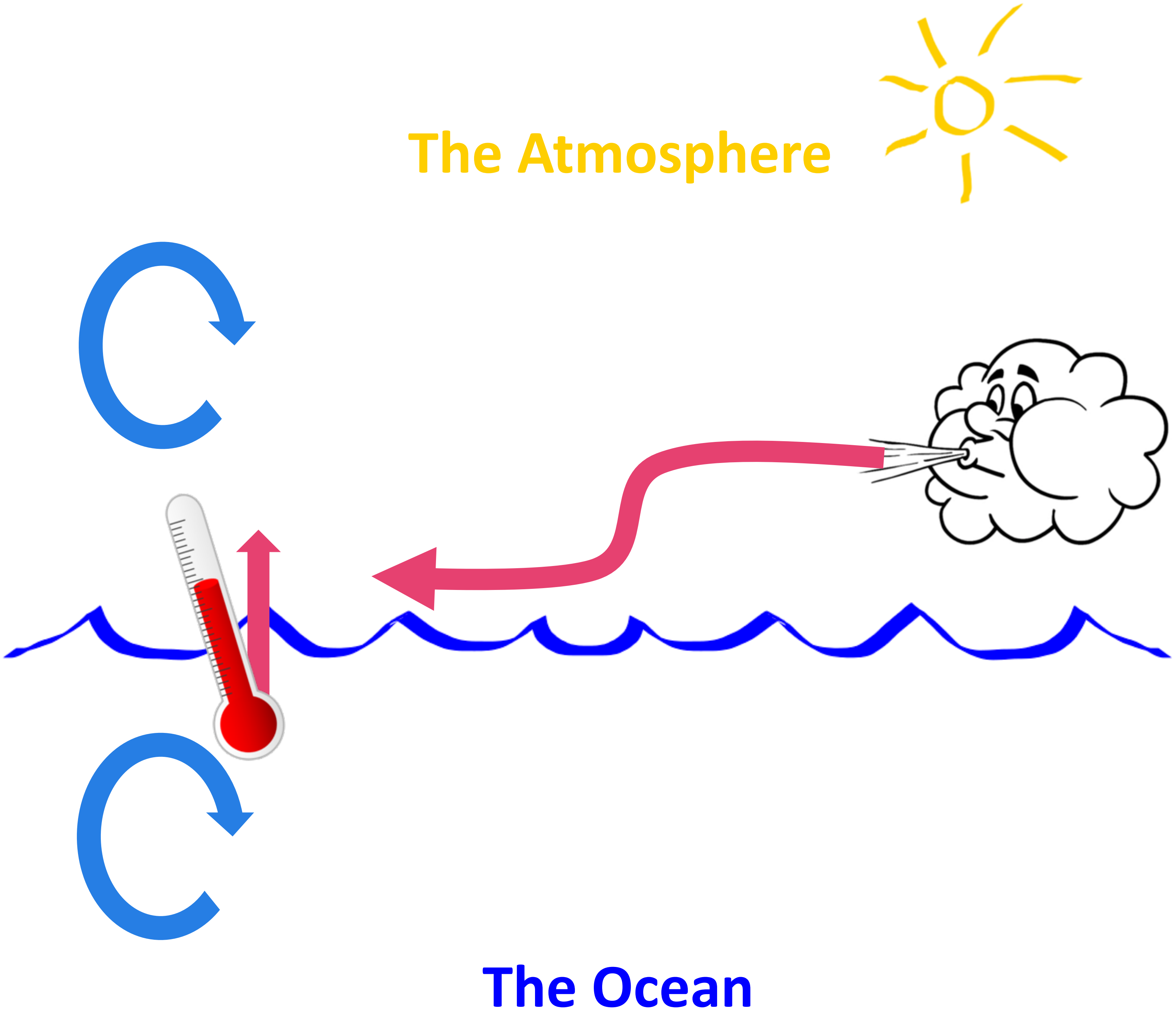
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven
  - Forced by the other fluid



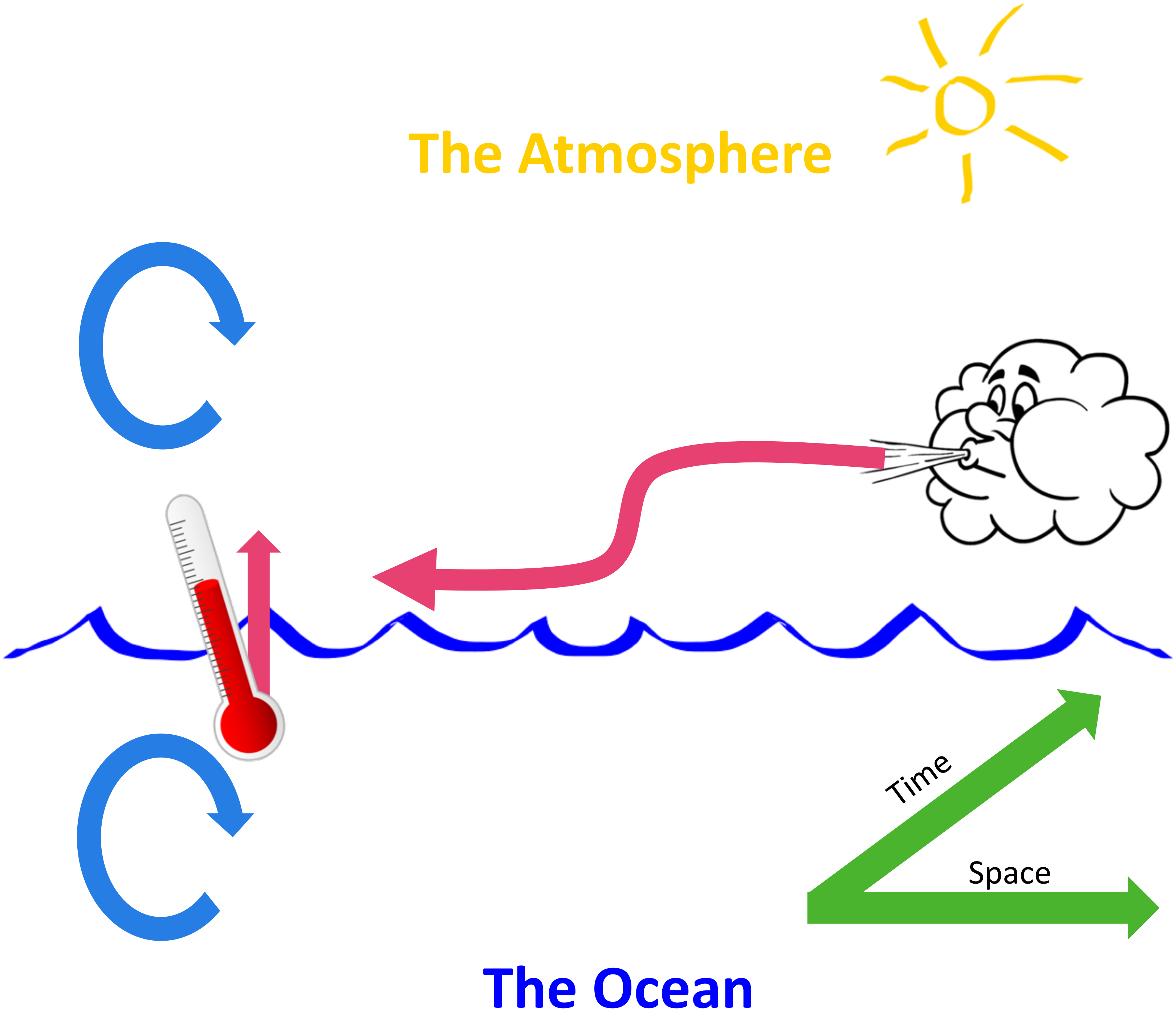
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven
  - Forced by the other fluid



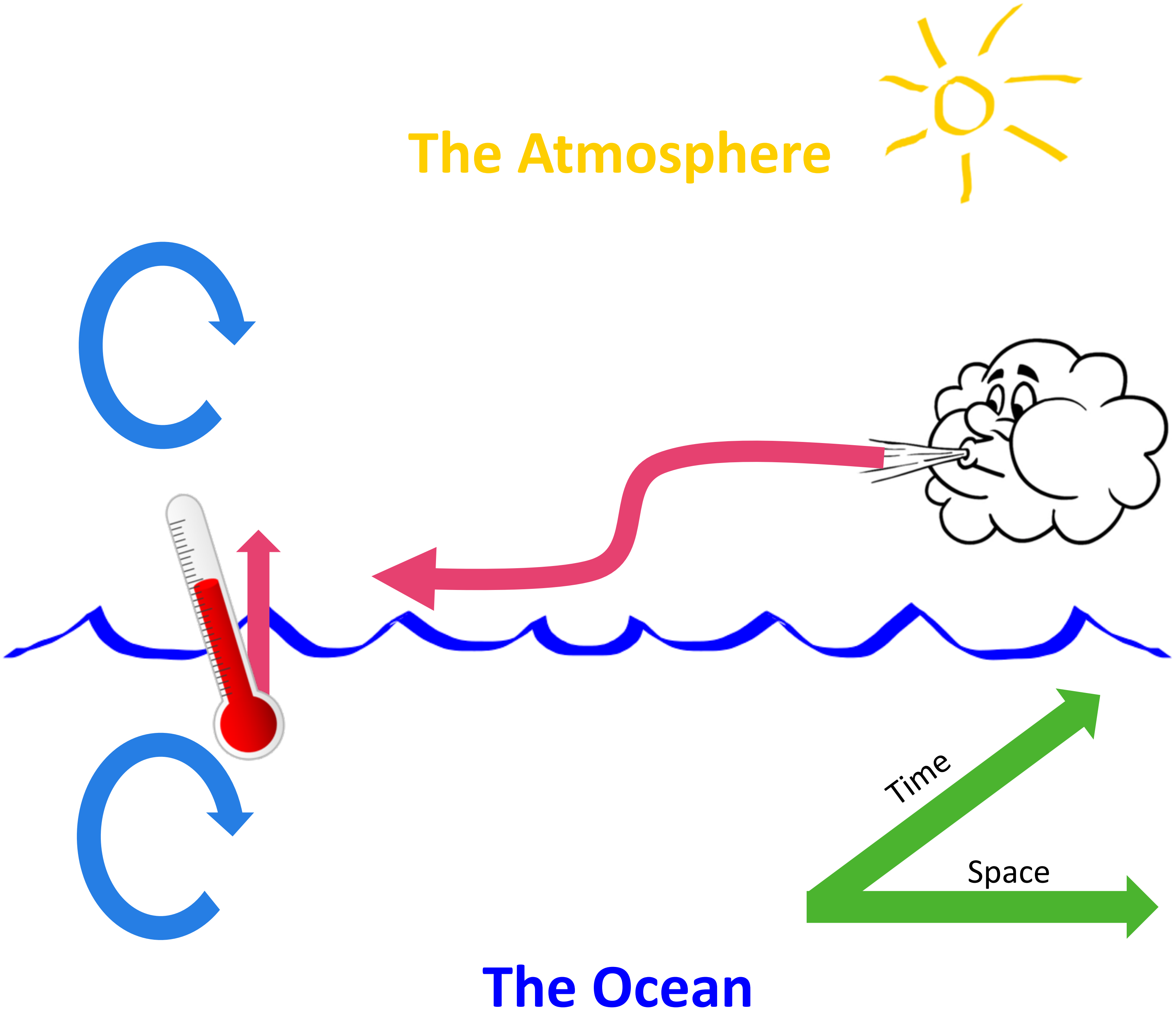
The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven
  - Forced by the other fluid
  - Across time and space scales



The Big Picture

- Ocean-atmosphere variability
- Energy exchanged in many ways:
  - Intrinsically-driven
  - Forced by the other fluid
  - Across time and space scales
- **My goal**: to understand which processes play the largest role in ocean-atmosphere variability



The Quasi-Geostrophic Coupled Model (Q-GCM)

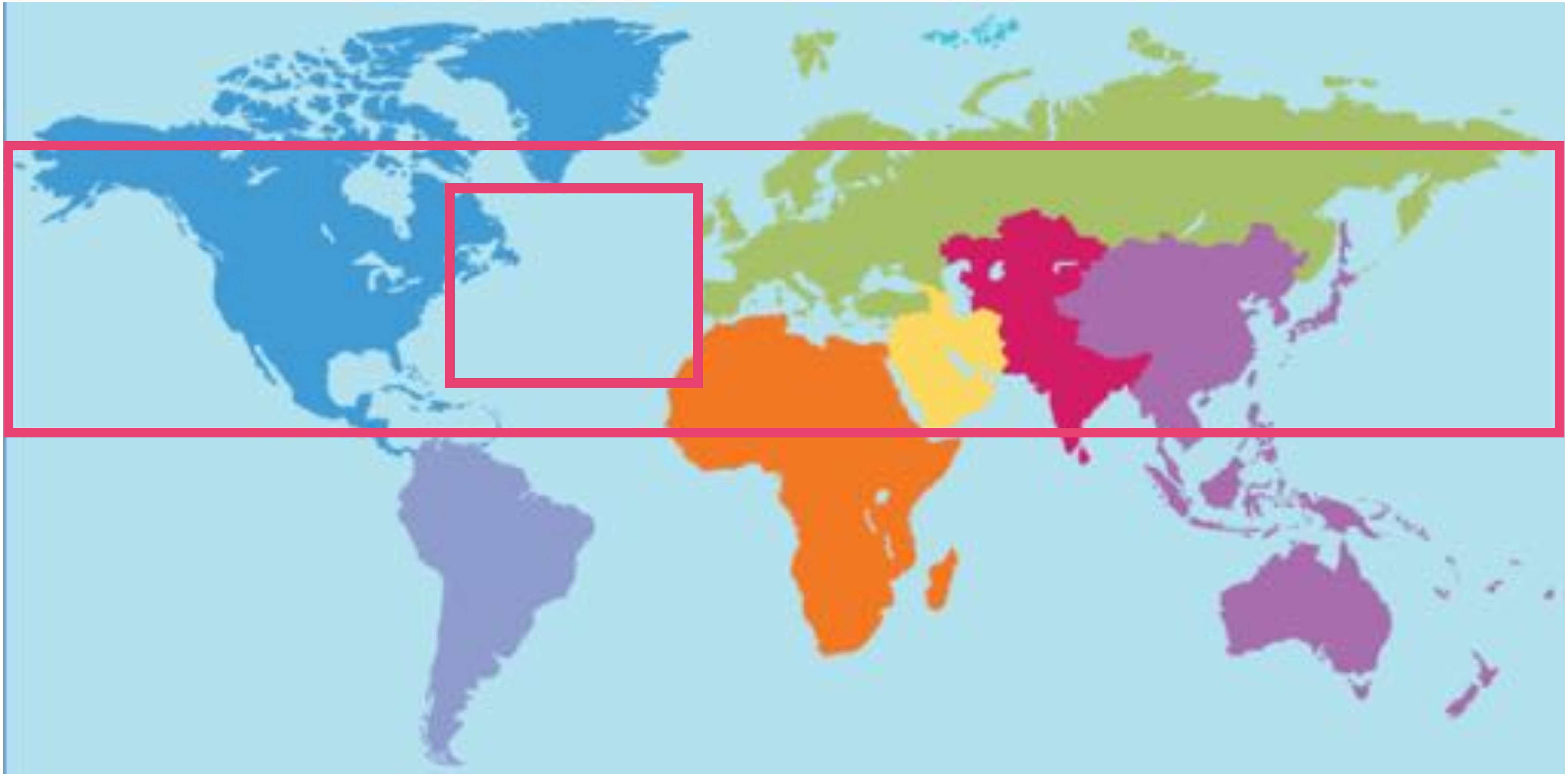
Hogg, Dewar, Killworth, & Blundell (2003)

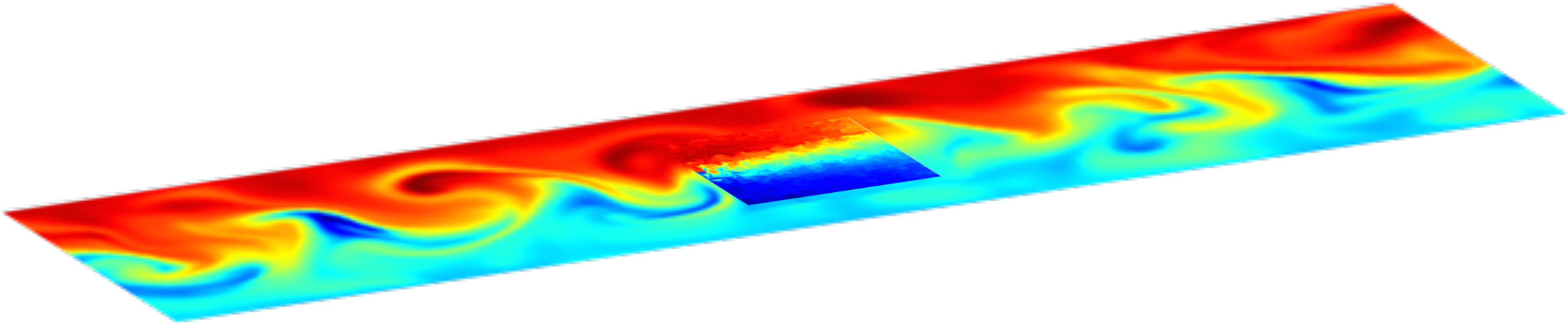
The Quasi-Geostrophic Coupled Model (Q-GCM)

Hogg, Dewar, Killworth, & Blundell (2003)

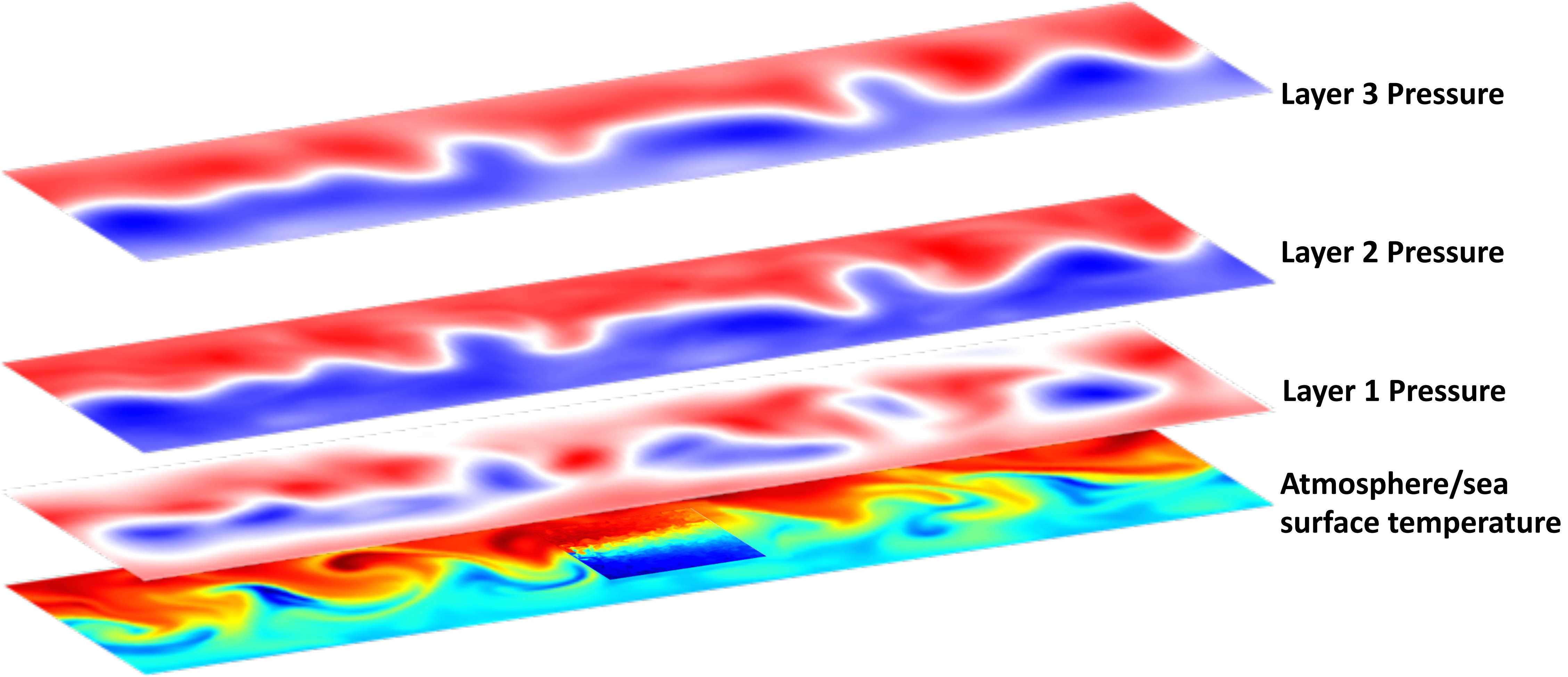
The Quasi-Geostrophic Coupled Model (Q-GCM)

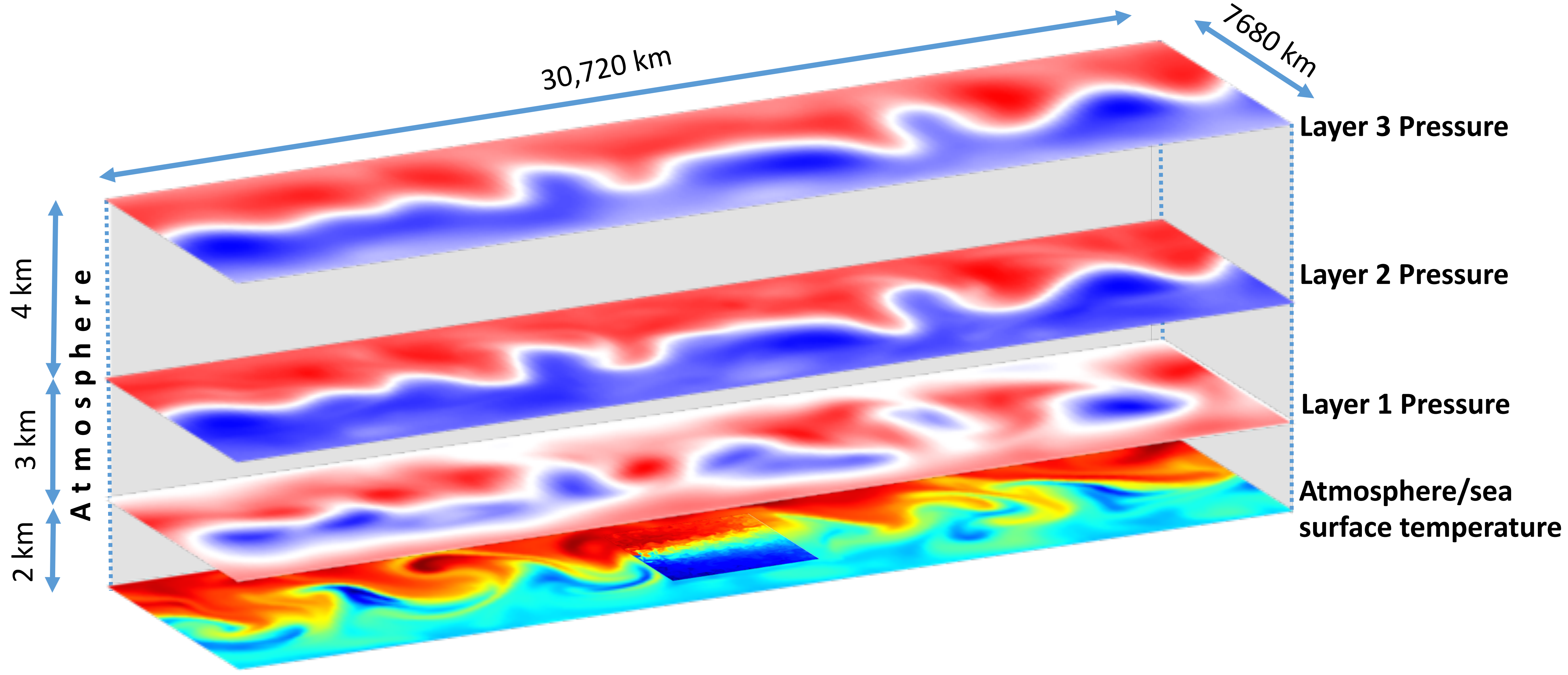
Hogg, Dewar, Killworth, & Blundell (2003)

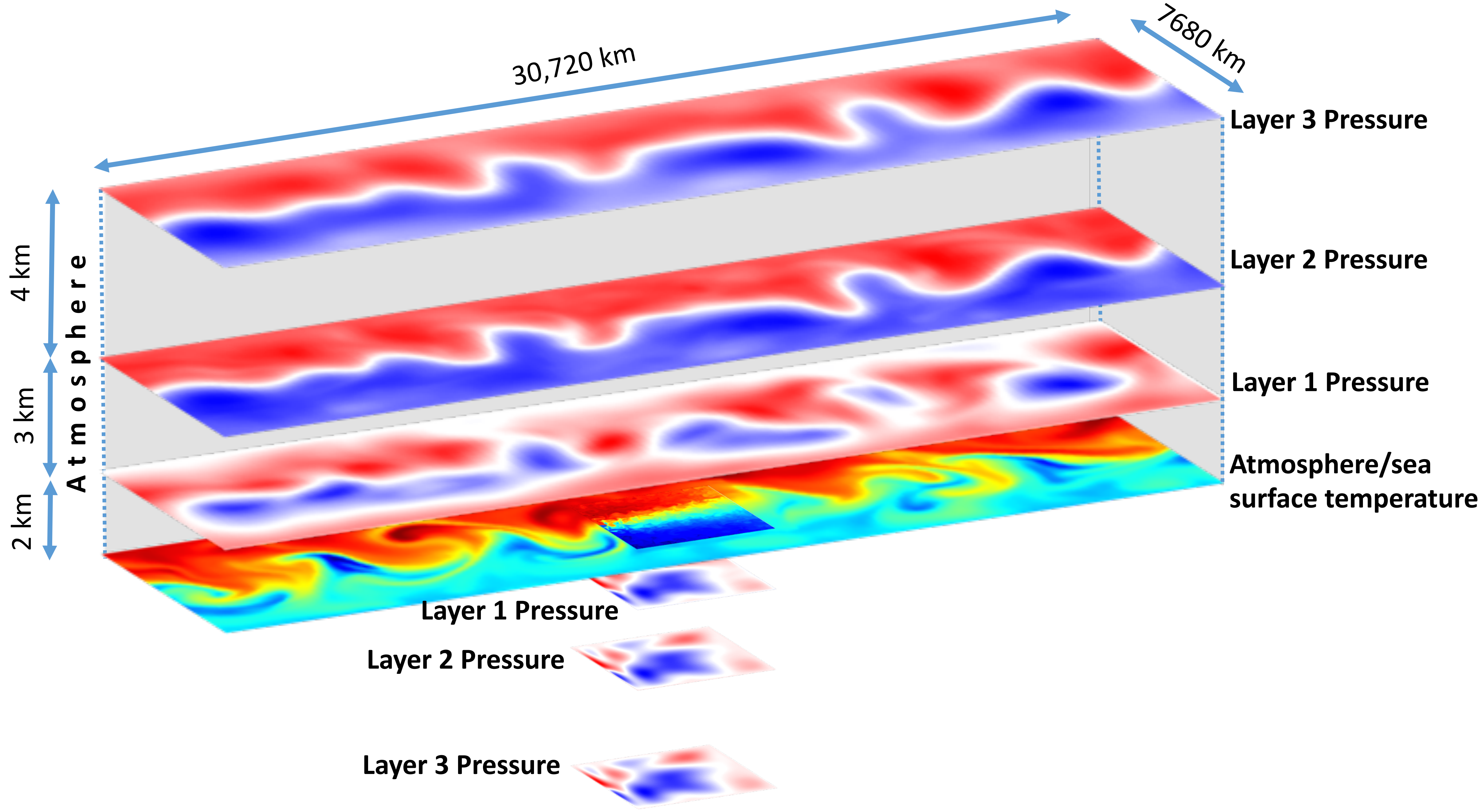




Atmosphere/sea surface temperature


Layer 3 Pressure
Layer 2 Pressure
Layer 1 Pressure
Atmosphere/sea
surface temperature


30,720 km
7680 km
Layer 3 Pressure
Layer 2 Pressure
Layer 1 Pressure
Atmosphere/sea
surface temperature
4 km
3 km
2 km
Atmosphere


30,720 km
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4 km
3 km
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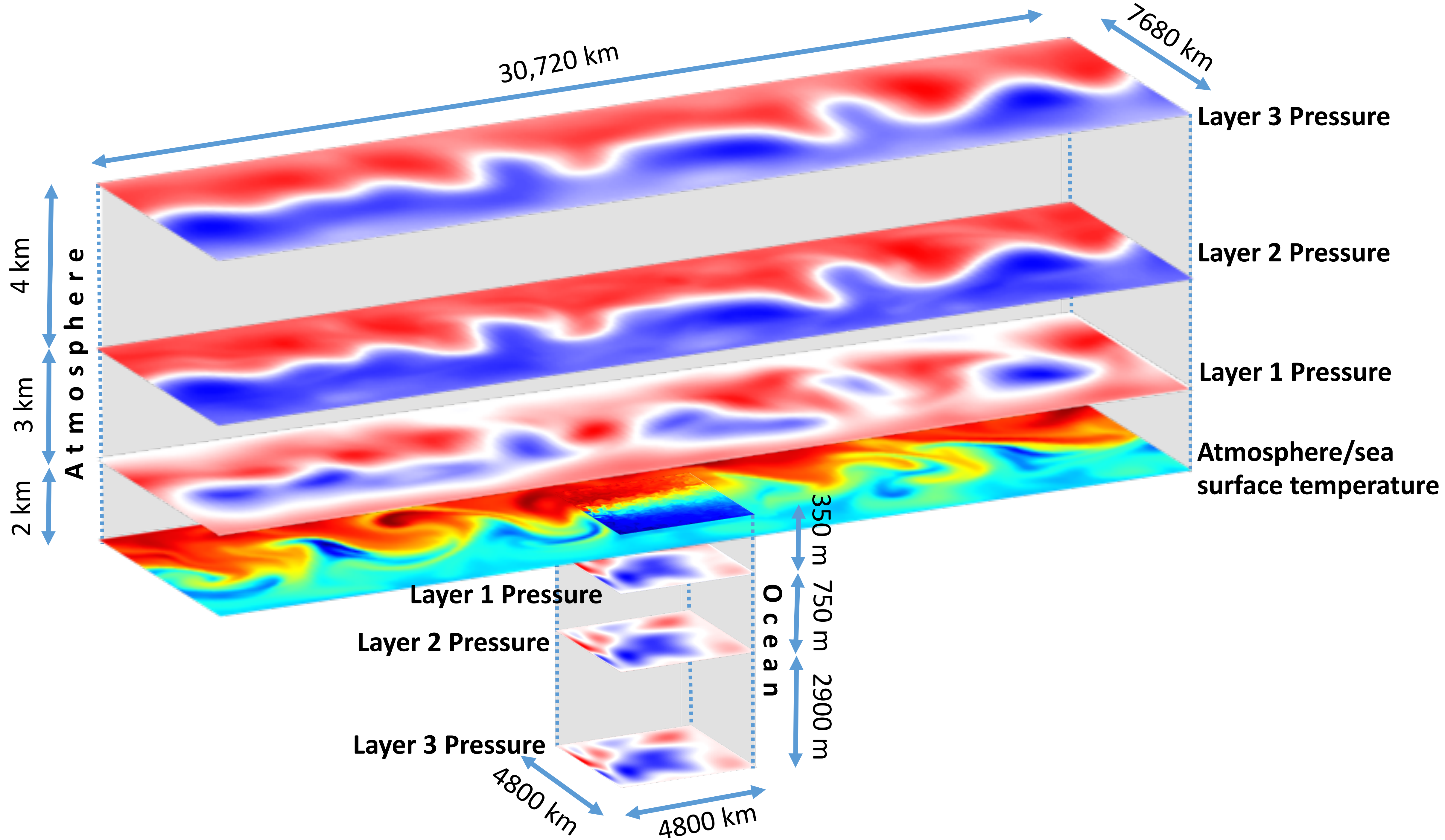
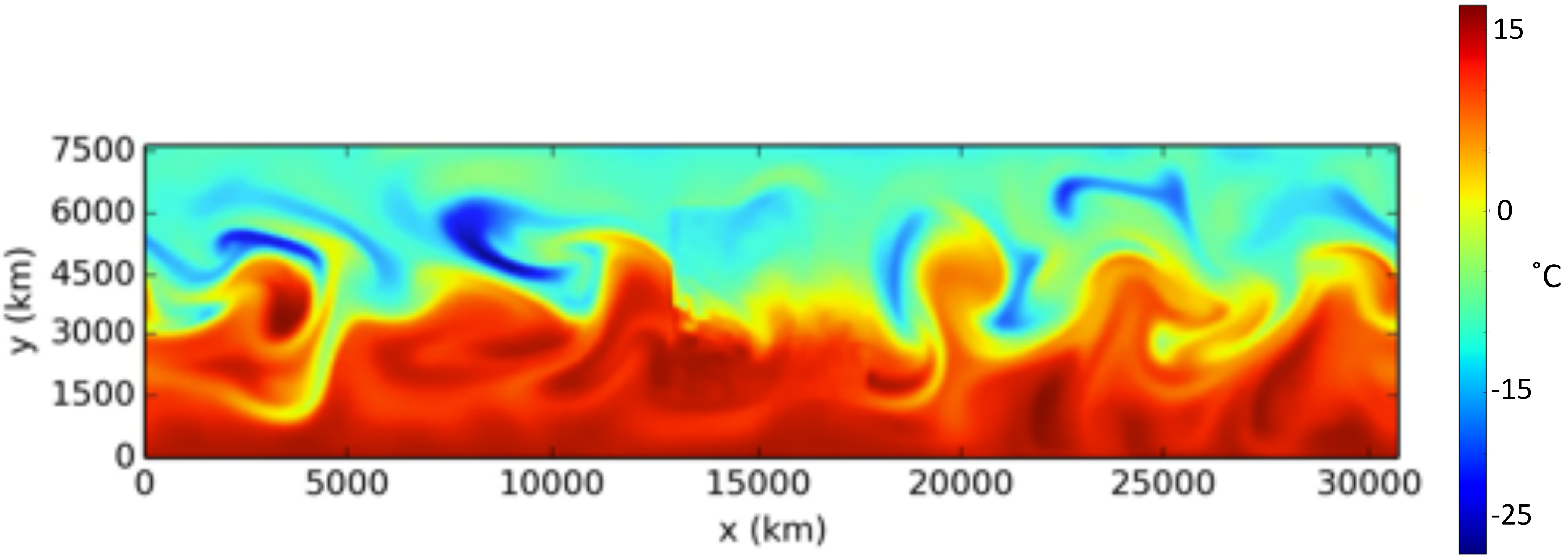
Atmosphere
Layer 1 Pressure
Layer 2 Pressure
Layer 3 Pressure

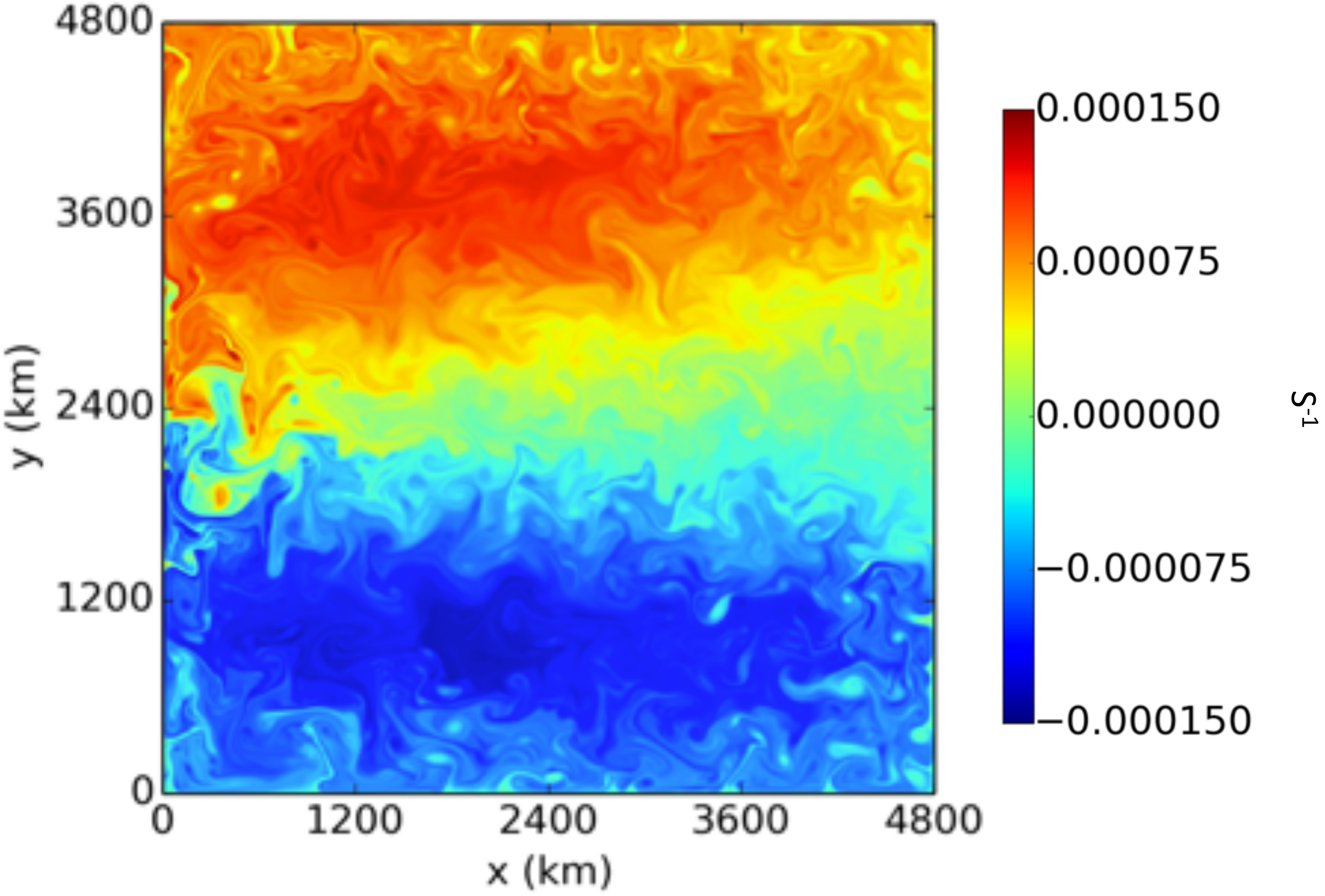


30,720 km
7680 km
Layer 3 Pressure
Layer 2 Pressure
Layer 1 Pressure
Atmosphere/sea surface temperature
4 km
3 km
2 km
Atmosphere
350 m
750 m
2900 m
Ocean
Layer 1 Pressure
Layer 2 Pressure
Layer 3 Pressure
4800 km
4800 km

Q-GCM: Atmospheric Surface Temperature Anomaly



Q-GCM: Ocean Potential Vorticity



Guess what computer language I use to do data analysis/visualization?

Guess what computer language I use to do data analysis/visualization?

Q-GCM Governing Equations

Advection, Forcing, Dissipation

$$\begin{cases} \frac{\partial}{\partial t} q_n = \frac{1}{f_0} J(q_n, p_n) + Be - \frac{A_4}{f_0} \nabla^6 p_n \\ f_0 q_n = f_0 \beta (y - y_0) + \nabla^2 p_n - f_0^2 A p_n \end{cases}$$

Planetary vorticity, Relative vorticity, Vortex stretching

Potential vorticity

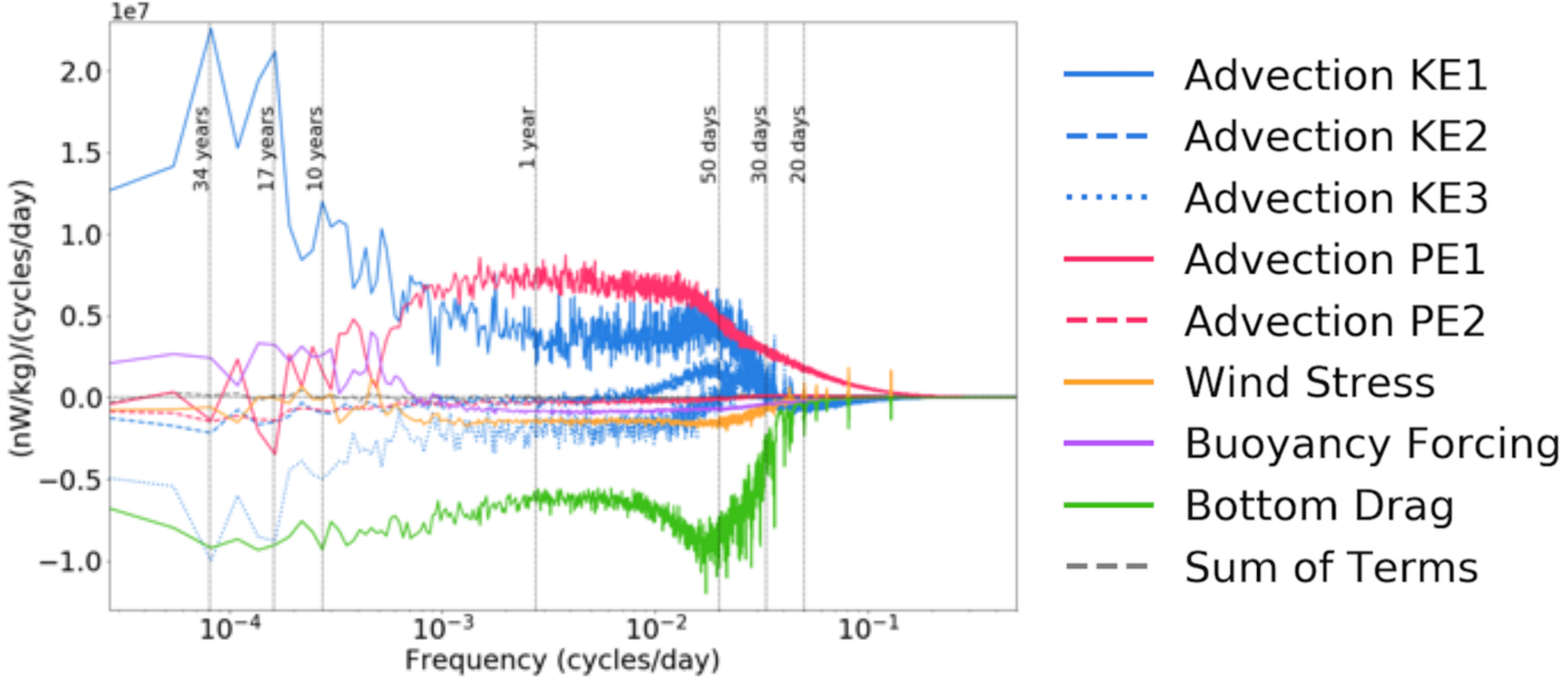
Spectral Energy Budget Equations: Ocean

$$0 = \int\int\Bigg(\underbrace{\frac{1}{f_0^3 H_{tot}} \sum_{n=1}^{3} H_n \,\mathrm{Re}\left[\widehat{p_n}^{*} J(\widehat{\nabla^2 p_n, p_n})\right]}_{\text{Advection of Kinetic Energy @ layer n}} + \underbrace{\frac{1}{f_0 g_1' H_{tot}} \sum_{i=1}^{2} \mathrm{Re}\left[(\widehat{p_{i+1} - p_i})^{*} J(\widehat{p_{i+1}, p_i})\right]}_{\text{Advection of Potential Energy @ interface i}}$$

$$+ \underbrace{\frac{1}{H_{tot}} \mathrm{Re}\left[\widehat{p_1}^{*}\widehat{w_{ek}}\right]}_{\text{Wind Stress}} - \underbrace{\frac{1}{H_{tot}} \mathrm{Re}\left[(\widehat{p_2 - p_1})^{*} \widehat{e_1}\right]}_{\text{Buoyancy Forcing}} - \underbrace{\frac{\delta_{ek}}{2 f_0 H_{tot}} \mathrm{Re}\left[\widehat{p_3}^{*} \widehat{\nabla^2 p_3}\right]}_{\text{Bottom Drag}} \Bigg) dx dy$$

Spectral Transfers: Ocean

Full Spectral Energy Budget



Thank you!

Handstanding at the ocean-atmosphere interface

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U. Michigan African Studies Center and M-Cubed program

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Groundwater Flow in Coastal Aquifers

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Groundwater

- Despite our heavy reliance on ground water, its nature remains a mystery to many people. Some find it hard to imagine that water can move underground at rates sufficient to cause discharge of millions of gallons per minute .Likewise, it is hard to understand how a domestic or irrigation well can extract several hundred gallons of water per minute out of 1 foot diameter pipe.

- More often than not, people envision that ground water exists somehow in a mysterious, hidden system of underground rivers, reservoirs, and water “veins.” Although these terms may be useful when speaking metaphorically about ground water, they are far from accurate.

Ground water is water that fills pores and fractures in the ground, much as milk fills the voids within bits of some grains in a breakfast bow!


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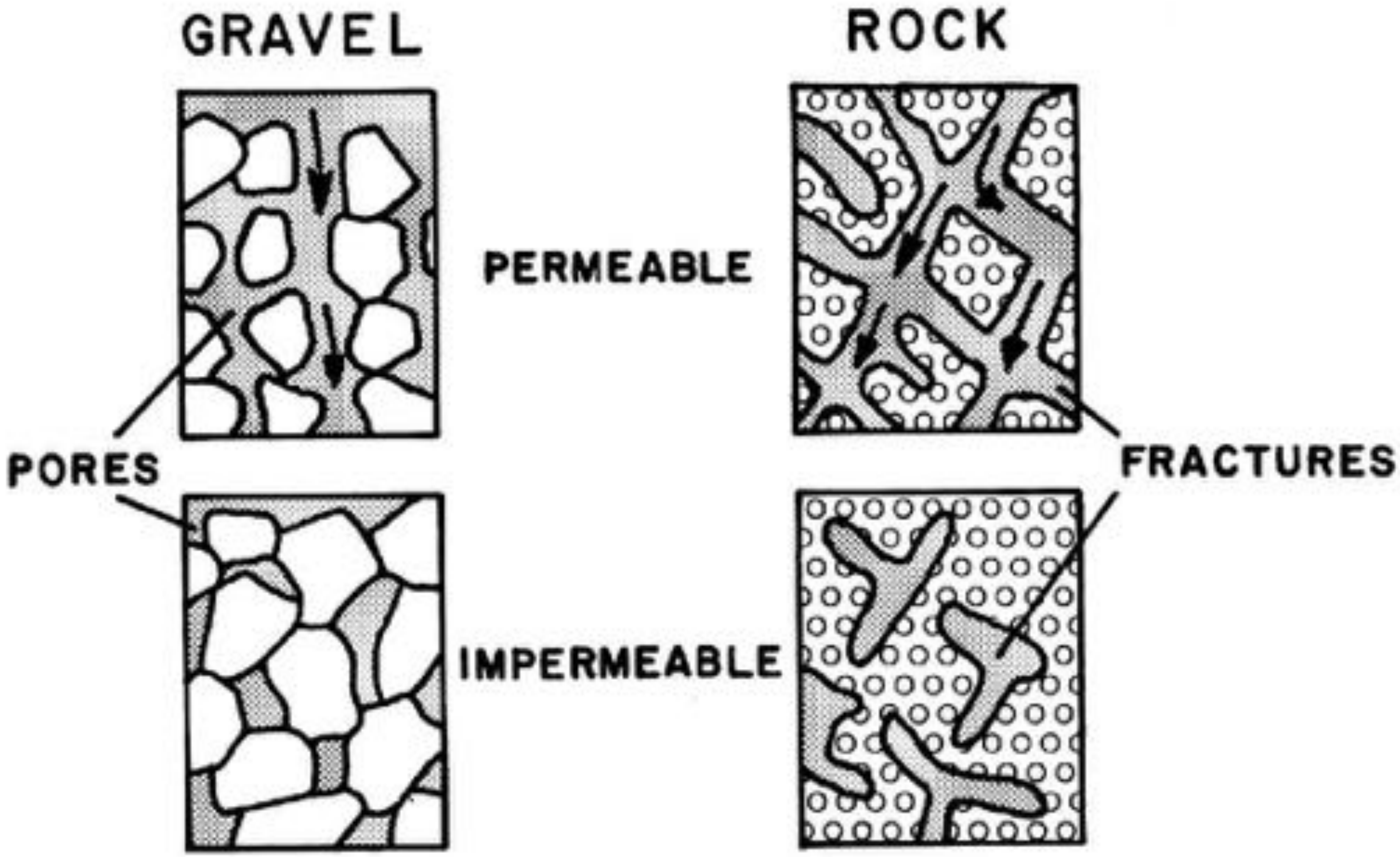
- Taking soaked Garri and Groundnut after normal Lunch

Aquifers

- An aquifer any geological formation - layer of sand, gravel, soil, or rock that is saturated, and able to transmit groundwater in sufficient quantities for domestic and industrial purposes.
- The amount of ground water that can flow through soil or rock depends on the size of the spaces in them and how well the spaces are connected. The amount of spaces is the ***porosity*** and the measure of how well the spaces are connected is the ***permeability.***

Types of Aquifers

- **Common Aquifers**: unconsolidated sand and gravel, sandstone, dissolved/fractured limestone, lava flows, fractured crystalline rocks
- **Aquiclude**: Impermeable layers which will not transmit or store groundwater, tend to form the upper or lower boundaries of aquifers
- **Aquitard** = "leaky" aquiclude: low permeability layers which transmit groundwater at very slow rates in both vertical and/or horizontal directions. More permeable than aquiclude


GRAVEL
ROCK
PERMEABLE
PORES
FRACTURES
IMPERMEABLE

Types of Aquifers : Confined, Unconfined, Perched

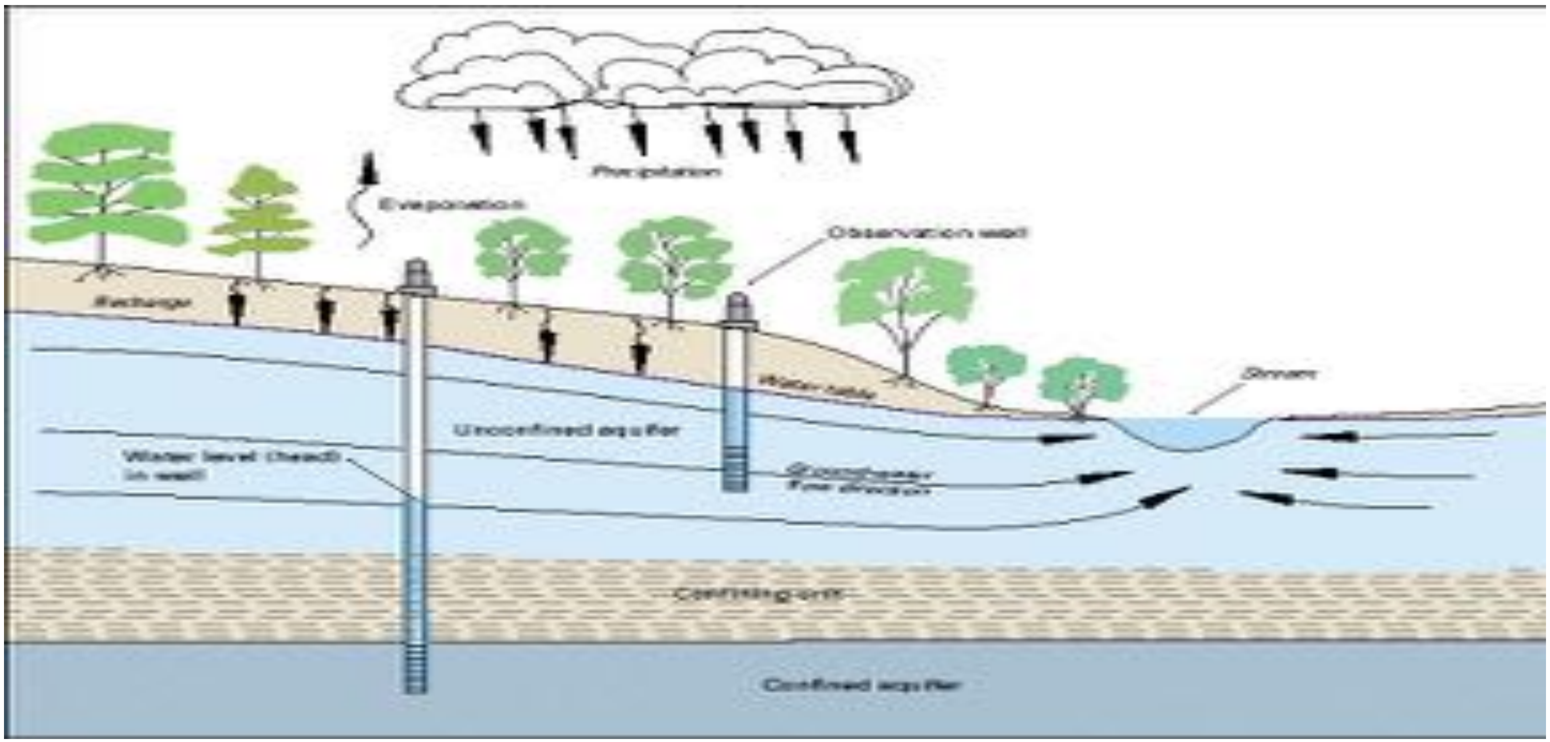


Figure A: Schematic cross sectional diagram showing layered system with an upper unconfined aquifer above a confining unit, and underlain by a confined aquifer. Note the water level in the two wells: In the unconfined aquifer the water level in the well is the same as the height of the water table. In the confined aquifer, the water level is higher than the top of the aquifer – indicating that the aquifer is fully saturated and that the water is under pressure.

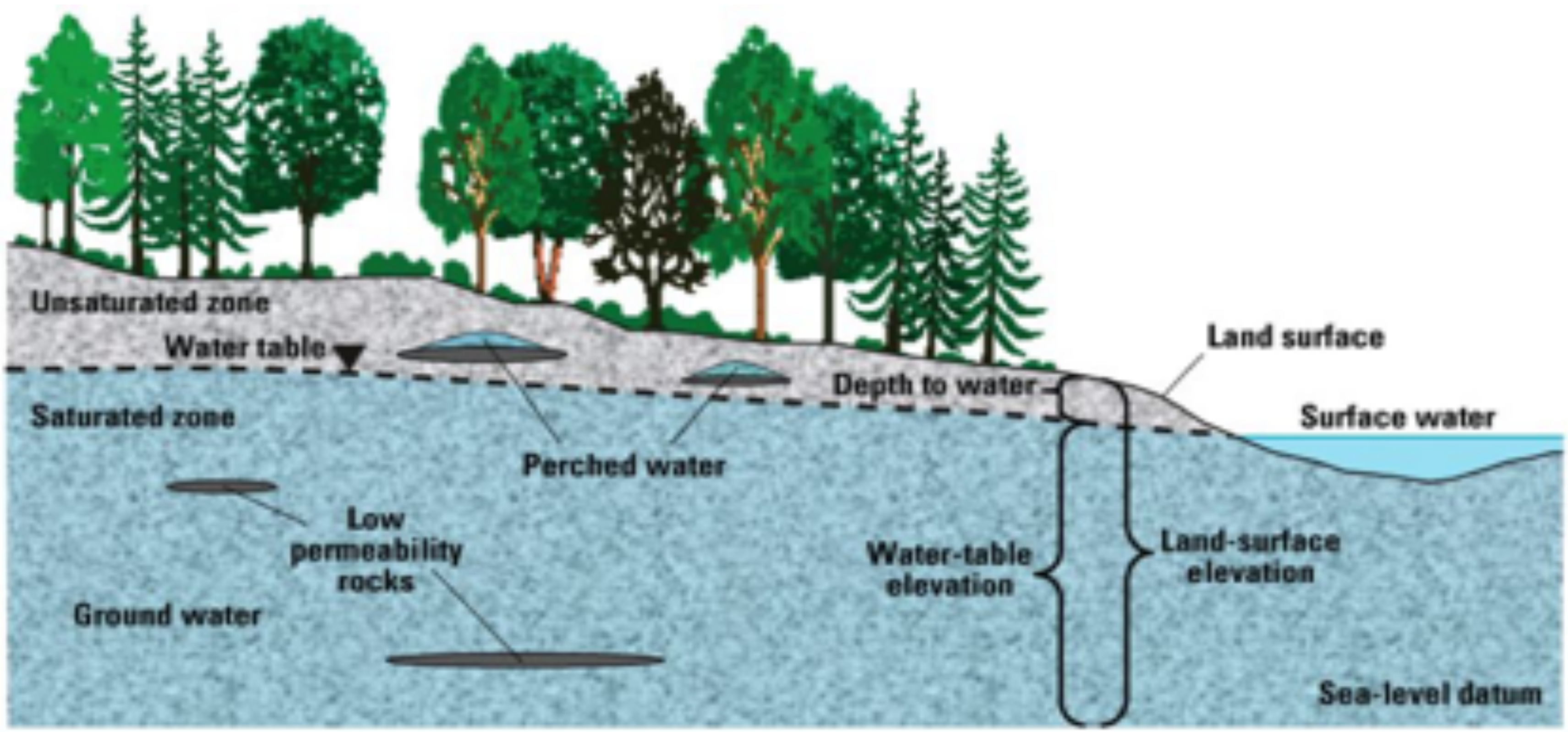


Figure B: Schematic cross section showing occurrence of Perched aquifers above an unconfined aquifer.

Occur above discontinuous aquitards, which allow groundwater to "mound" above them. They are perched, because they sit above the regional water table, and within the regional vadose zone (i.e. there is an unsaturated zone below the perched aquifer).

Aquifer Characteristics

- **Transmissivity**- measure of the amount of water that can be transmitted horizontally through an aquifer unit by the full saturated thickness of the aquifer

$$T = Kb \qquad 1.0$$

- **Storativity** = storage coefficient. Volume of water that a permeable unit will absorb or expel from storage per unit surface area per unit change in head .

Groundwater flow

- Subsurface flow of groundwater is driven by differences in energy – water flows from high energy areas to low energy

- The mechanical energy of a unit volume of water is determined by the sum of Gravitational potential energy (GPE), pressure energy (PE), and kinetic energy (KE):

$$Energy\ per\ unit\ Volume = \boldsymbol{\rho g z} + \boldsymbol{P} + \frac{\boldsymbol{\rho V^2}}{\boldsymbol{2}} \qquad (2.0)$$

- ρ is fluid density, g gravitational acceleration, z is elevation, P is fluid pressure , and V is fluid velocity

- If we let go of K.E component i.e $\frac{\rho V^2}{2} = 0$

Then

- $Energy\ per\ unit\ weight\ = Hydraulic\ Head\ = z + \frac{P}{\rho g}$ 3.0

- Since groundwater flow depends on aquifer permeability, we can get Groundwater Flow rate (GFR) from Darcy law

- States that flow rate is linearly proportional to the hydraulic gradient

$$q = -\frac{\rho g k}{\mu}(\nabla h) \quad 4.0$$

q is the Darcy flux, or flow rate per unit surface area, μ is fluid viscosity

-
- In inland aquifer, the density of groundwater is constant and [4]is reduced to the simpler form of Darcy's law [3].

- In coastal aquifers, however, saline water is present along the coast .

  so

$$\rho \neq constant$$

Therefore a more inclusive form of Darcy's law [4], is required.

Groundwater Contamination - Saltwater Intrusion(SWI)

- **SWI** is the first cause of contamination of coastal aquifers
- The higher pressure and density of saltwater causes it to move into coastal aquifers in a wedge shape under the freshwater. The saltwater and freshwater meet in a transition zone where mixing occurs through dispersion and diffusion.
- Human activities especially in the coastal areas have altered the hydrodynamic equilibrium between freshwater and saltwater

Control of SWI

- reduction of the abstraction rates
- relocation of abstraction wells
- subsurface barriers
- natural recharge
- artificial recharge
- abstraction of saline water, and
- Abstraction, Desalination and Recharge (ADR), consists of three steps; abstraction of brackish water from the saltwater zone, desalination of the abstracted brackish water using RO treatment process, and recharge of the treated water into the aquifer

Questions you may want to ask

-
- How does water get into the ground?
- How do one get water out of the ground?
- **Obtained by drilling or digging wells.**
- **A well is a pipe in the ground that fills with ground water.**
- **You bring this water to land surface by a pump.**
- Can groundwater be exhausted?
- **Shallow wells may become dry if the water table falls below the bottom of the well (Diagram)**
- **May happen when $Discharge > Recharge$ especially during dry season**

Thank You For your Attention

Felix Uba