Towards a profound digital transformation of climate change ecosystem for sustainable mitigation and adaption climate actions and services in West Africa: benefits, challenges, and opportunities

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Combating Climate Change. Improving Livelihoods

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Climate change Ecosystem

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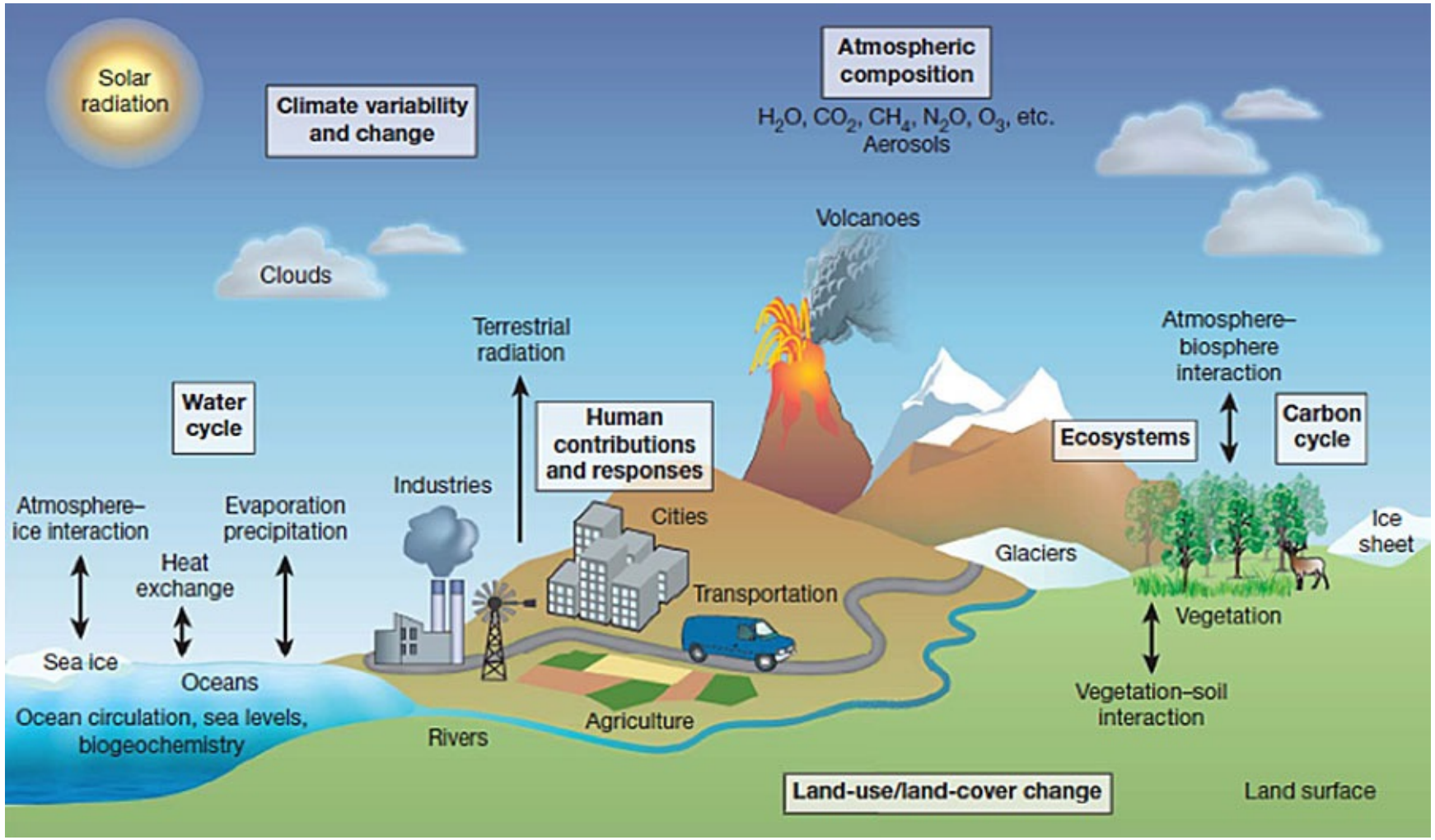
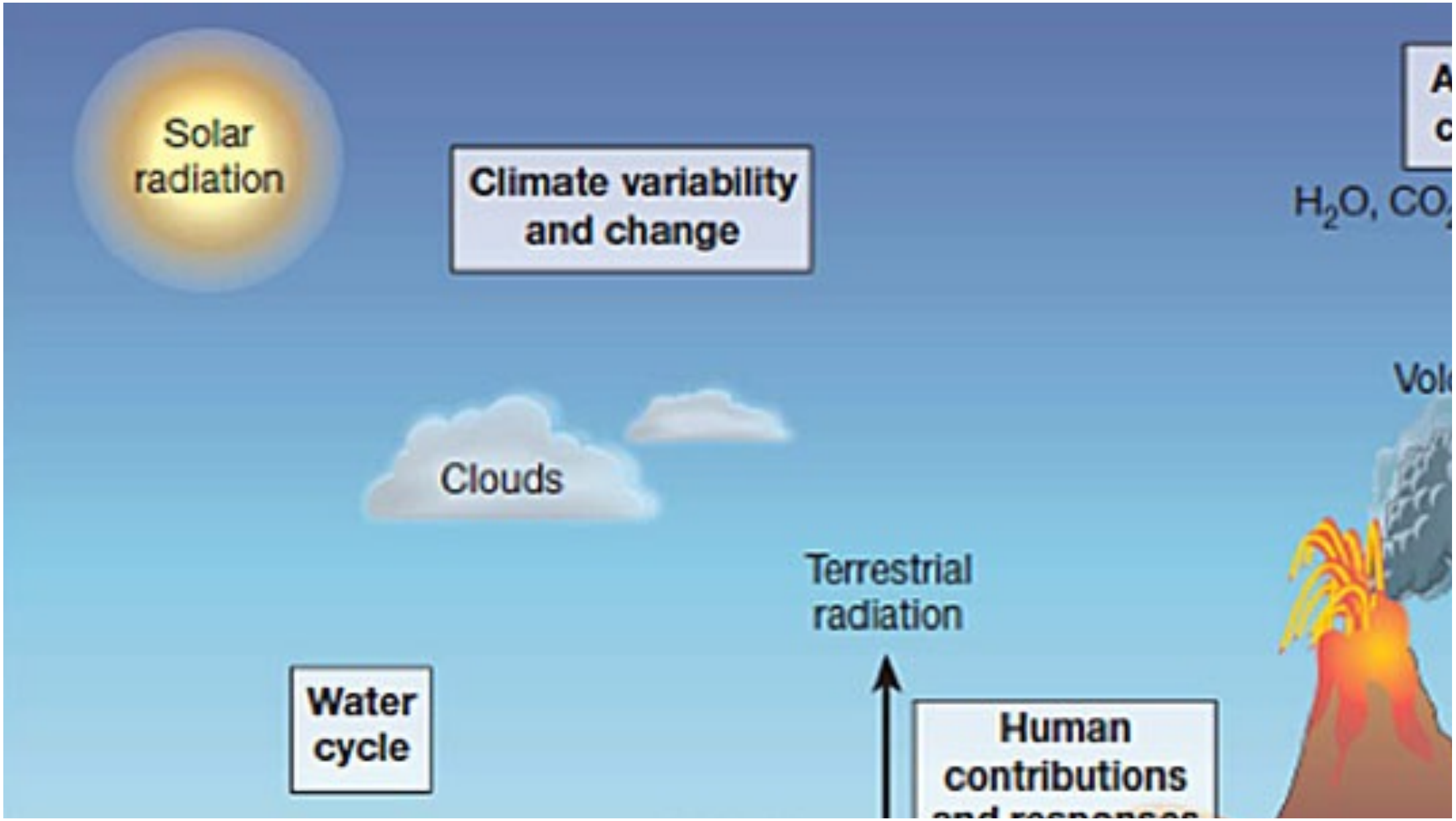
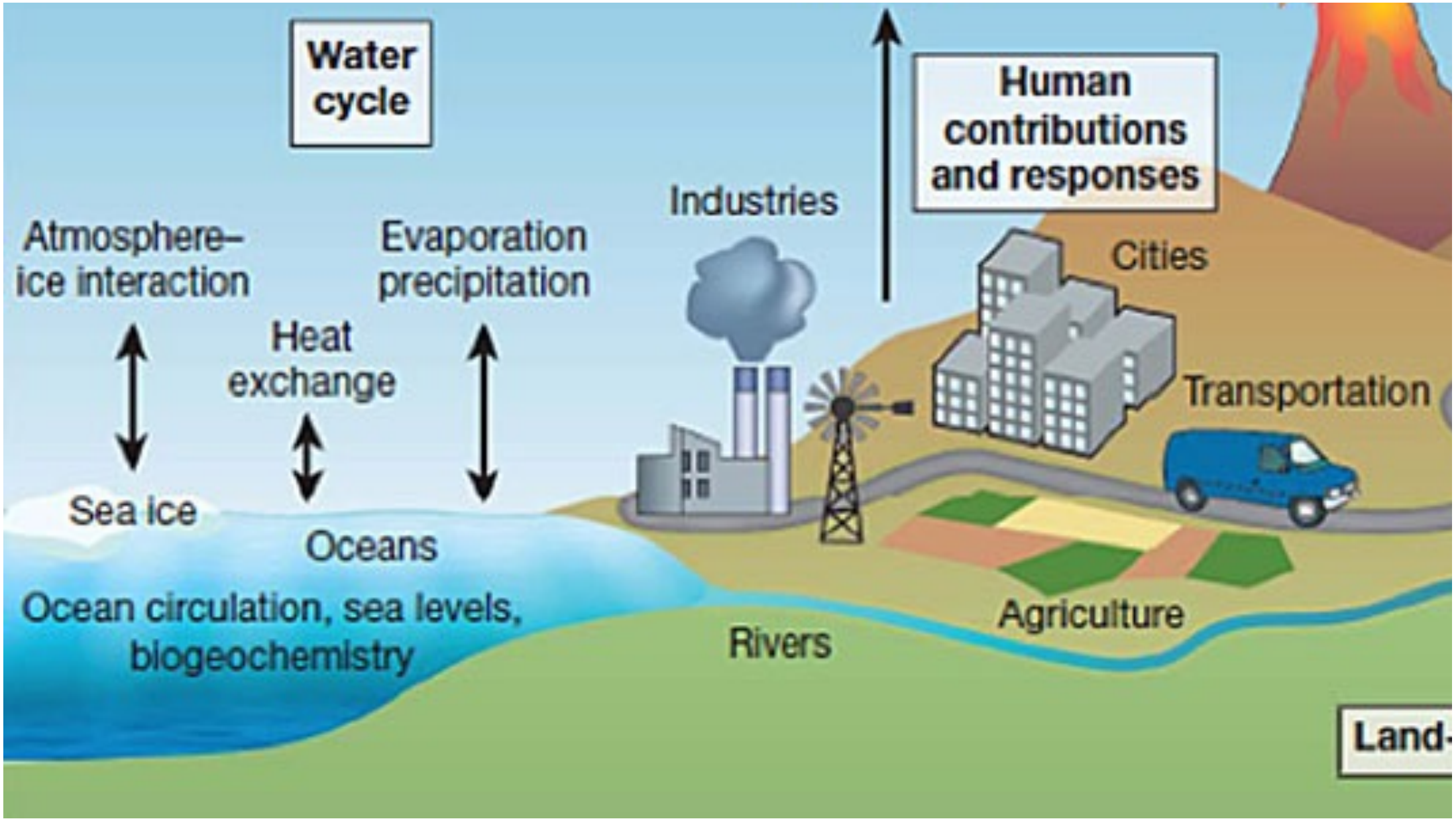
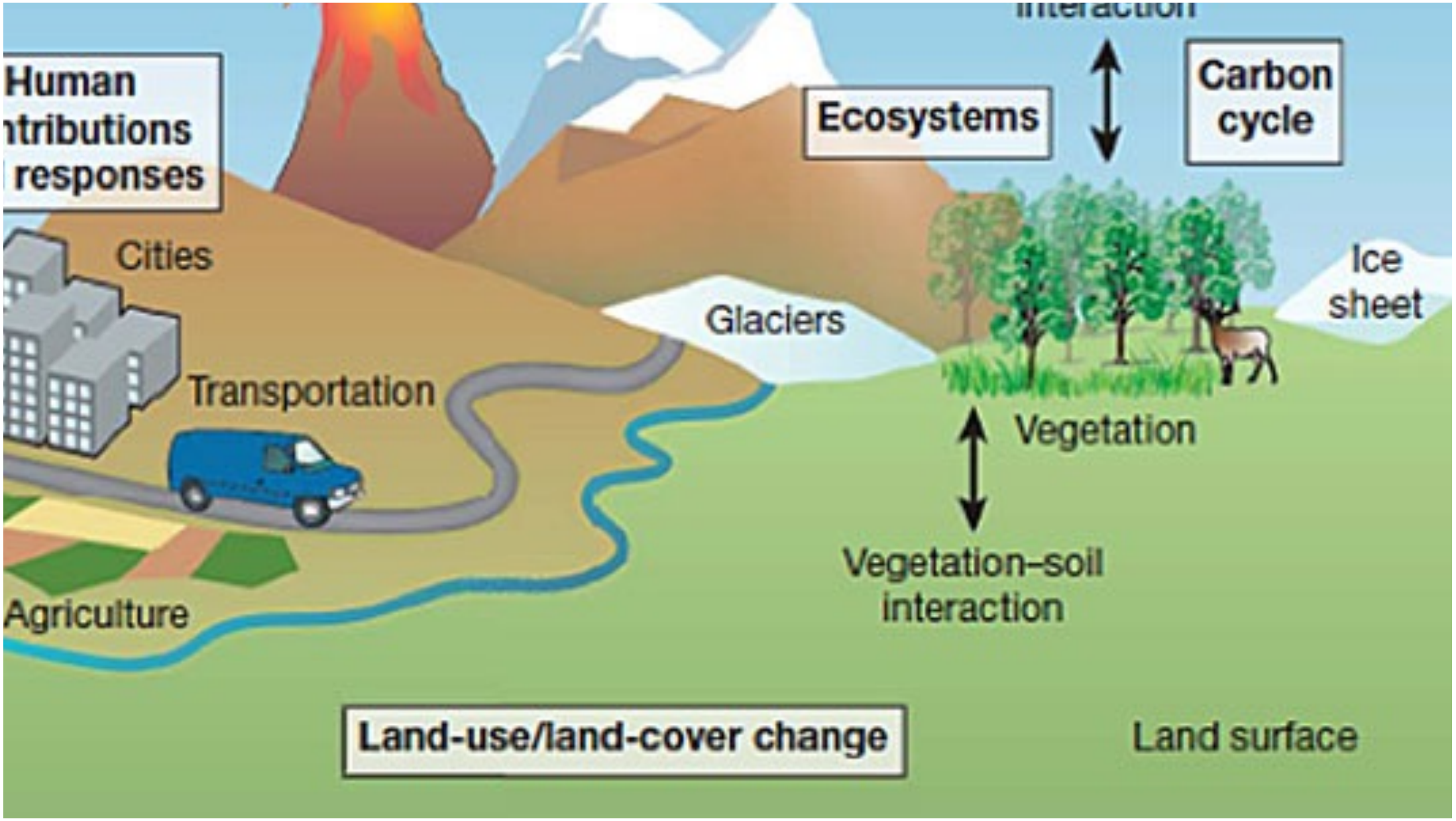
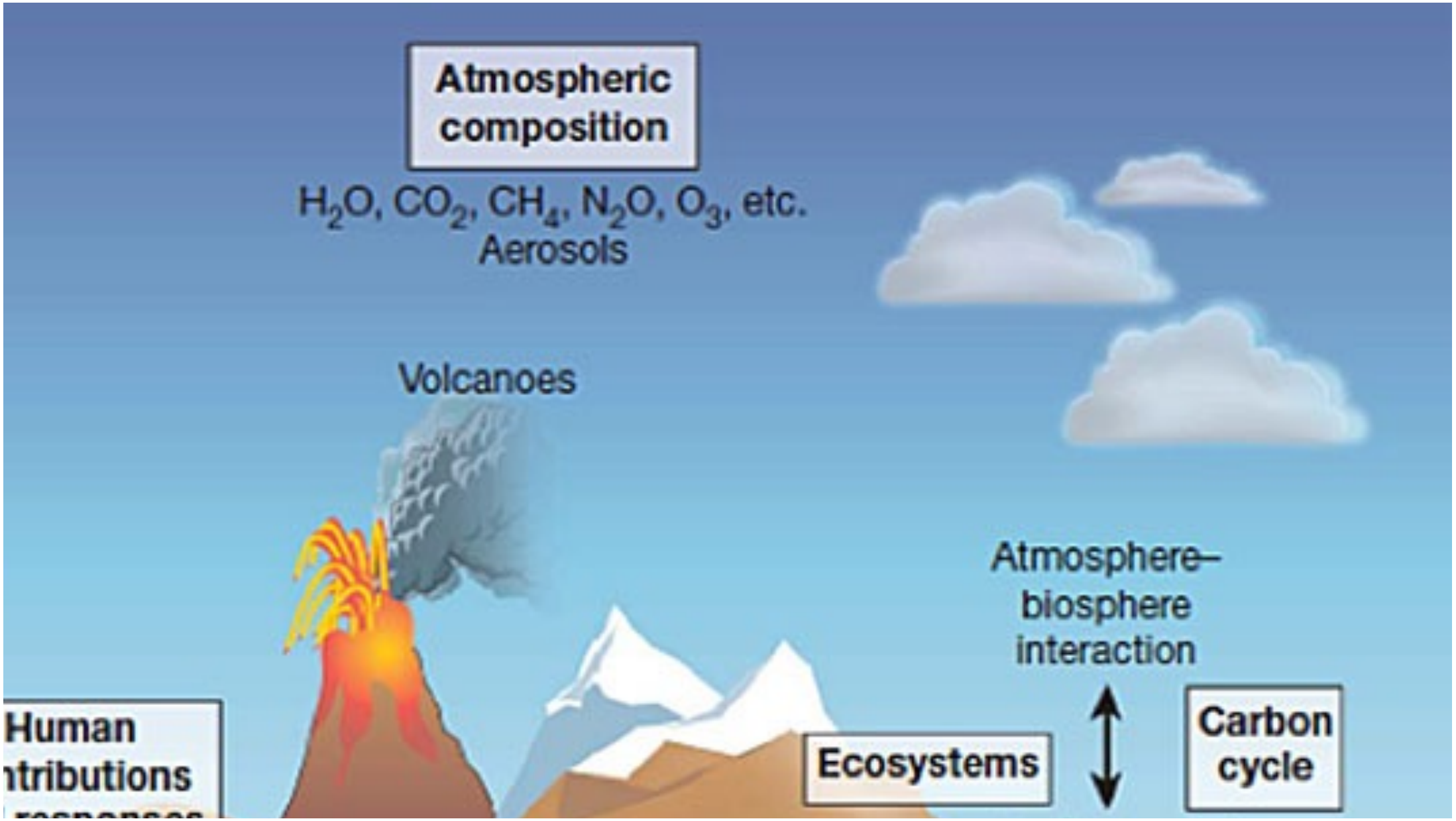
Climate change is a complex phenomenon with multidisciplinary ecosystems



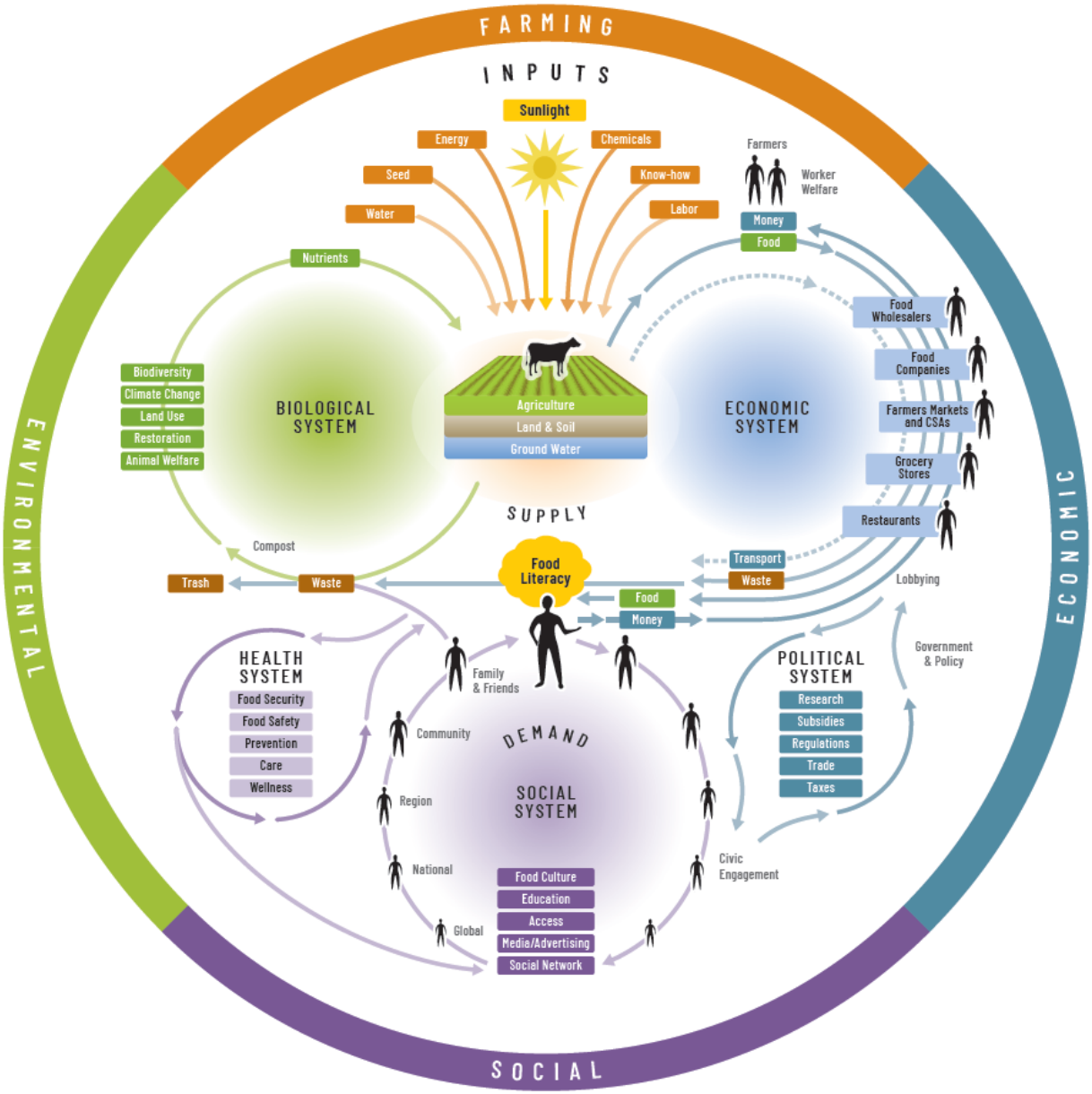

Solar radiation
Climate variability and change
H_2O, CO_2
Clouds
Terrestrial radiation
Water cycle
Human contributions

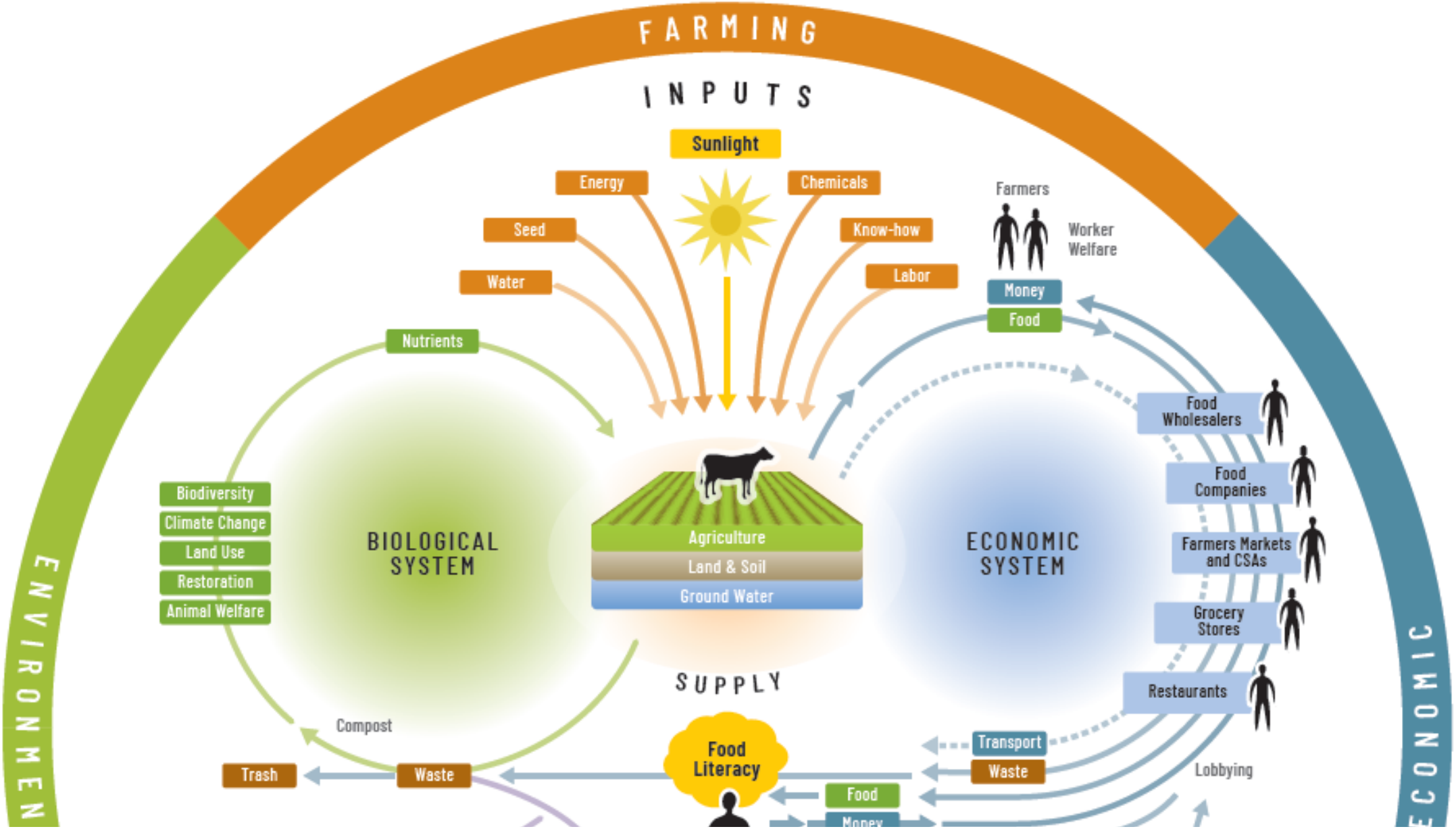

Water cycle
Human contributions and responses
Industries
Cities
Atmosphere–ice interaction
Evaporation precipitation
Heat exchange
Transportation
Sea ice
Oceans
Ocean circulation, sea levels, biogeochemistry
Agriculture
Rivers
Land-

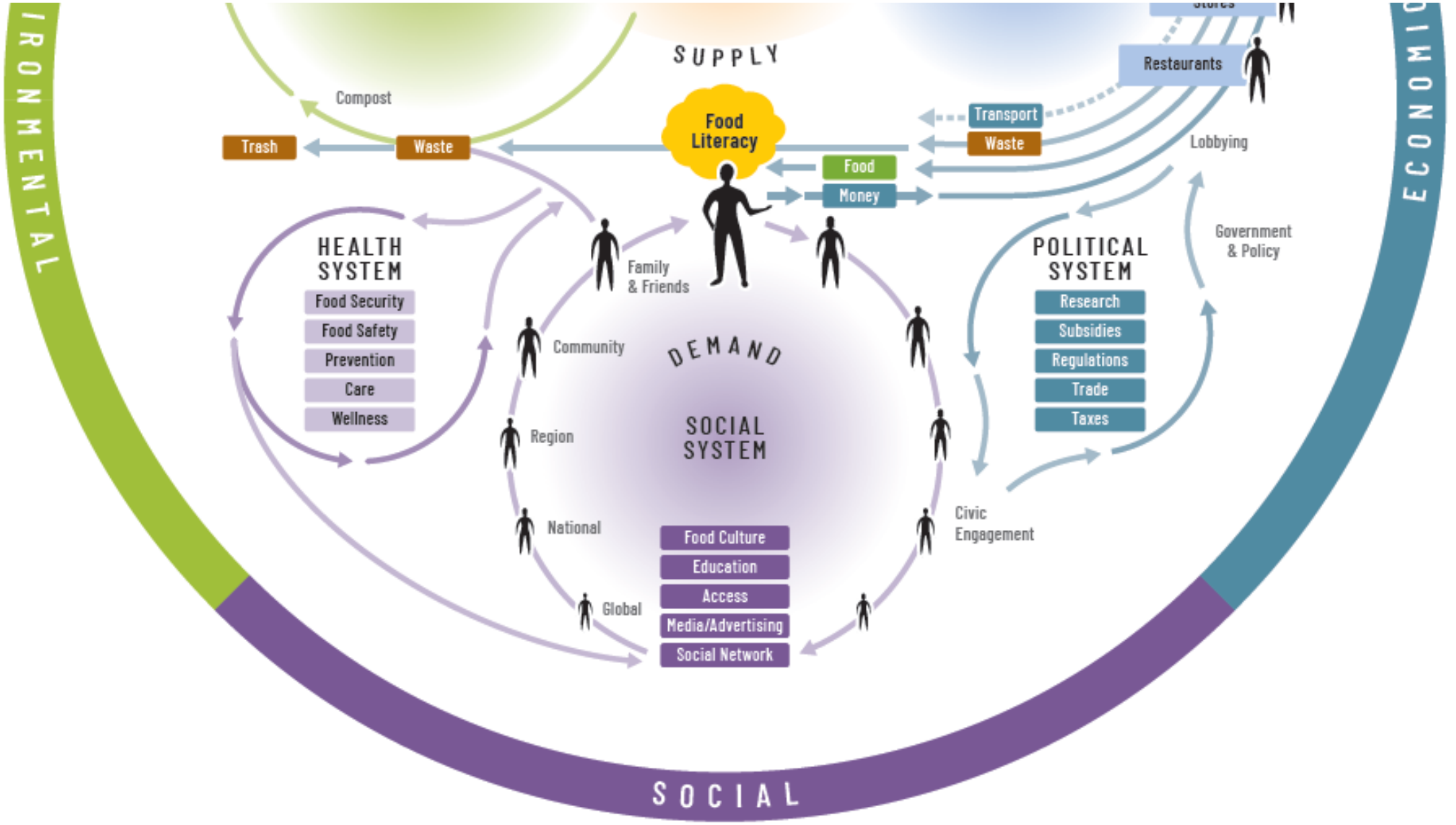

Human
ntributions
responses
Cities
Transportation
Agriculture
Glaciers
Ecosystems
Carbon
cycle
Ice
sheet
Vegetation
Vegetation–soil
interaction
Land-use/land-cover change
Land surface


Atmospheric composition
H_2O, CO_2, CH_4, N_2O, O_3, etc.
Aerosols
Volcanoes
Atmosphere–biosphere interaction
Human
ntributions
Ecosystems
Carbon cycle

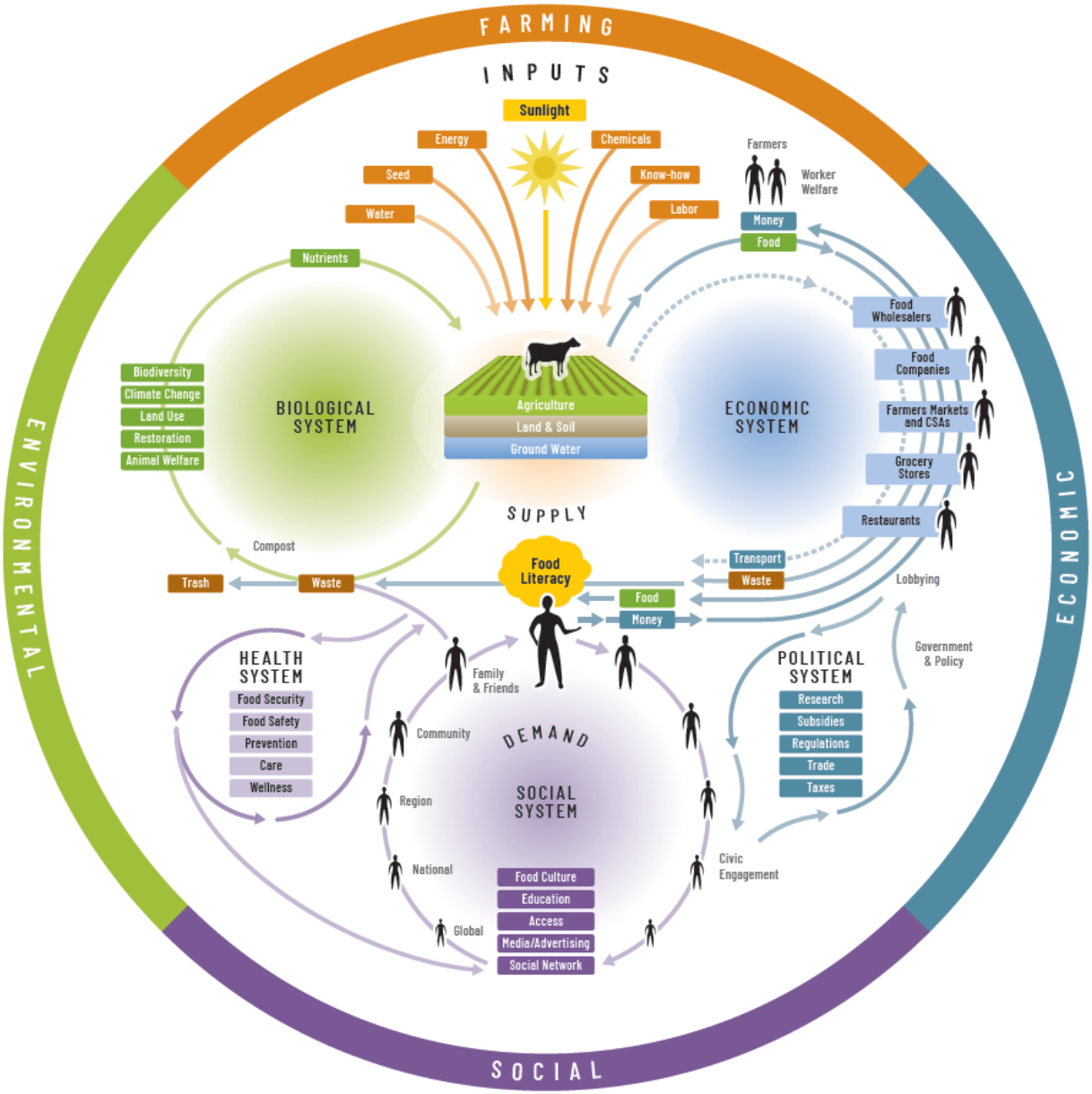
Climate change impacts and effects are also multiverse




FARMING
INPUTS
Sunlight
Energy
Chemicals
Seed
Know-how
Water
Labor
Farmers
Worker Welfare
Money
Food
Nutrients
Biodiversity
Climate Change
Land Use
Restoration
Animal Welfare
BIOLOGICAL SYSTEM
Agriculture
Land & Soil
Ground Water
ECONOMIC SYSTEM
Food Wholesalers
Food Companies
Farmers Markets and CSAs
Grocery Stores
Restaurants
SUPPLY
Compost
Trash
Waste
Food Literacy
Transport
Waste
Food
Money
Lobbying
ENVIRONMENT
ECONOMIC


IRONMENTAL
ECONOMI
SOCIAL
SUPPLY
Compost
Trash
Waste
Food Literacy
Transport
Waste
Restaurants
Lobbying
Food
Money
HEALTH SYSTEM
Food Security
Food Safety
Prevention
Care
Wellness
Family & Friends
Community
DEMAND
Region
SOCIAL SYSTEM
National
Global
Food Culture
Education
Access
Media/Advertising
Social Network
POLITICAL SYSTEM
Research
Subsidies
Regulations
Trade
Taxes
Government & Policy
Civic Engagement

Climate change impacts and effects are also multiverse



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What is digital transformation

Example: Herder's life with no digitalization

Herding…

-- for Milking…

-- to feed family

-- to make small money

To simply SURVIVE!

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Digital Transformation ?

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What is digital transformation

Example: Possible herders' life with digitalization transformation

Drone herding →

Automatic milking → E-milk can →

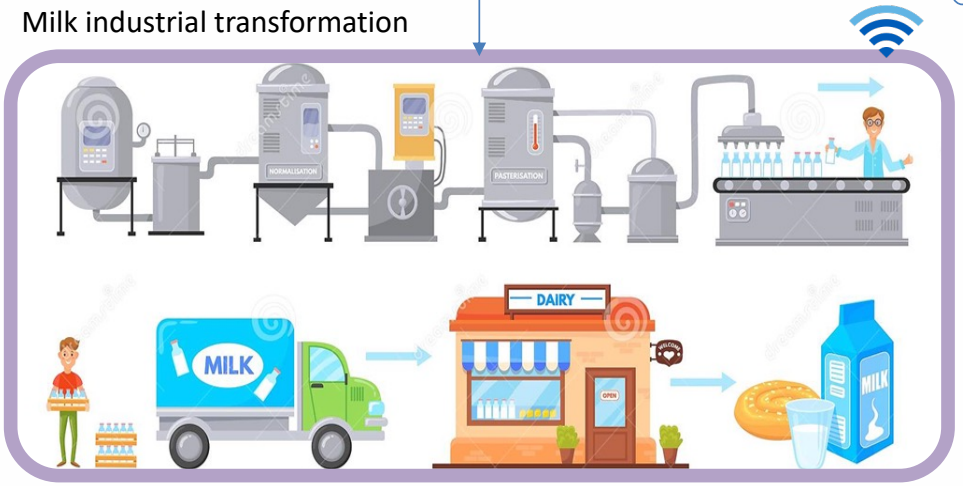
Production analytics →

information in local language →

Selling to industry →

Mobile banking in local lang.

Milk industrial transformation



→

To improve livelihood and simply ENJOY LIFE!

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What is digital transformation

Using Digital technologies to drive fundamental change and improvement in cultural, organizational and operational aspects in companies (and also in society - communities)

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Why is Digital Transformation against climate change in WA an EMERGENCY !

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Why is digital transformation against CC in WA an EMERGENCY

Digital Transformation…

…To close the Technology and Data Gaps

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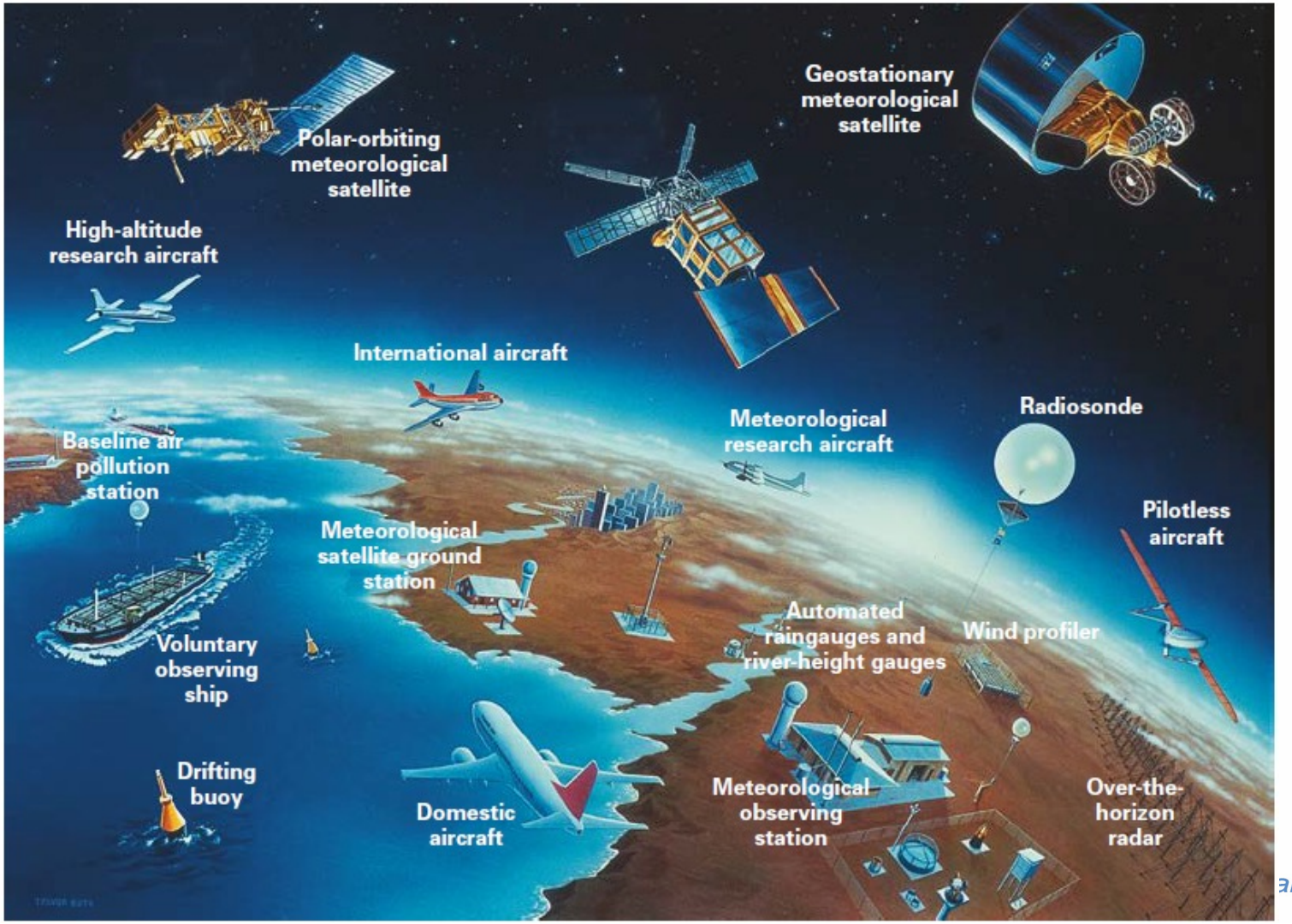
(1) Technology is VITAL to observe climate change and gather data



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Polar-orbiting meteorological satellite
Geostationary meteorological satellite
High-altitude research aircraft
International aircraft
Meteorological research aircraft
Radiosonde
Baseline air pollution station
Meteorological satellite ground station
Pilotless aircraft
Automated raingauges and river-height gauges
Wind profiler
Voluntary observing ship
Drifting buoy
Domestic aircraft
Meteorological observing station
Over-the-horizon radar

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Why is digital transformation against CC in WA an EMERGENCY

(1) Technology is VITAL to observe climate change and gather data

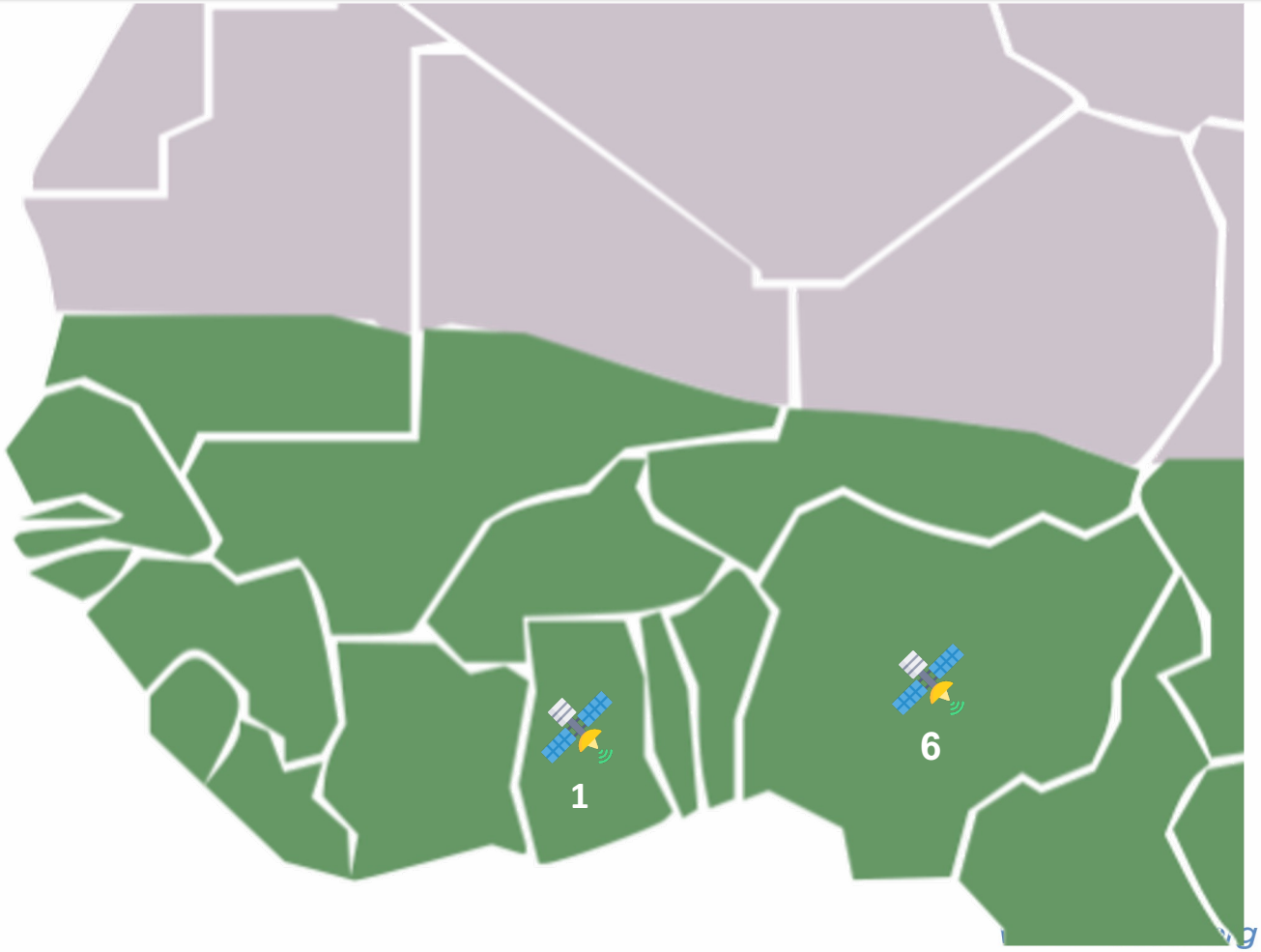
1. Satellites Observation by West Africa

7 satellites by 2 countries

NIGERIA: 6
- (NigeriaSat-1, -2, -X |
- NigComSat-1, -1R |
- NigeriaEduSat-1)

GHANA: 1
- (GhanaSat-1)

BURKINA: 0 < x < 1
- First francophone country working on satellite project



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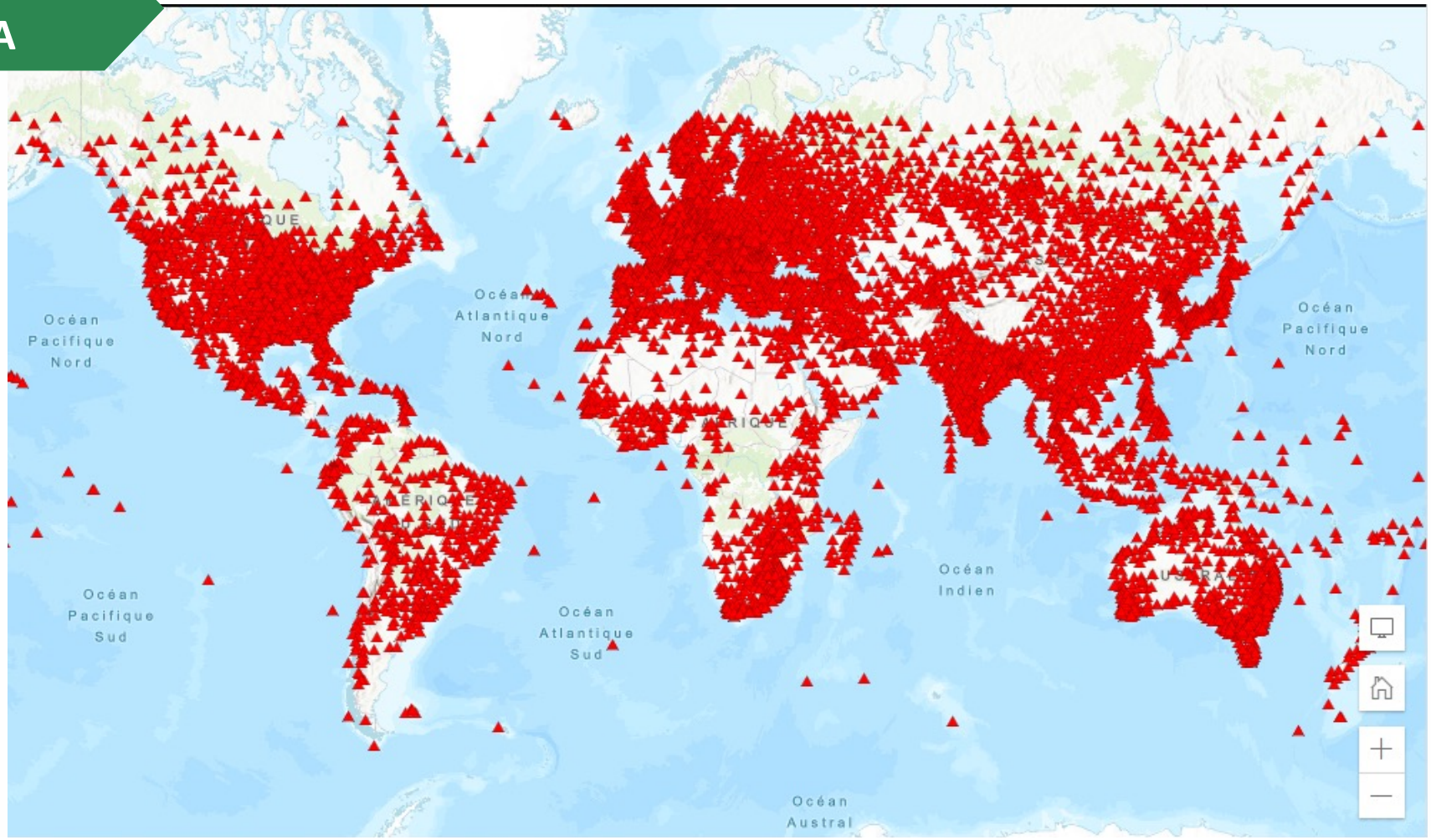
Why is digital transformation against CC in WA an EMERGENCY

(1) Technology is VITAL to observe climate change and gather data

2. WMO global Weather Observation in WA



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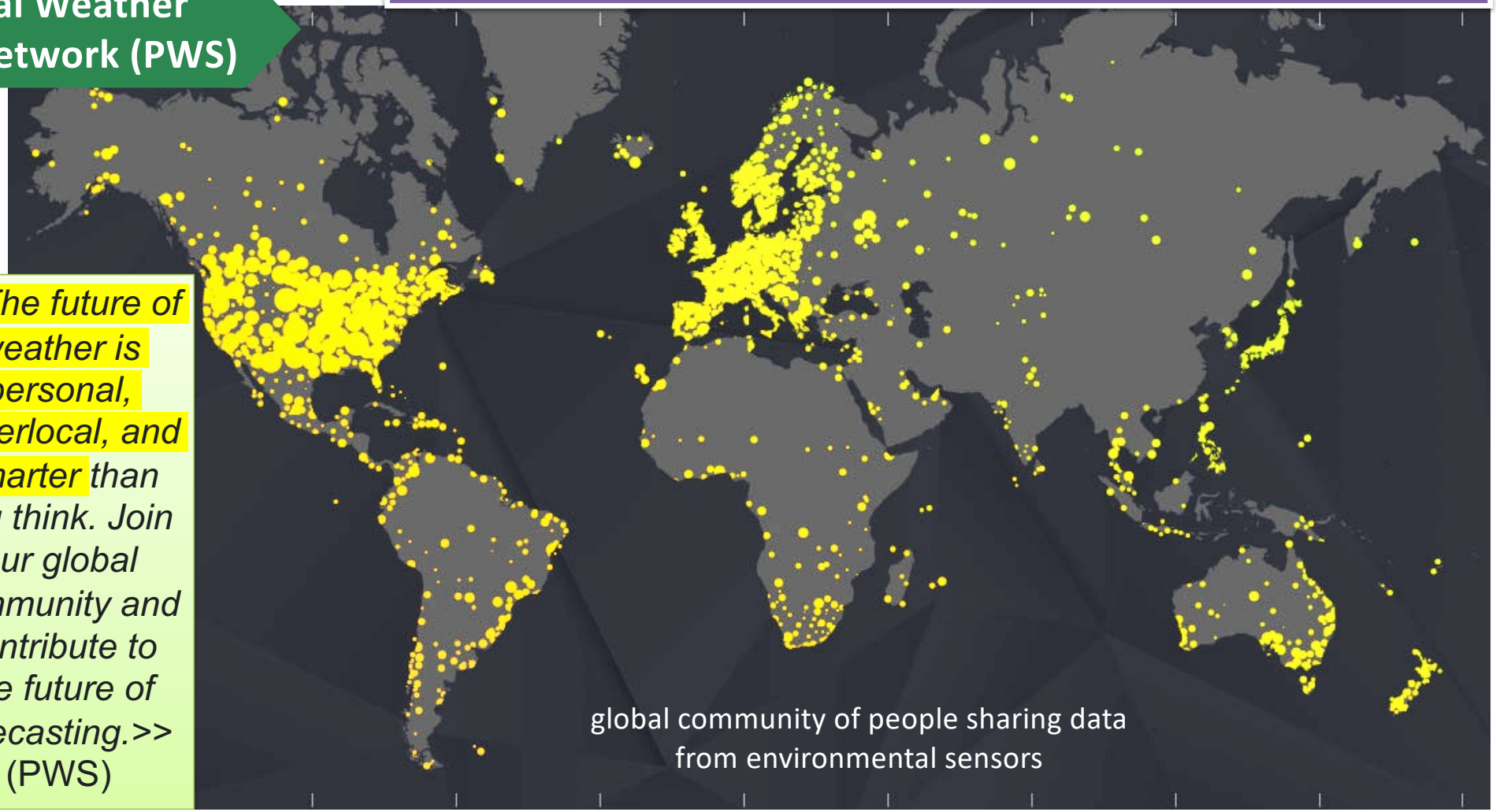
Why is digital transformation against CC in WA an EMERGENCY

(1) Technology is VITAL to observe climate change and gather data

3. Personal Weather Station Network (PWS)



<<The future of weather is personal, hyperlocal, and smarter than you think. Join our global community and contribute to the future of forecasting.>> (PWS)

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Why is Digital Transformation against climate change in WA an EMERGENCY !

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Why is digital transformation against CC in WA an EMERGENCY

Digital Transformation…

…To relieve population suffering and ensure succession by younger generation

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Why is digital transformation against CC in WA an EMERGENCY

(2) To relieve parents' sufferings and ensure take over by youth

Traditional Husbandry & Agriculture & activities

This is not ENJOYING LIFE

a VERY FEW PORTION of literated youth can accept to suffer-live this way! MAJORITY is fleeing!

Digital Tech to help relieve, ease and ADAPT

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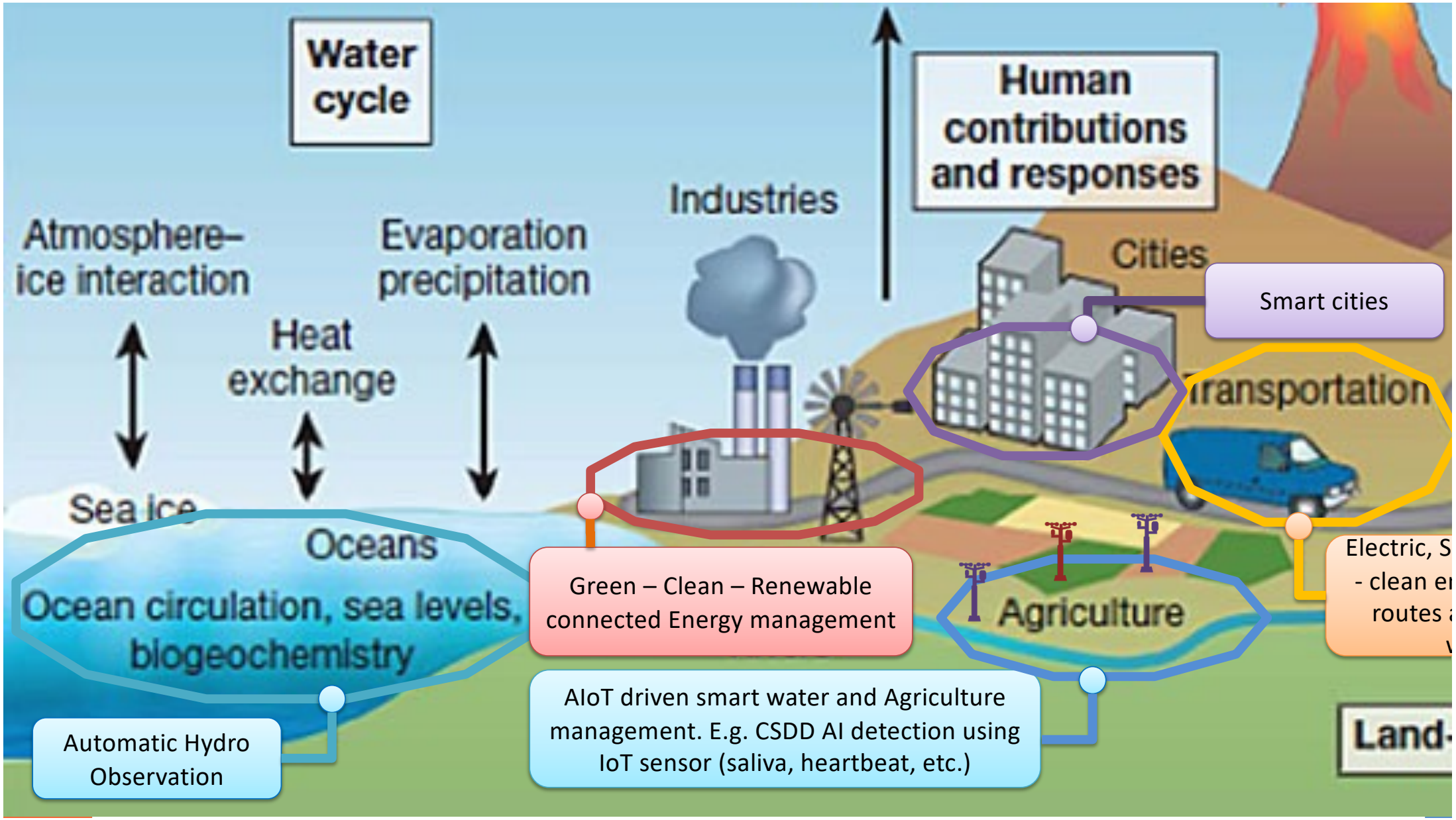
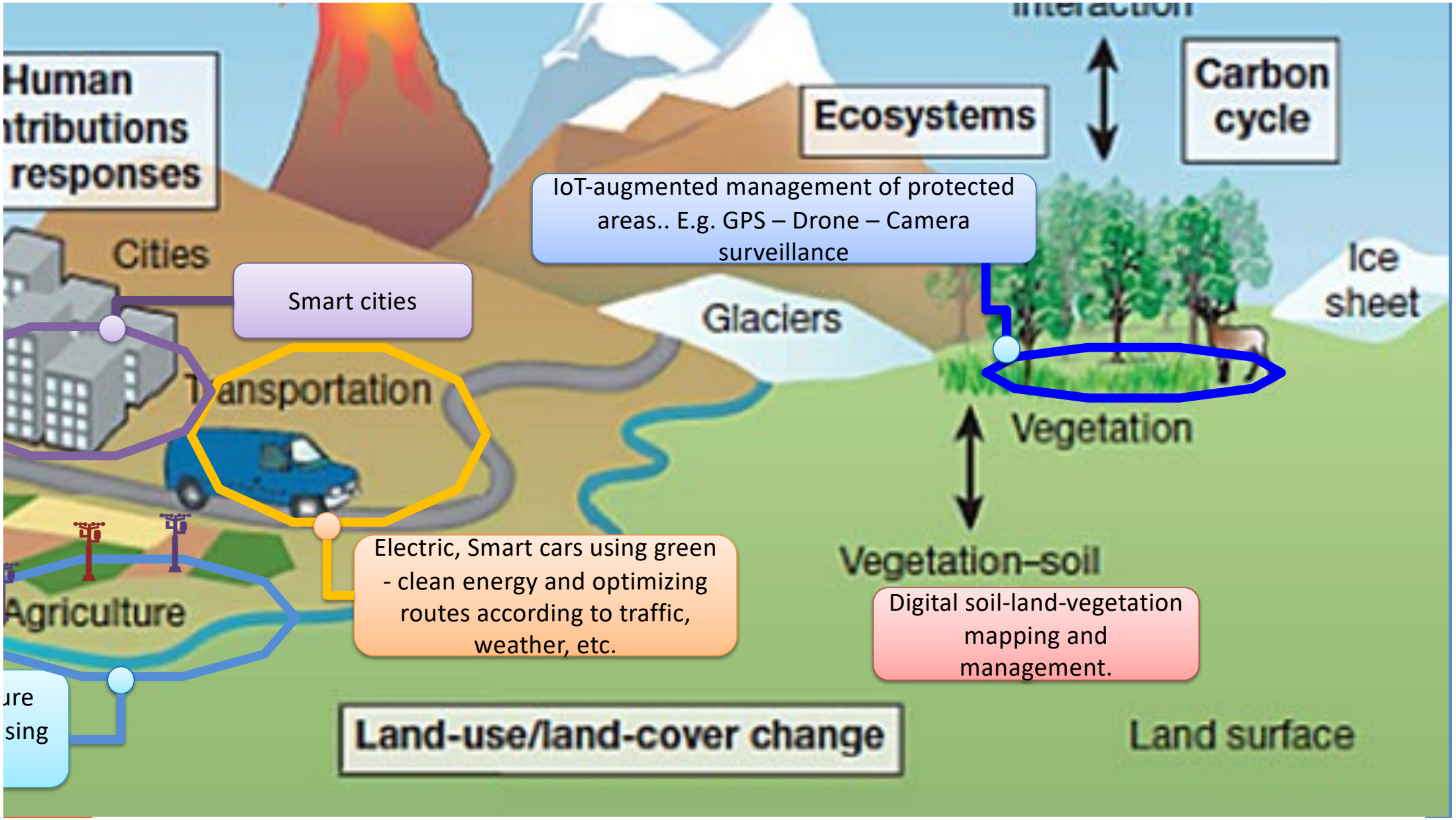
Potential Benefits of Digital Transformation against climate change in WA


Water cycle
Human contributions and responses
Industries
Cities
Smart cities
Atmosphere–ice interaction
Evaporation precipitation
Heat exchange
Transportation
Sea ice
Oceans
Ocean circulation, sea levels, biogeochemistry
Green – Clean – Renewable connected Energy management
Agriculture
Electric, S
- clean e
routes
AIoT driven smart water and Agriculture management. E.g. CSDD AI detection using IoT sensor (saliva, heartbeat, etc.)
Automatic Hydro Observation
Land-


Human
ntributions
responses
Ecosystems
Carbon
cycle
IoT-augmented management of protected areas.. E.g. GPS – Drone – Camera surveillance
Cities
Smart cities
Glaciers
Ice
sheet
Transportation
Vegetation
Vegetation–soil
Electric, Smart cars using green - clean energy and optimizing routes according to traffic, weather, etc.
Digital soil-land-vegetation mapping and management.
Agriculture
ure
sing
Land-use/land-cover change
Land surface

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Challenges about Digital Transformation to tackle climate change in WA

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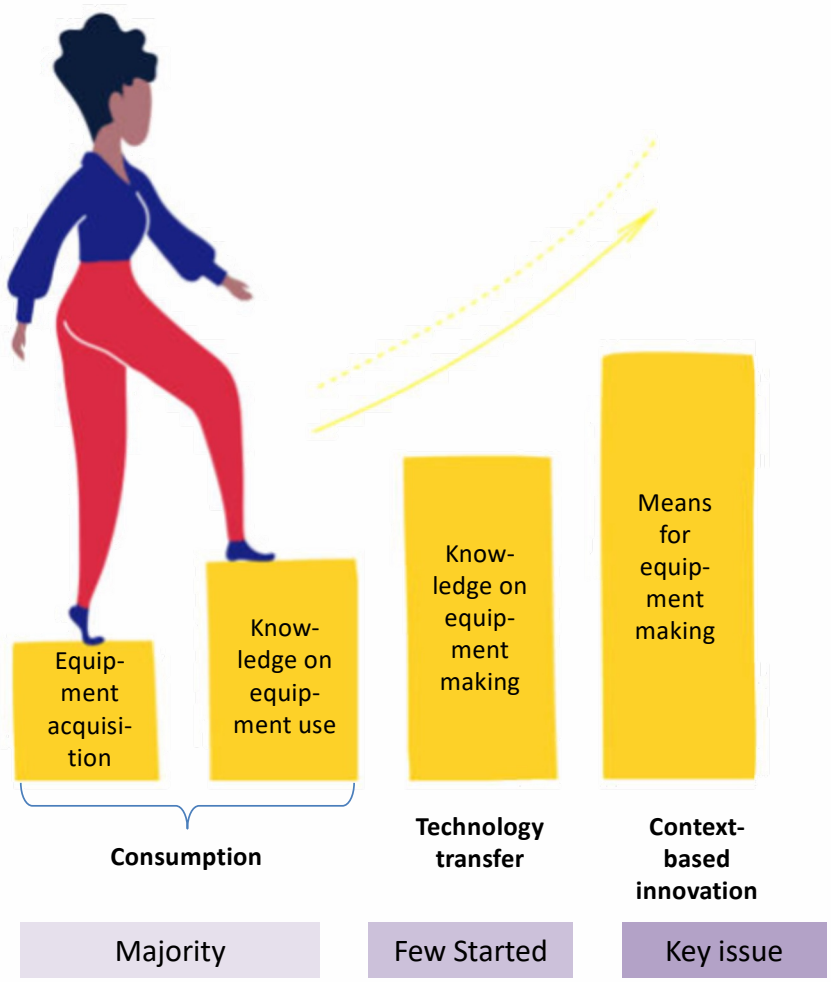
Gaps to Mastery of Technology in West Africa



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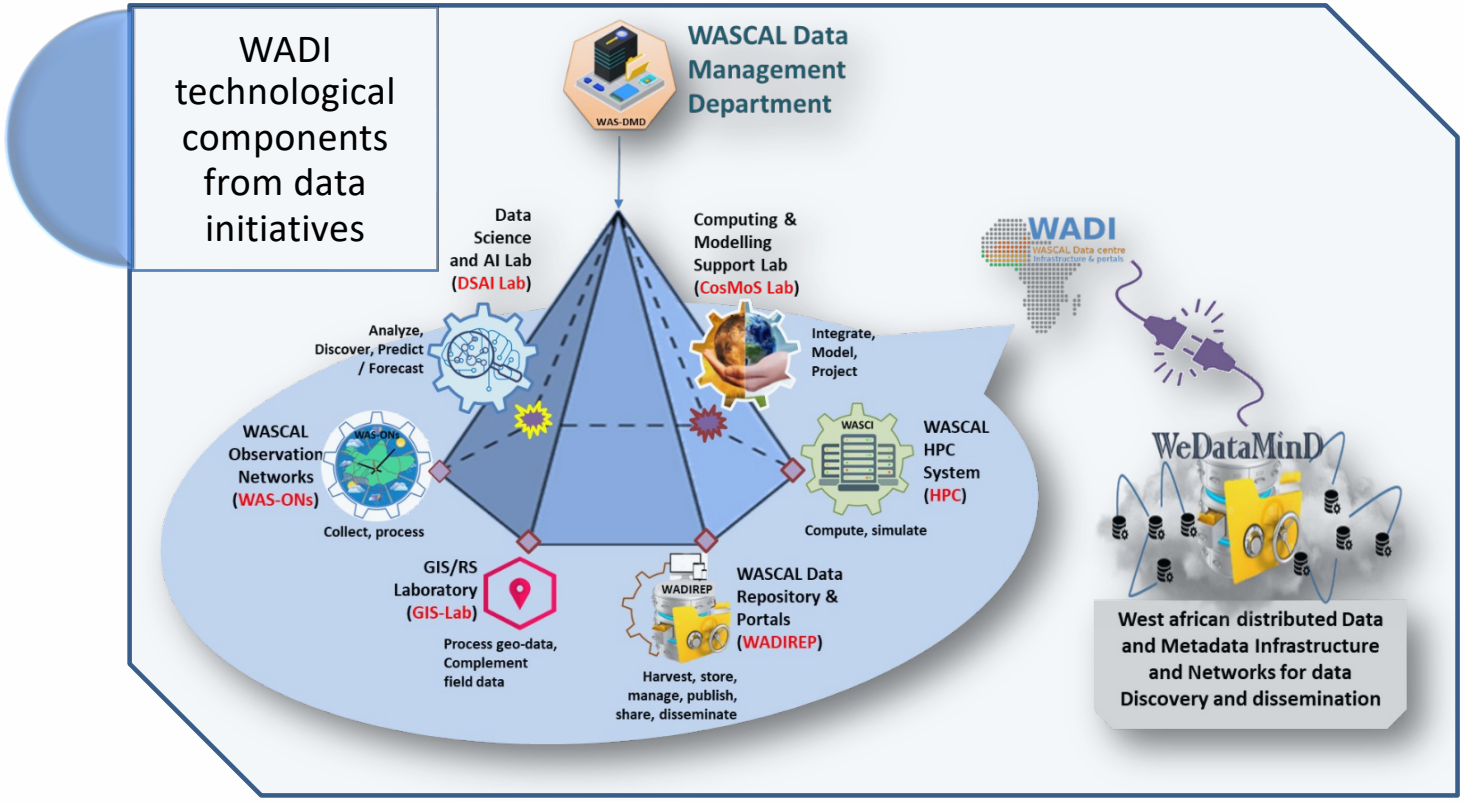
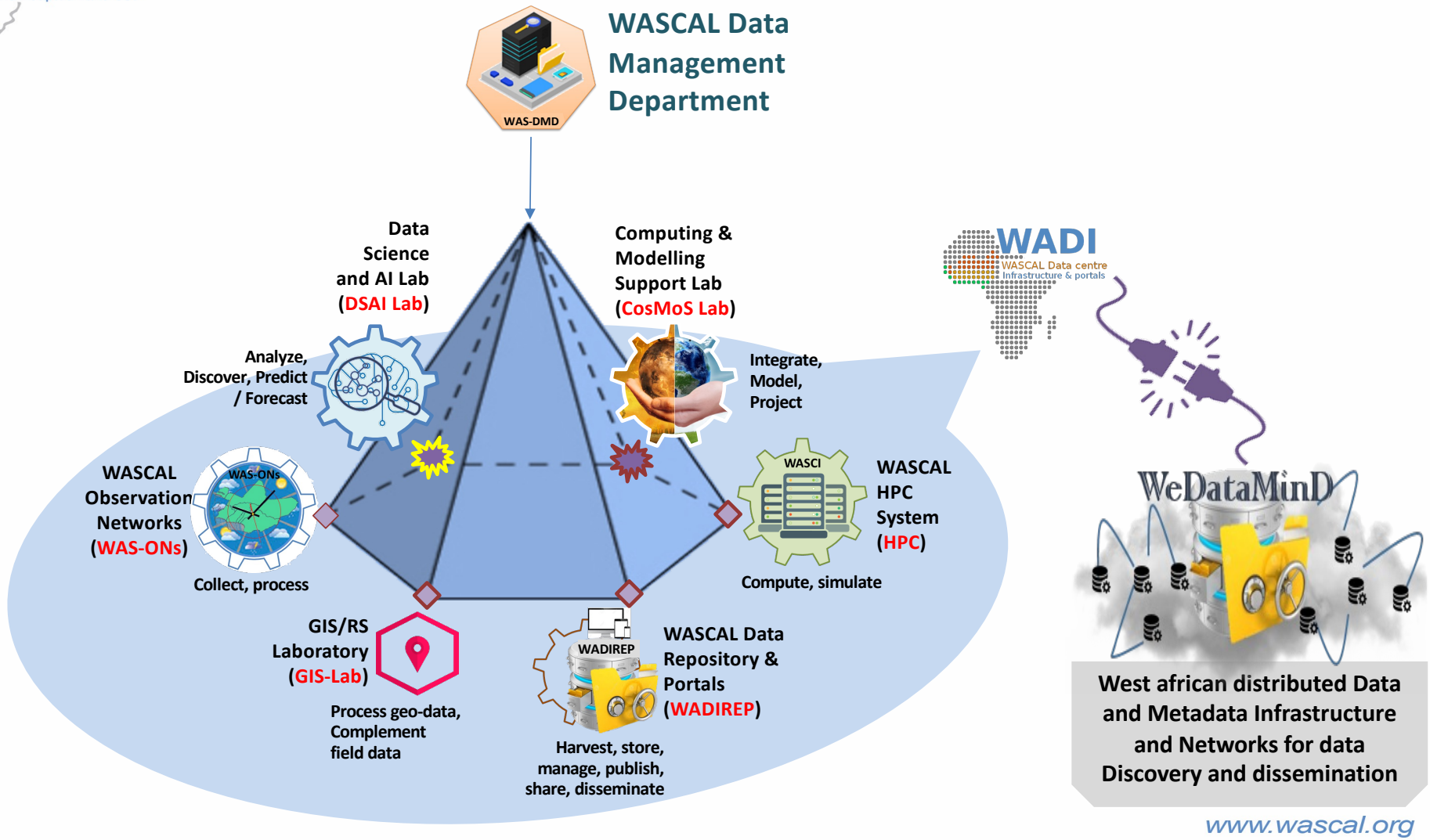
Opportunities of Digital Transformation to tackling climate change in WA

WASCAL open Data Infrastructure to closing Technology and data gaps

Each WADI technological component was a result from a research-needs data initiative



WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps



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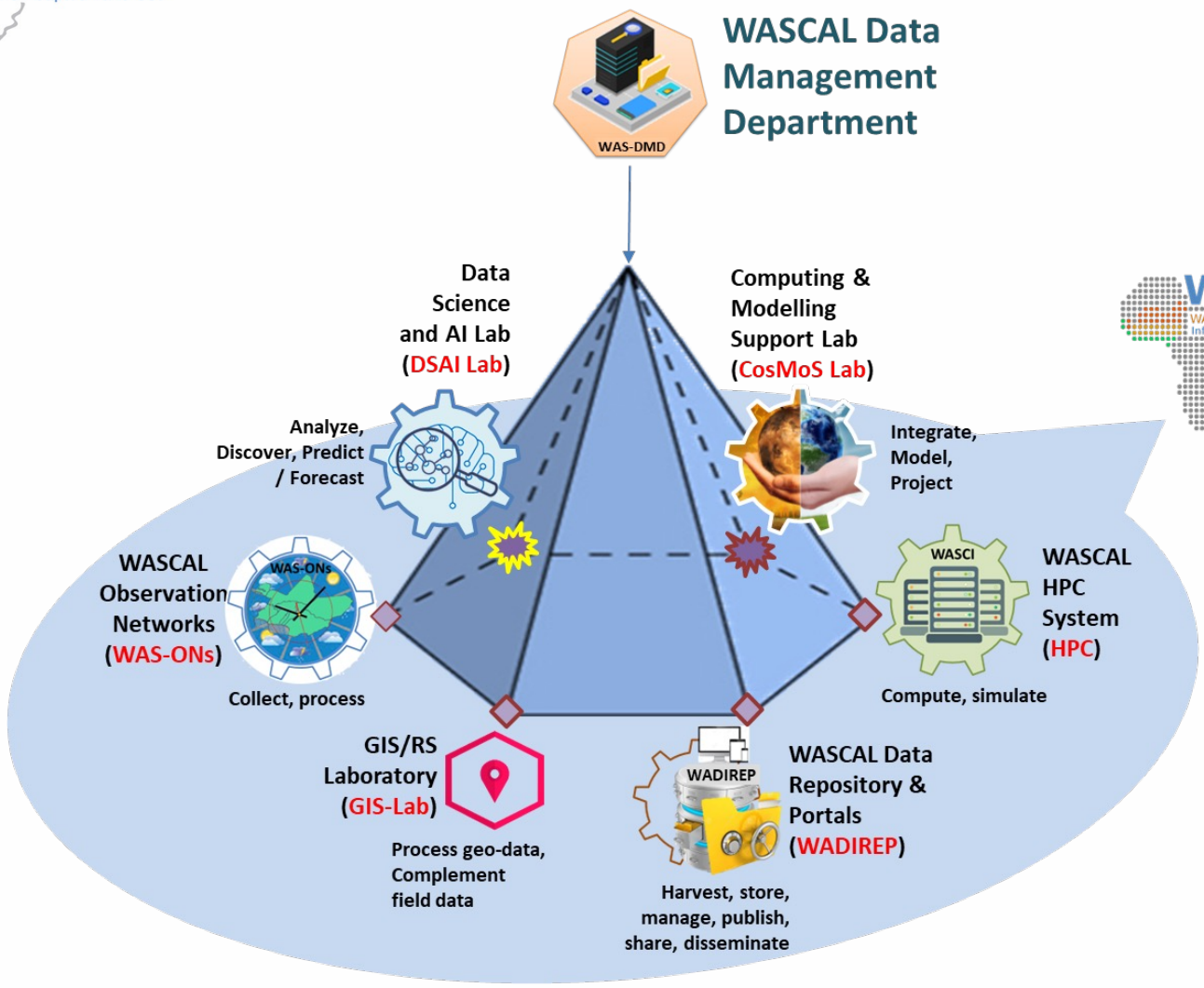

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WASCAL Data centre Infrastructure & portals

WeDataMinD

West african distributed Data and Metadata Infrastructure and Networks for data Discovery and dissemination

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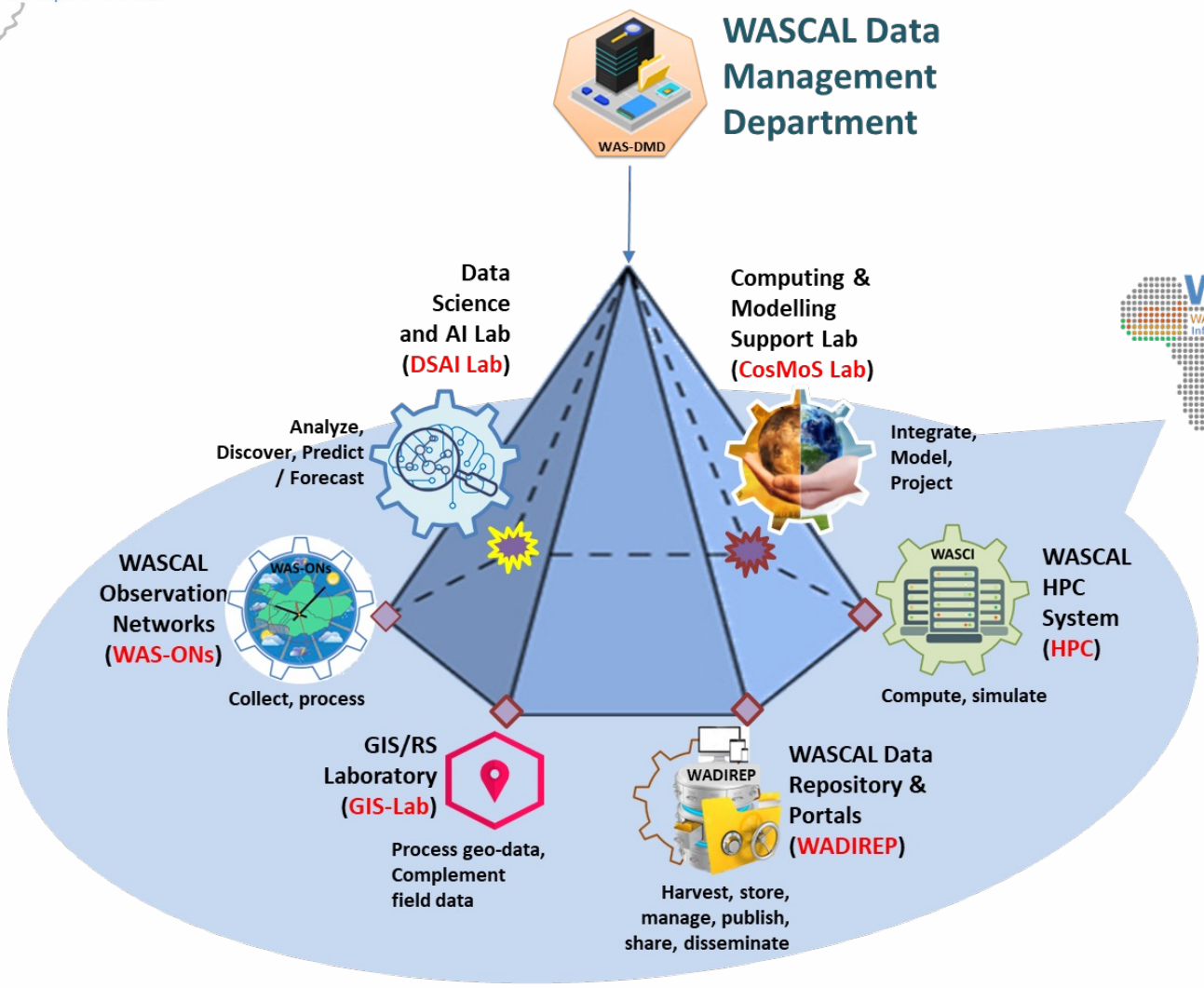
WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps



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WASCAL Observation Networks (WAS-ONs)

Collect, process

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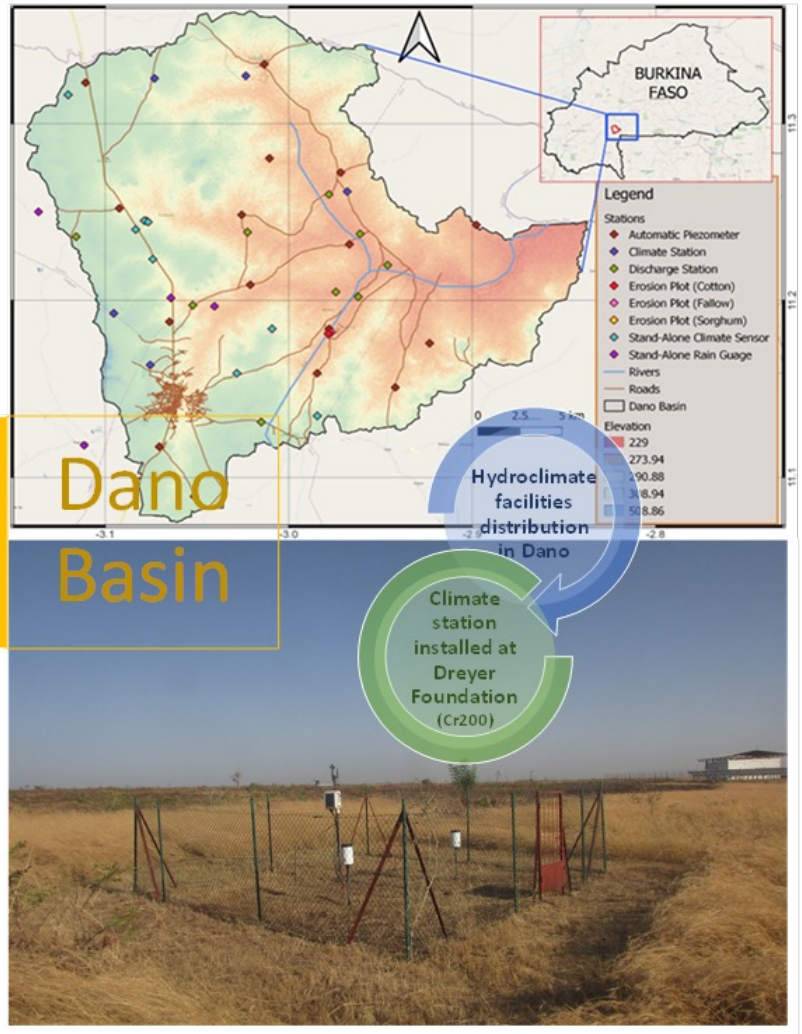
Data Initiative 1-A: Setup of local-mesoscale hydro-climatic observatories

A national city-level Sudanian and Sudano-Sahelian ecosystem with a micro stream belonging to Mouhoun river (Black Volta)



Equipped with diverse facilities for climate change observation and on-field climate services experiments and delivery

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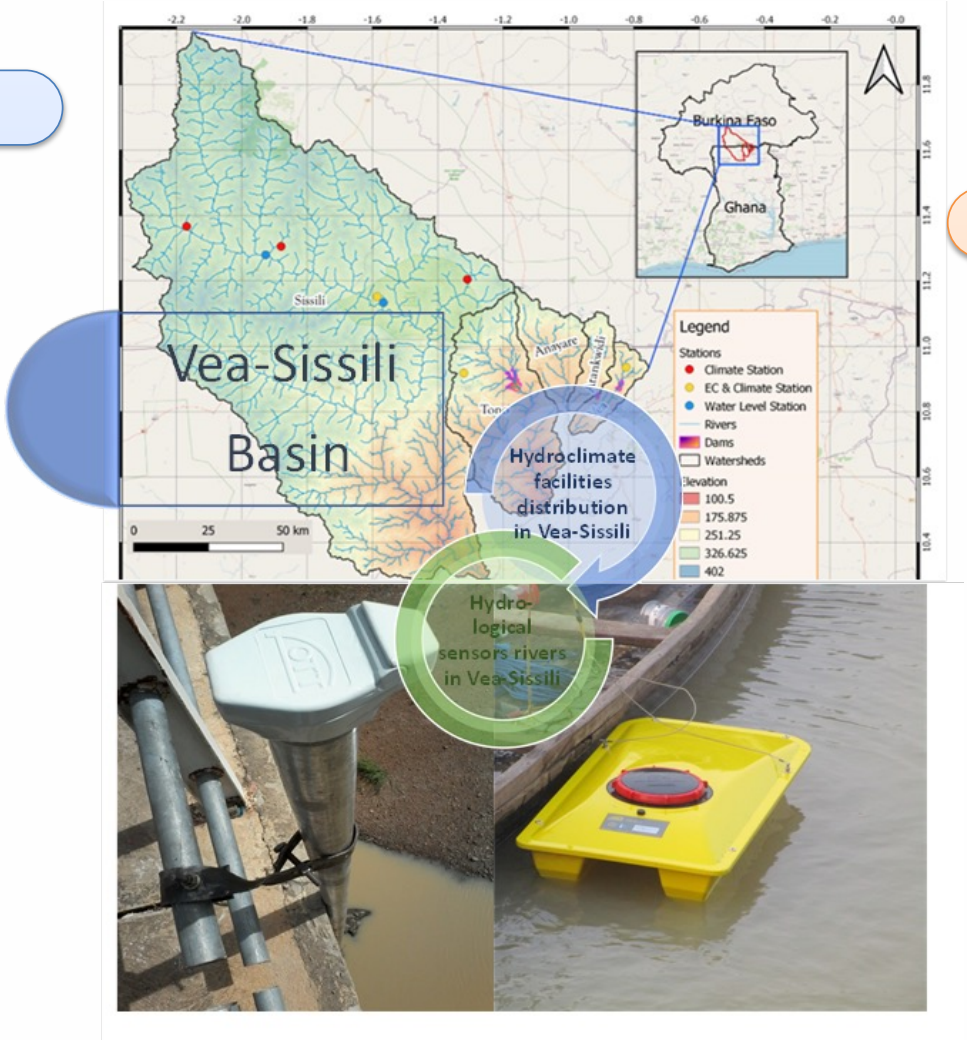
Data Initiative 1-B: Setup of local-mesoscale hydro-climatic observatories

A local transboundary (Burkina-Ghana) complex ecosystem driven by West African Monsoon (WAM) with wetlands, inland valleys, small dams and wells/pumps



Well equipped with data facilities for testing and delivering various climate services

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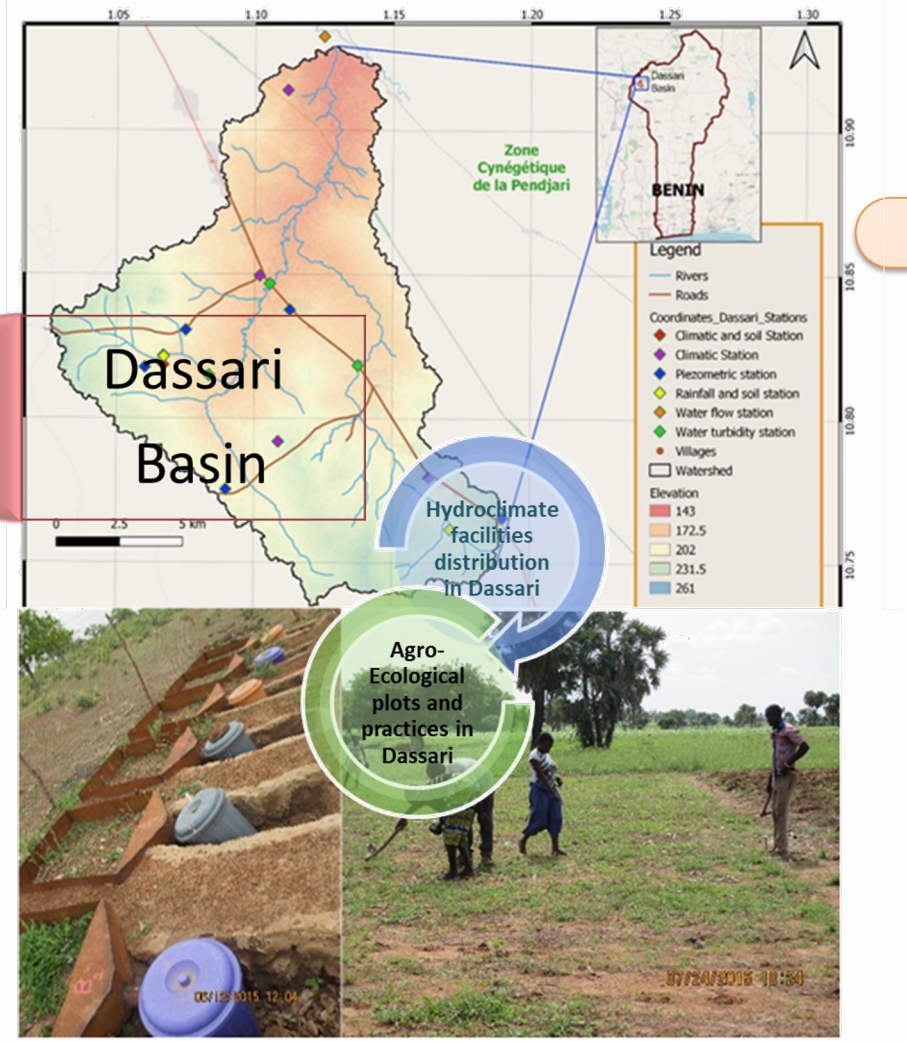
Data Initiative 1-C: Setup of local-mesoscale hydro-climatic observatories

A national city-level Sudano-Guinean ecosystem with rivers converging to Pendjari park and surrounding anthropogenic activities by residents



Equipped with various data facilities for design, test, delivery of customized climate services

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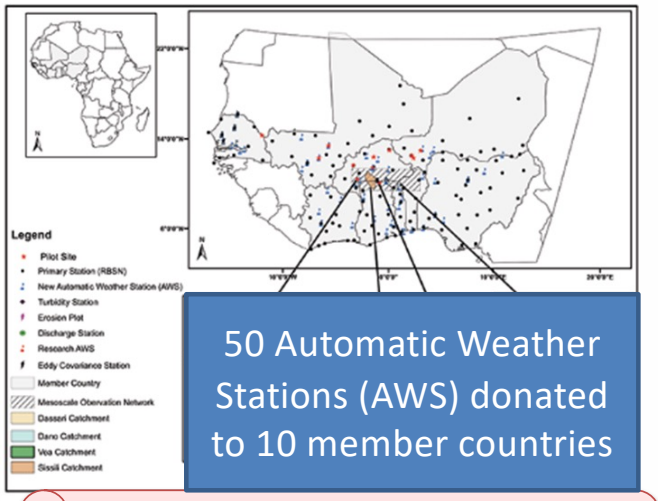
WASCAL Observation Networks (WAS-ONs)

Collect, process

Data Initiative 2-A: Cooperative setup of a regional transboundary CLIMATIC ON



50 Automatic Weather Stations (AWS) donated to 10 member countries

A modern near-surface regional METEOROLOGICAL observation networks bringing on-board all National Meteorological Services and Agencies (NMSAs) through signature of MoU specifying roles and data sharing policies

For provision of regional evidence to underlying causes of extreme events (droughts, floods, air pollution, dry spells, etc.), and development of climate services for mitigation, adaptation measures and risks assessments

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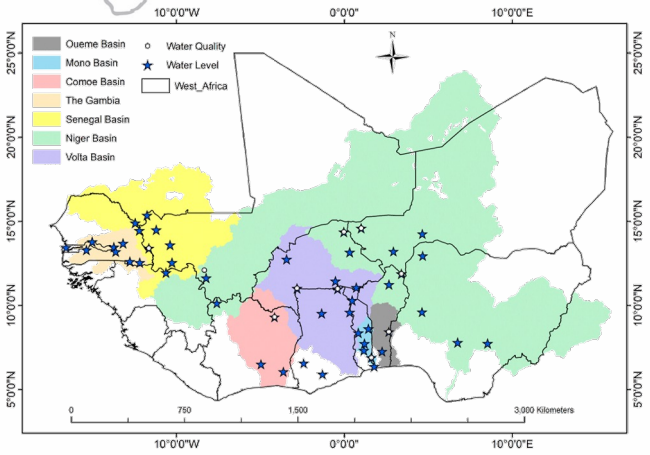
Data Initiative 2-B: Cooperative setup of a regional transboundary HYDRO ON



A novel near-surface regional HYDROLOGICAL observation networks bringing on-board all National Hydrological Services and Agencies (NHSAs) through signature of MoU specifying roles and data sharing policies

WASCAL Technicians installing an Automoatic Hydro Sensor (AHS) in a member countrystation

60 Automation Hydrological Sensors (AHS) donated to 11 member countries

For provision of regional evidence to underlying causes of extreme events (droughts, floods, air pollution, dry spells, etc.), and development of climate services for mitigation, adaptation measures and risks assessments

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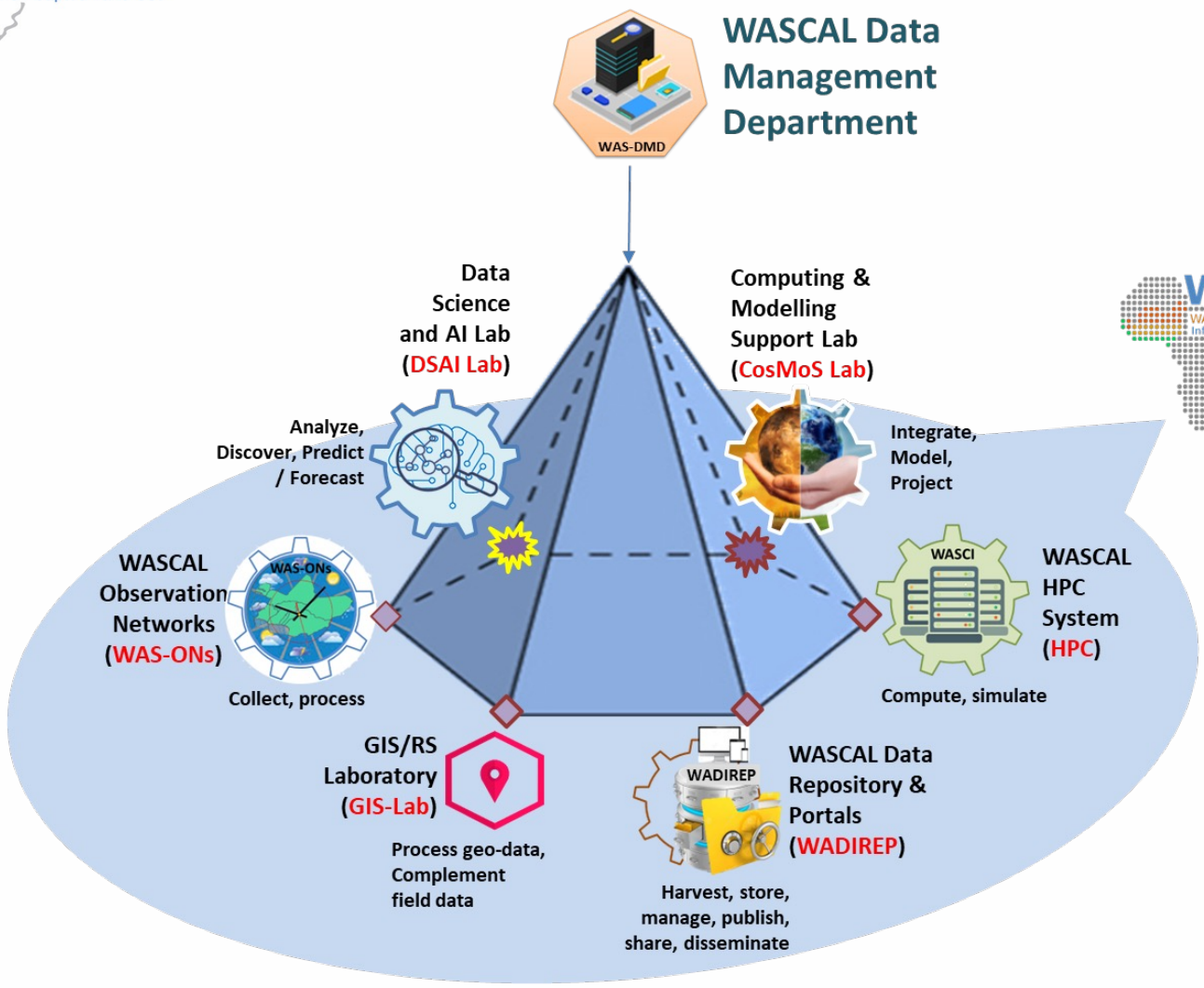
WASCAL Observation Networks (WAS-ONs)

Collect, process

WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps



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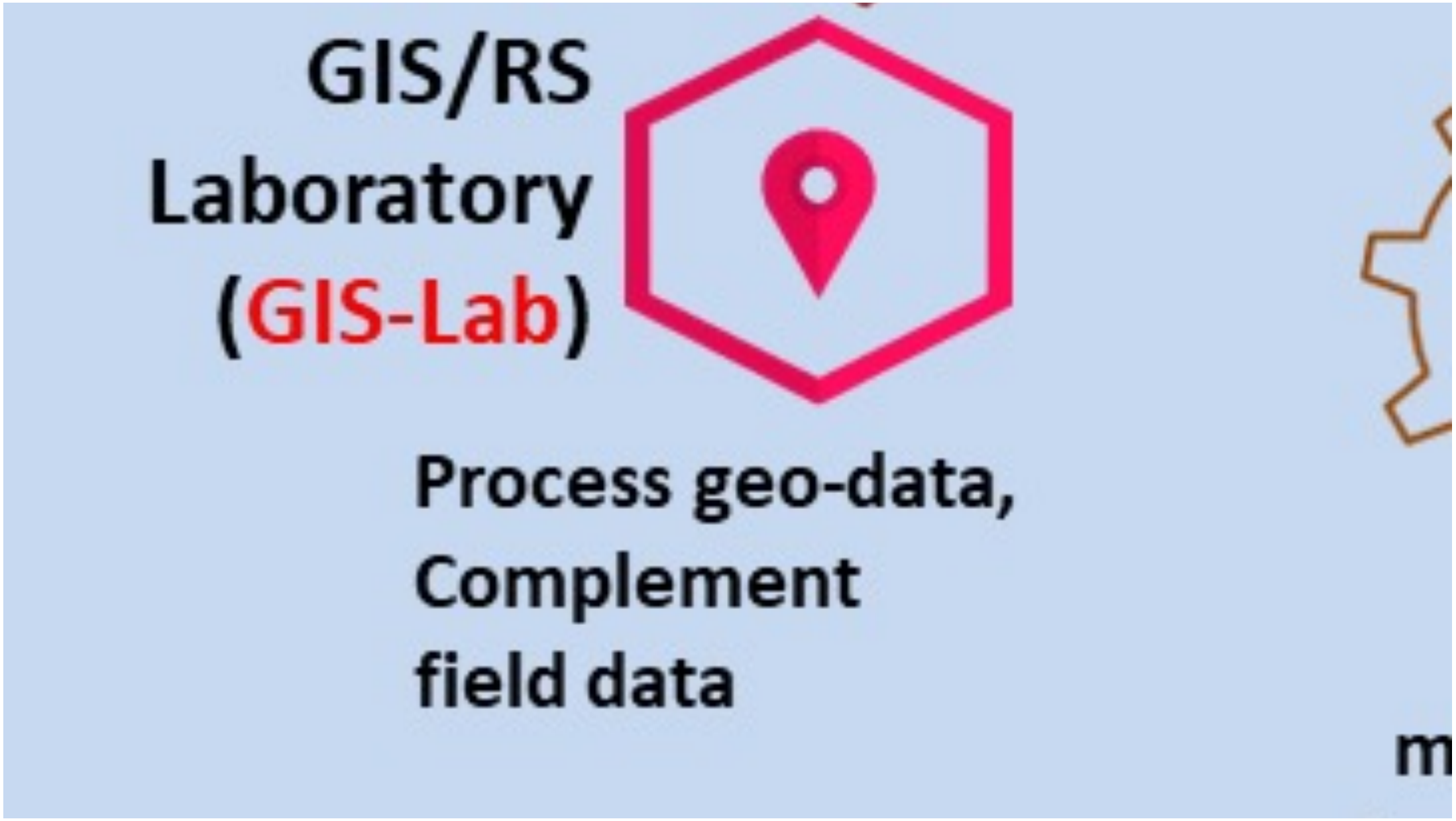
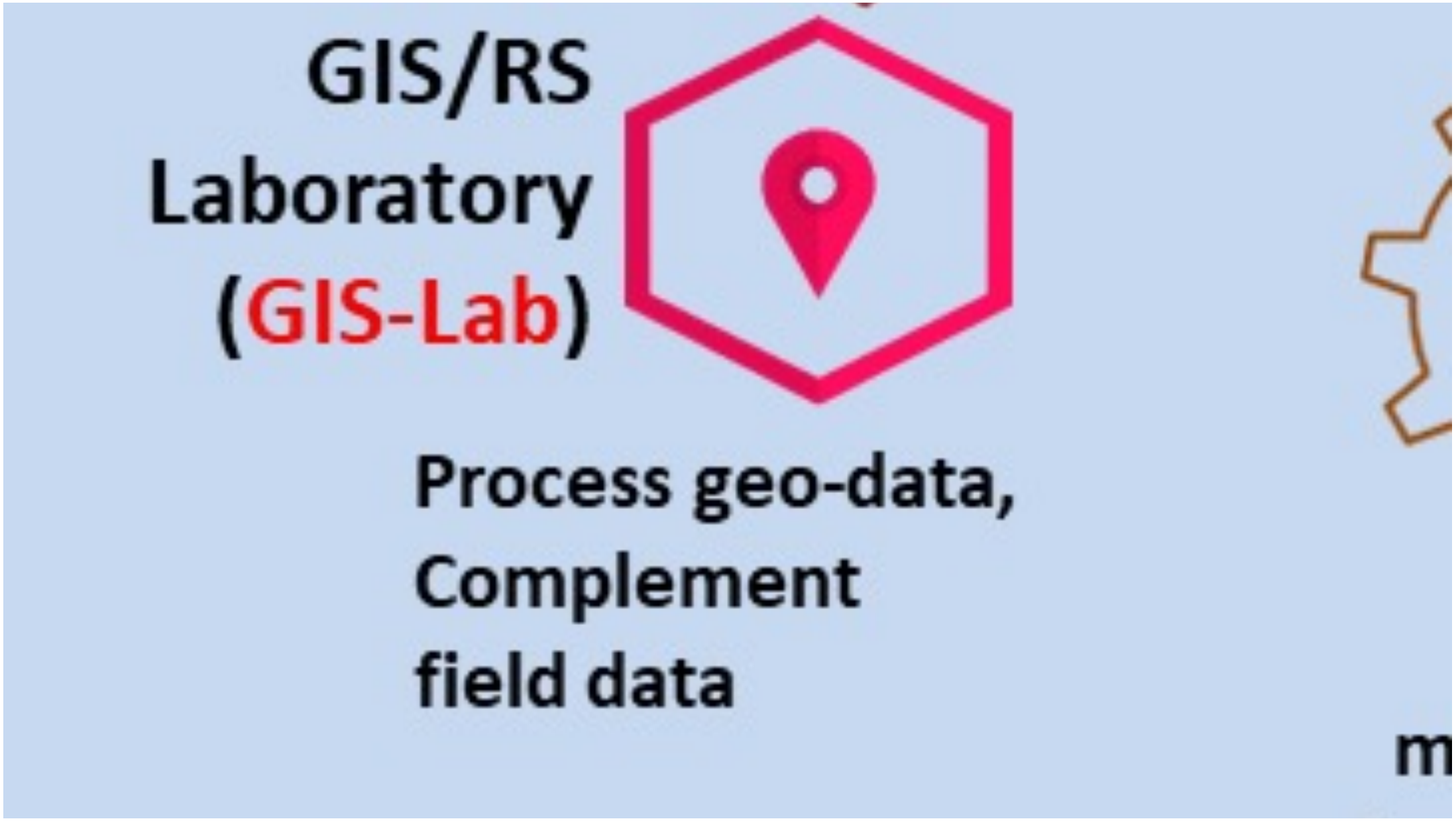

GIS/RS
Laboratory
(GIS-Lab)
Process geo-data,
Complement
field data
m

Data Initiative 3: Setup of a GIS and Remote sensing Infrastructure (GIS Lab)

A modern lab for geospatial data and imagery acquisition and processing, and training **to complement ground observations**

Equipped with a sateliite data receiving antenna and server from EUMETCAST , 3 Phantom DJI multispectral drone (UAV), GPS professional receivers, etc.


GIS/RS
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Process geo-data,
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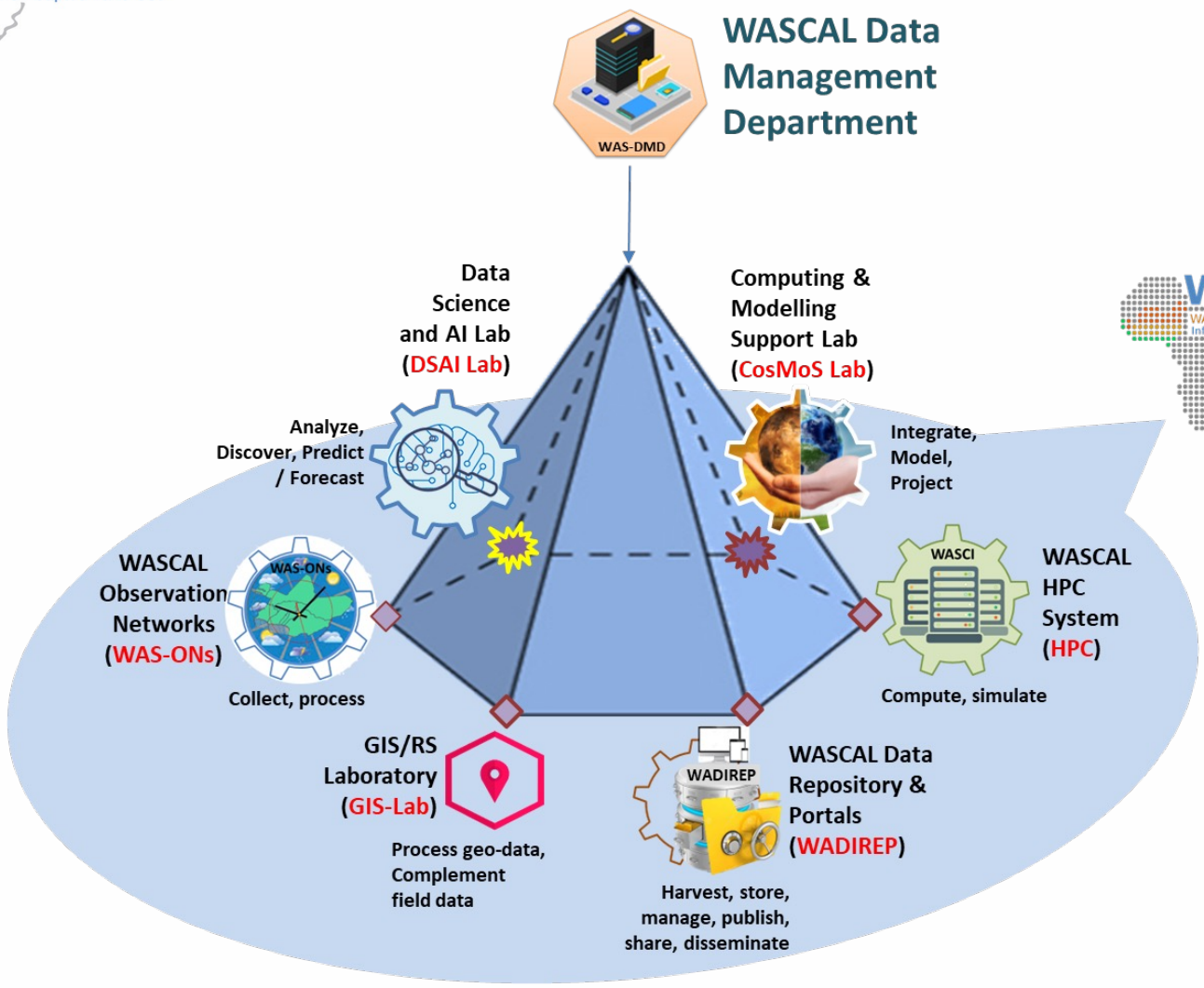

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WASCAL Data Repository & Portals (WADIREP)

Harvest, store, manage, publish, share, disseminate

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Data Initiative 4: Setup of a data repository, portals and apps infrastructure (WADIREP)

An innovative Cloud-based infrastructure of climate and environment-related data bases, portals, web-services, and applications for ICT-based delivery of data-driven services

WADIREP hosts currently: (i) The WASCAL Hydro-Meteorological time series open data portal [http://wascal-hydromet-net.org/], (ii) The WASCAL Scientific Research Data Catalog [https://wascal-dataportal.org/2.0/], (iii) The WASCAL-NESA Sunflower platform for AWS monitoring [http://sunflower.wascal-hydromet-net.org/], (iv) The cov-clichange app: WASCAL dashboard for monitoring COVID-19 daily statistics against air quality and climatic variables [https://wascal-dataportal.org/cov-clichange-app/], (v) The WASCAL value-added remotely sensed Environmental data portal (under-development)..

WASCAL Data Repository & Portals (WADIREP)

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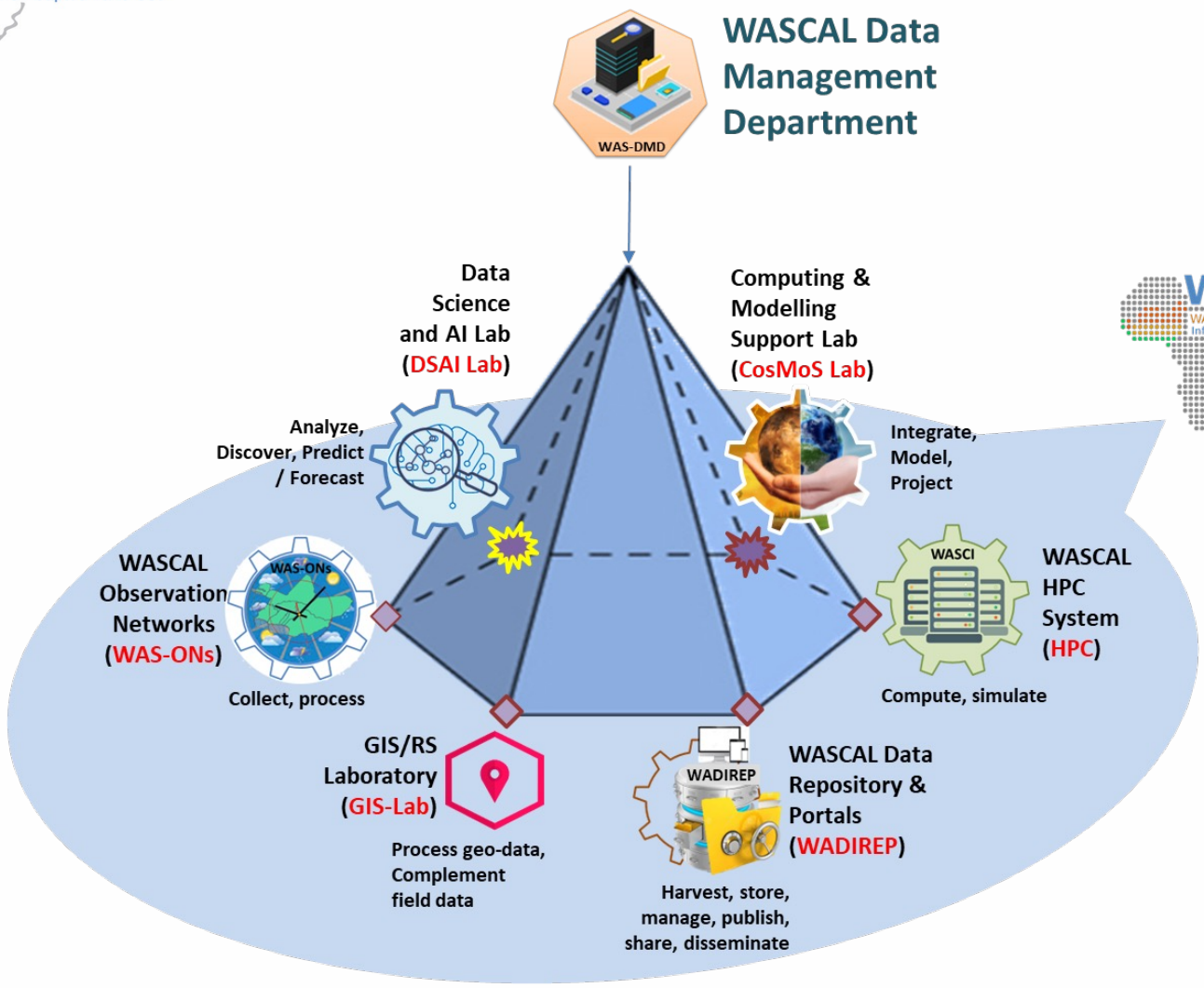
WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps



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WASCAL HPC System (HPC)

Compute, simulate

Data Initiative 5 Setup of a high performance computing (HPC) Data Center

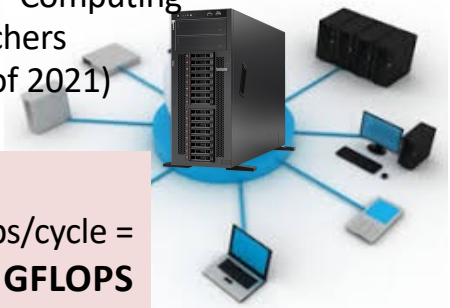
HPC System:

- **2 racks of 20 DellEMC PowerEdge R640 server Nodes.**

- **each processor with 8 cores (total 16 cores per compute node), 1024GB of RAM , two 120GB SSD drives and six 1TB HDD drives will be added to each compute node**

Data Computing Services:

Regional Climate Computing services to WA researchers and students (by end of 2021)



Computing Power

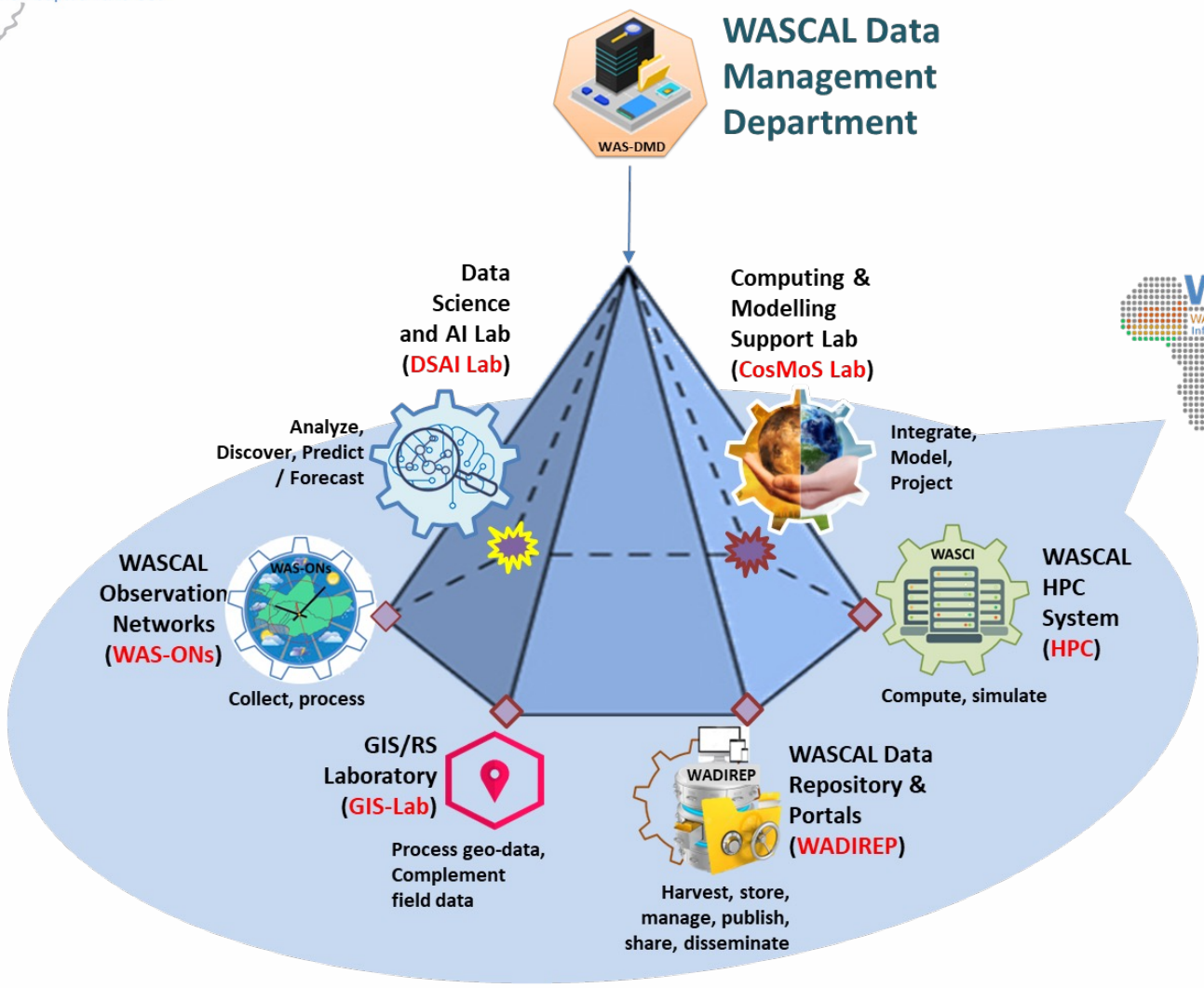
Nb Cores∗Avg frequency∗Ops/cycle =
320x3.2x10^9x32= **32 768 GFLOPS**
= 32,768 TFLOPS

This WASCAL Scientific Computing Infrastructure (WASCI) provides WASCAL Competence Centre with a long-needed and expected operational and computational power in order to enable further developments of regional climate models and carry out numerous projection and simulation experiments.

WASCAL HPC System (HPC)

Compute, simulate

WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps



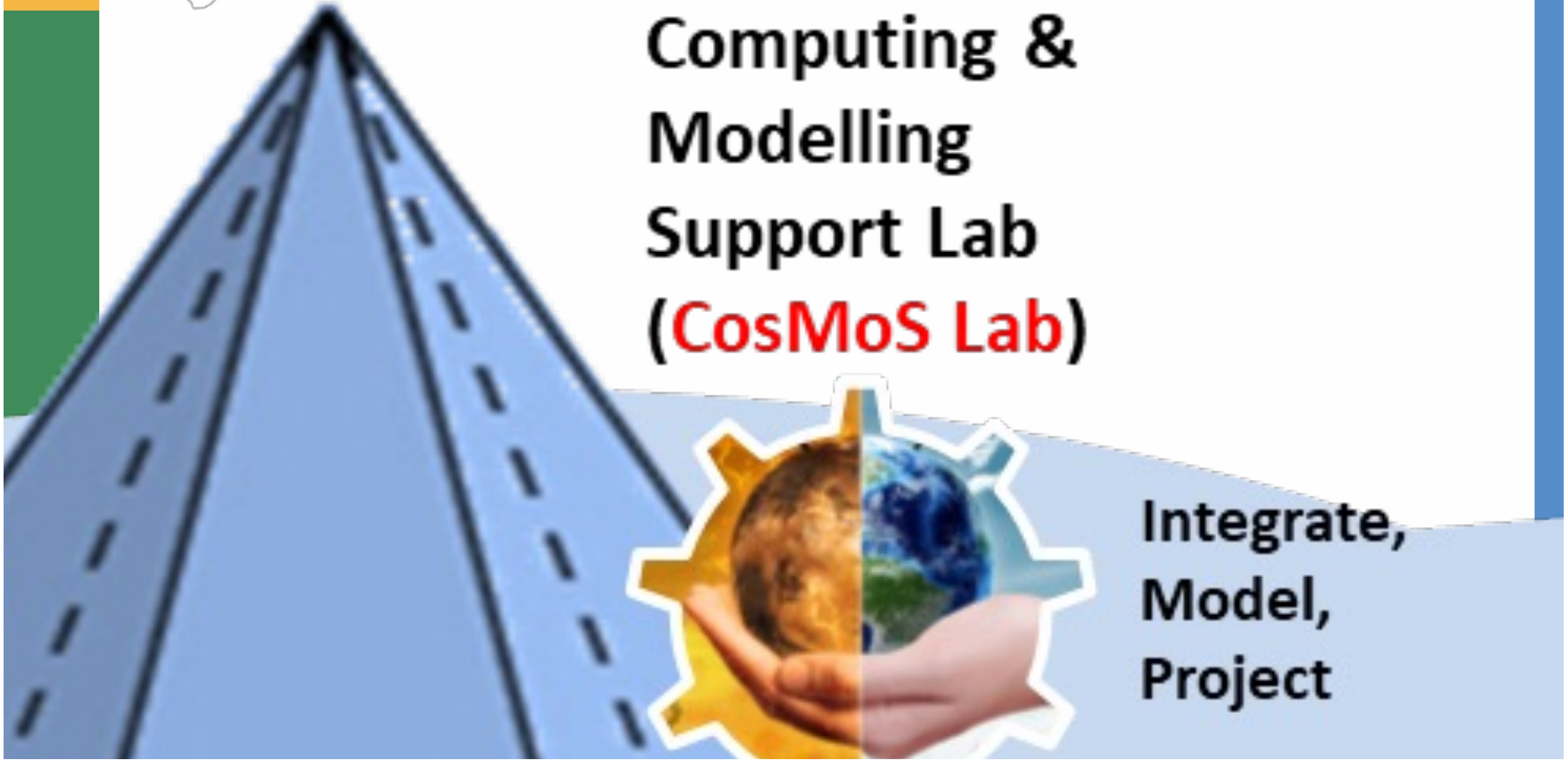
WADI
WASCAL Data centre Infrastructure & portals

WeDataMinD

West african distributed Data and Metadata Infrastructure and Networks for data Discovery and dissemination

www.wascal.org

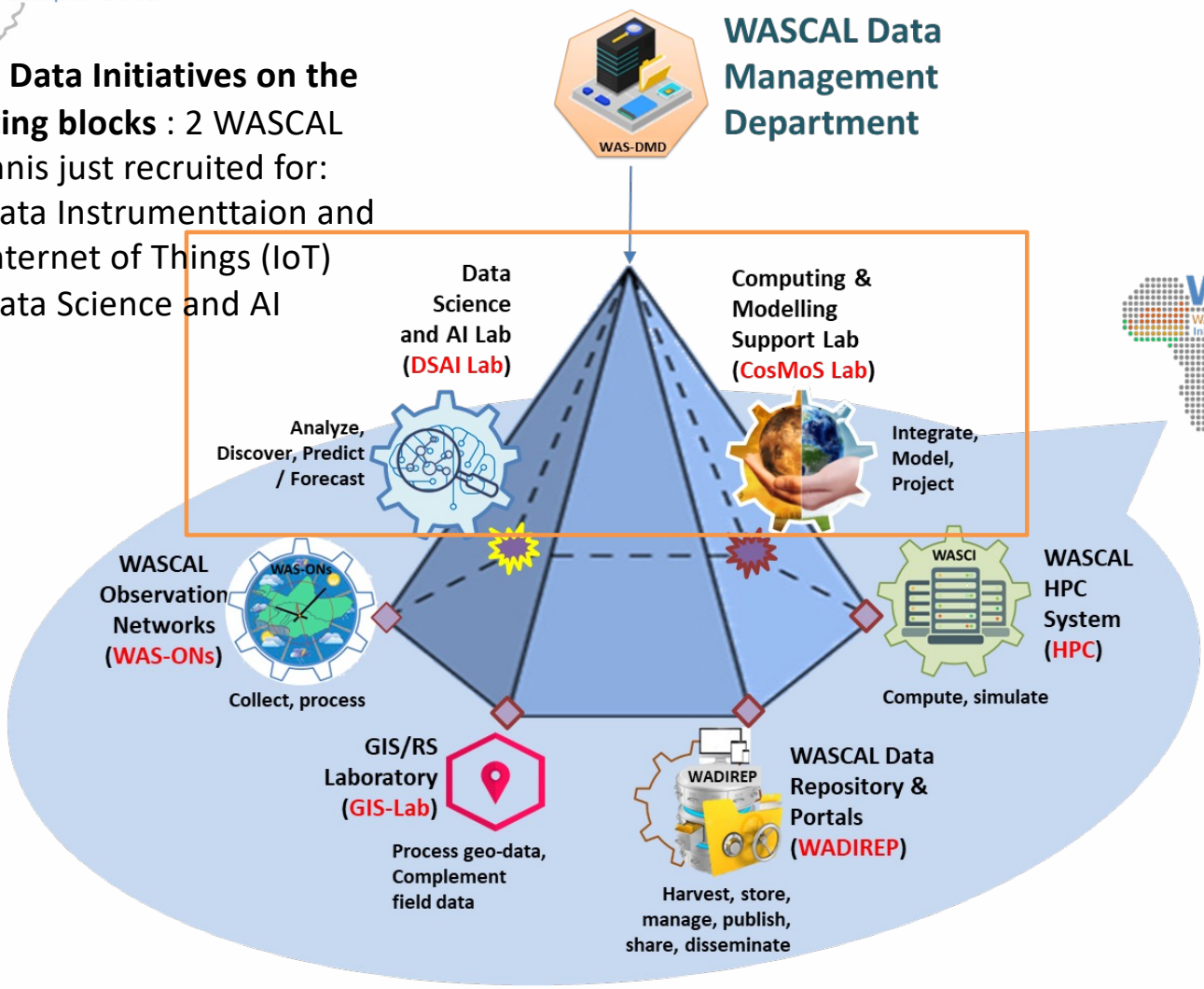
WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps

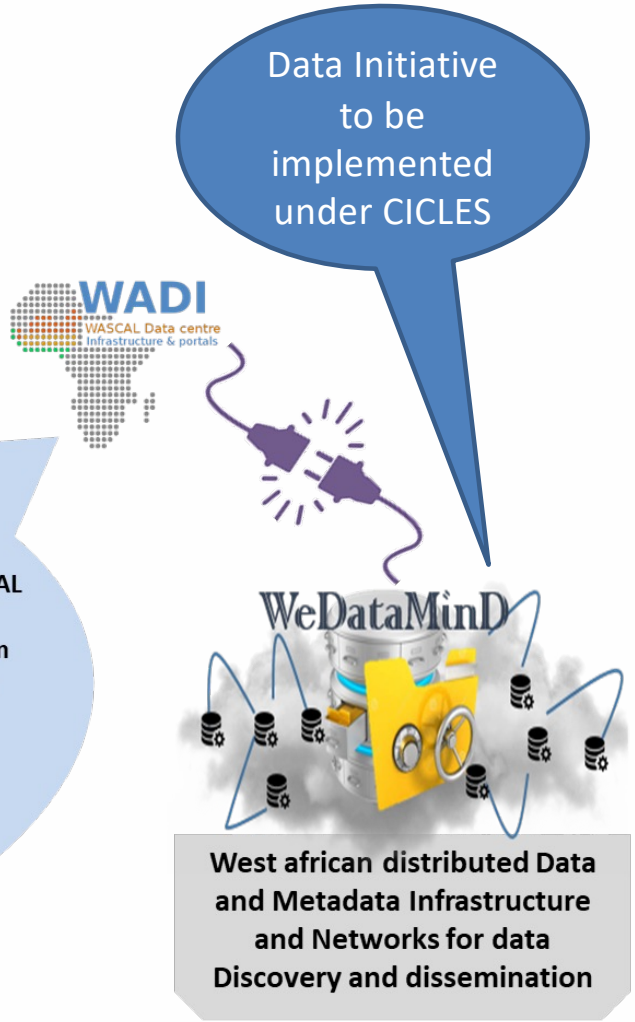


WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps

New Data Initiatives on the starting blocks : 2 WASCAL alumnis just recruited for:

- Data Instrumenttaion and Internet of Things (IoT)
- Data Science and AI





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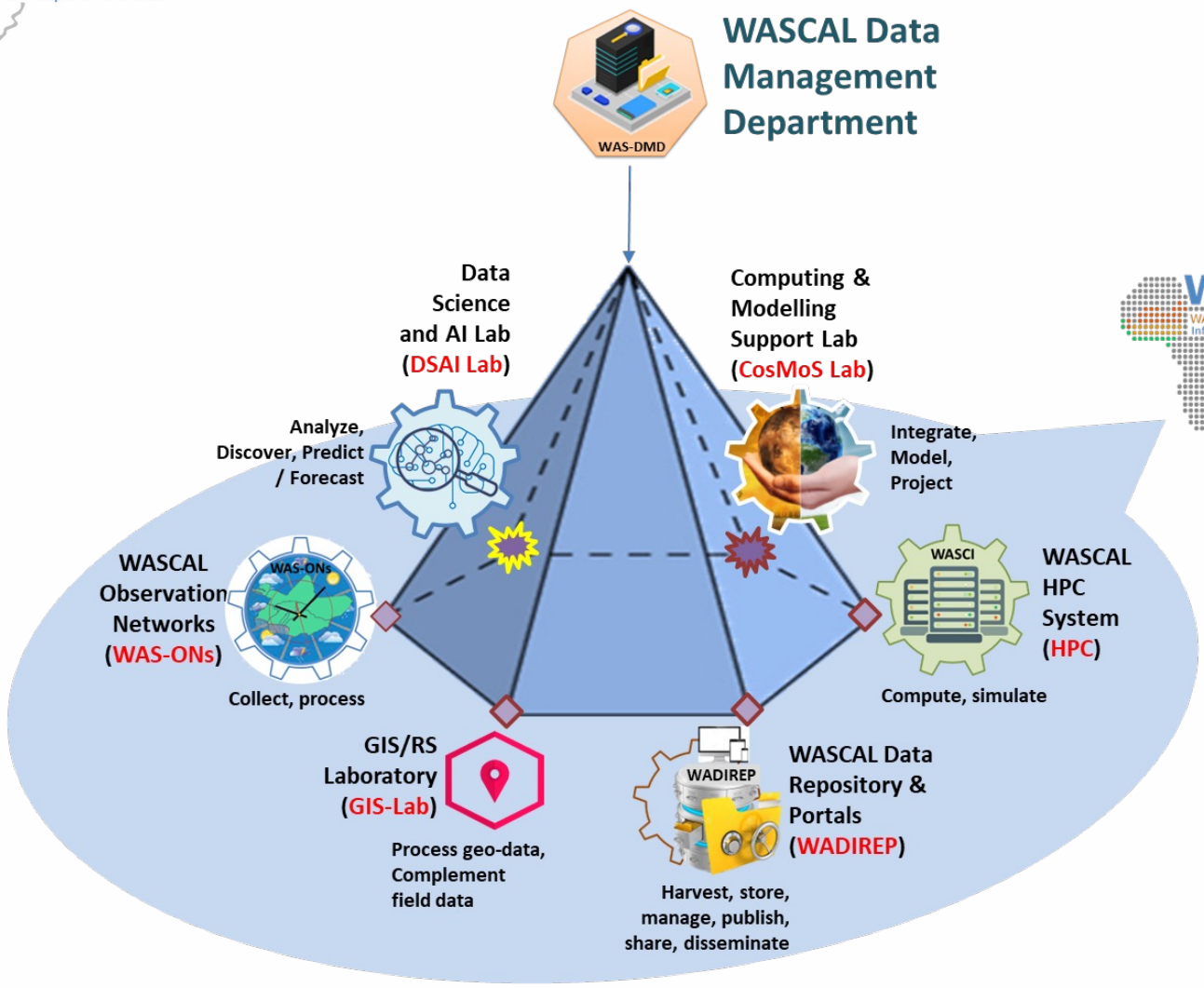

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WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps

Computing & Modelling Support Lab (CosMoS Lab)

Integrate, Model,

Data Initiative 4: Setup of a data repository, portals and apps infrastructure (WADIREP)

An innovative Cloud-based infrastructure of climate and environment-related data bases, portals, web-services, and applications for ICT-based delivery of data-driven services

WADIREP hosts currently: (i) The WASCAL Hydro-Meteorological time series open data portal [http://wascal-hydromet-net.org/], (ii) The WASCAL Scientific Research Data Catalog [https://wascal-dataportal.org/2.0/], (iii) The WASCAL-NESA Sunflower platform for AWS monitoring [http://sunflower.wascal-hydromet-net.org/], (iv) The cov-clichange app: WASCAL dashboard for monitoring COVID-19 daily statistics against air quality and climatic variables [https://wascal-dataportal.org/cov-clichange-app/], (v) The WASCAL value-added remotely sensed Environmental data portal (under-development)..

WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps

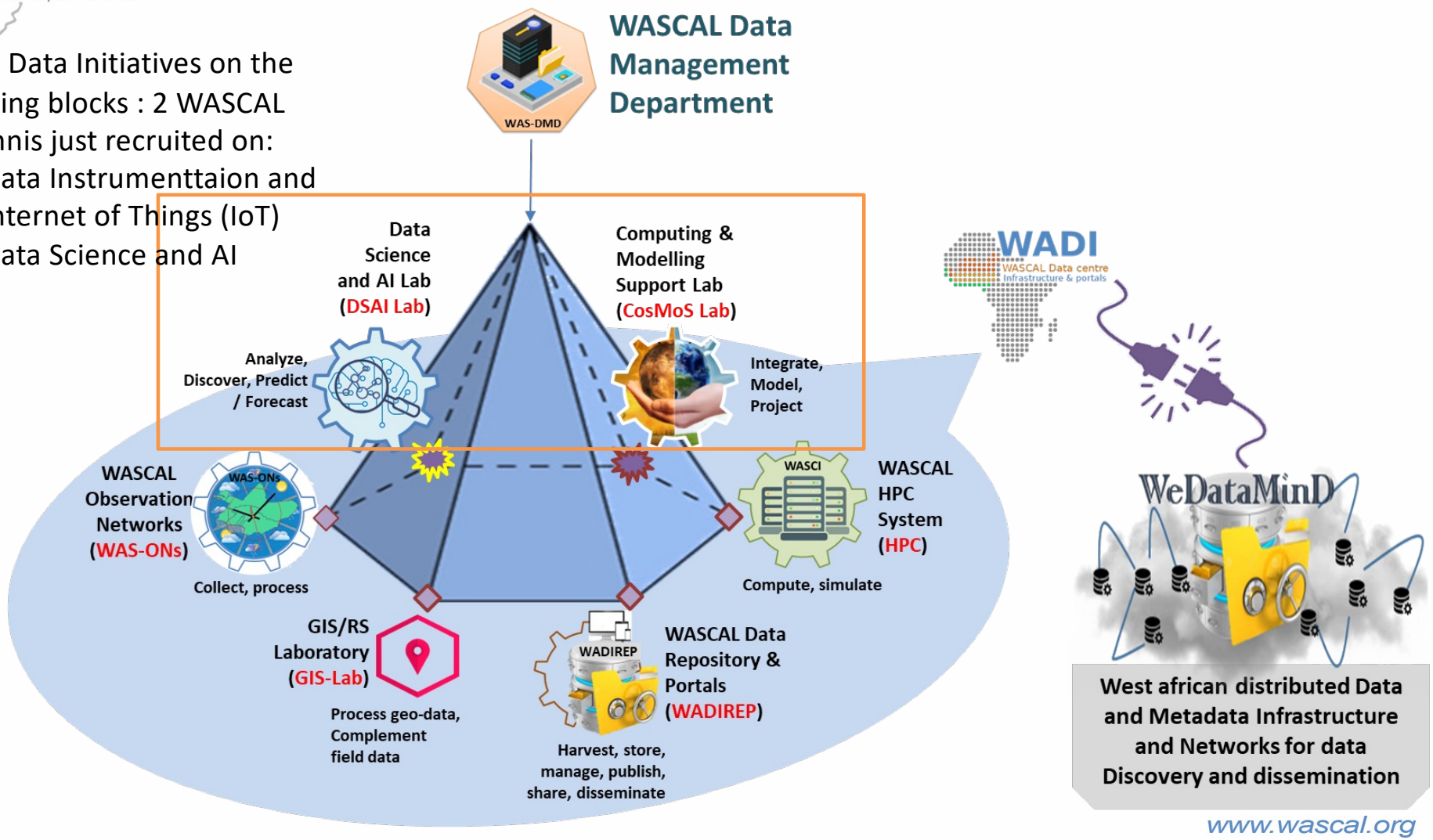
Computing & Modelling Support Lab (CosMoS Lab)

Integrate, Model,

WASCAL open Data Infrastructure INIATIVES to closing Technology and data gaps

New Data Initiatives on the starting blocks : 2 WASCAL alumnis just recruited on:

- Data Instrumenttaion and Internet of Things (IoT)
- Data Science and AI



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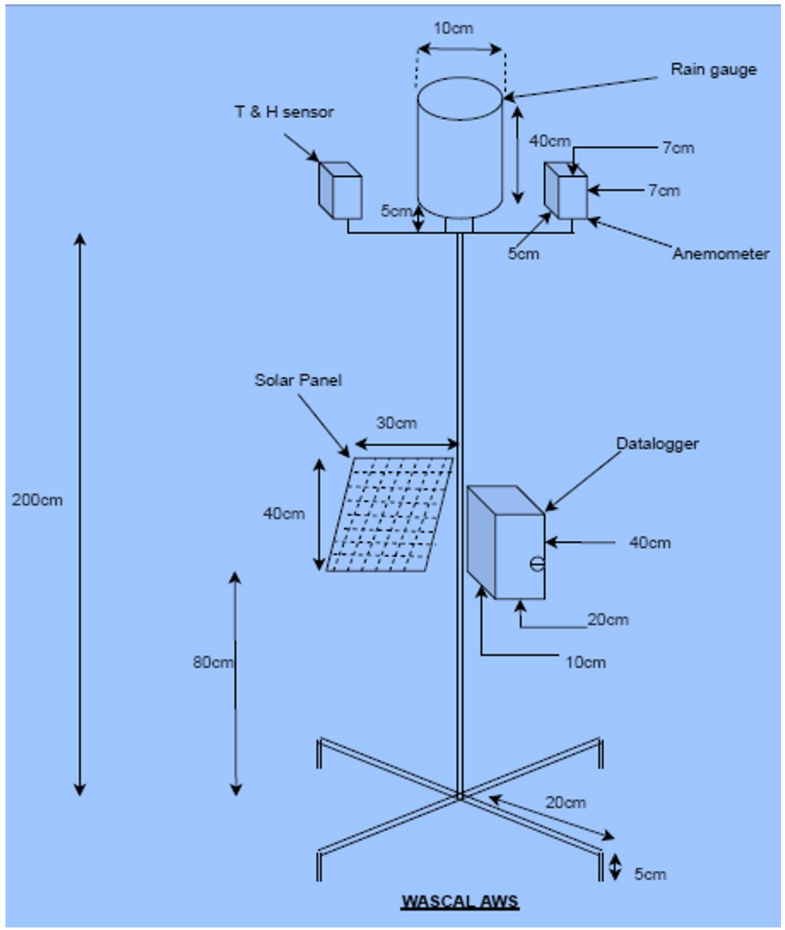
WASCAL
West African Science Service Centre on Climate Change and Adapted Land Use

KEY RECOMMENDATIONS

- ✓ Promote Applied Research leading to development of innovative tools as usable results
- ✓ Empower WASCAL GSPs with various skills in Data Science and AI that could decouple their potential in proposing applied solutions to face climate change in West Africa.
- ✓ Empower WASCAL GSPs with various skills in Arduino and Internet of Things that could decouple their potential in proposing applied solutions to face climate change in West Africa.
- ✓ **WASCAL to promote Climate Change Entrepreneurship to foster applied solutions and Climate Incubation centers to mature in-house prototype**

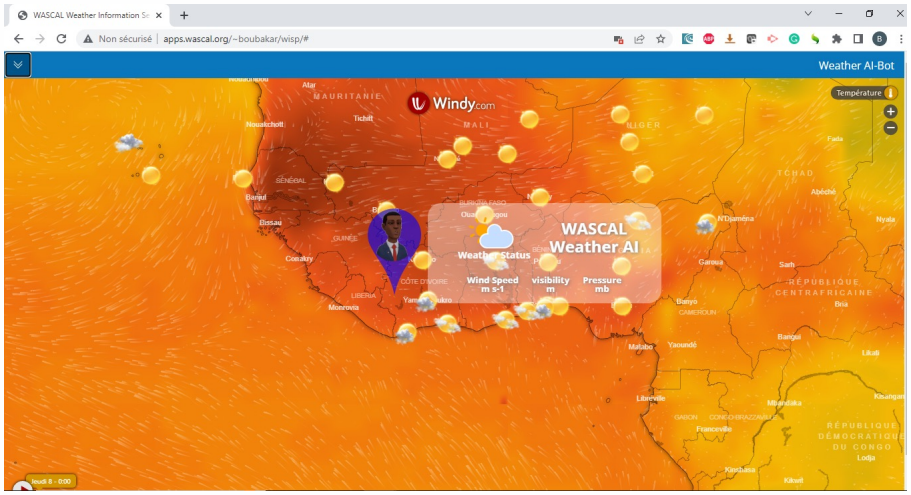
WASCAL
West African Science Service Centre on Climate Change and Adapted Land Use

Already on the starting blocks



WASCAL in-house AWS prototype

- PPEDMAS PROJECT
- WACAL AI HUB



THANK YOU