CLIMATE SENSITIVITY TO WATER TAMPERING AN OPTICAL TO INFRARED CONVERSION OF TERRESTRIAL BOTANICAL MATERIAL DUE TO FRONT AND BACK LOADING OF LAND USE ACTIVITY

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Coastal hazard and shortage of water are increasing in many areas around the world. This problem affects coastal engineering in facing challenges due to natural disaster, production of oxygen by phytoplankton, and development of natural resources. On the other hand, humans think that water will always be available for use at any time. This may not be true with the changing world climate. **Climate sensitivity** was discussed on the two elements that define climate--temperature and precipitation (rainfall).

General science of this project relates to the state of water as it changes from water vapor (air), liquid, to solid and how it can be measured/managed spatially as part of the Earth's natural resources. In each state of water, heat loss or gain was computed or modeled as sensible heat. Sensible implying effective temperature or blackbody assumption, to include: radiation temperature, radiance temperature, distributed temperature, and color temperature [**1**]. Physical geography shows this heat in the thermal skin-depth environments or applied surfaces, which consists of digital surface model (DSM), digital terrain model (DTM), and digital surface water model (DSWM). The digital data structure of these models are derived from vector-based triangulated irregular network (TIN) [**2**], where the primary structure is the digital elevation model (DEM) [**3**], an equalizer of these models. The secondary structure is the rasterized DEM. Both structure are primarily modulated by moisture and temperature at top and bottom surfaces of an entity, such as sea surface and surface of sea floor. These observed effects were used for land use/land cover, to estimate or predict relationships that are derived from 1) air/land, 2) air/water, 3) water/land, 4) animal/land, and 5) animal/water interfaces. These sensitivities can be measured or observed from satellite sensors on platforms like as RADARSAT 1 or TerraSAR-X.

Needs analysis: land-use activities loads thermal effects of terrestrial surfaces as rhythm that aids the fluctuation of global hydrologic cycle. These effects are parts of land use/land cover relationships that affect water availability, consumption, and management (WACM). These surfaces are naturally occurring within human cultures; hence, WACM build on different regimes of anthropogenic disturbance, which create random and varied climate impacts. These impacts now challenge global WACM.

Objective: to use remote sensing techniques (distant measurements of the physical environments of a surface) to align WACM solutions with HyspIRI mission--applications of hyperspectral remote sensing of surface emission of effective temperature. *Methodology:* "coherent temporal resolution--CTR" of hyperspectral remote sensing observations, with underlying assumption that entity surfaces act like blackbodies (BB), where the sum of surface emissivity and reflectance is unity--(emissivity + reflectance = 1) [**4**] or their *generic* + *specific* properties = (absorptivity + reflectance = *unity)* this implies that emissivity = absorptivity$^{T=}$ [**5**]. Humans depend on these surface expressions for survival; hence they contribute to the thermal expressions or culture of the surfaces. These surfaces are derived from air/land, air/water, water/land, and animal/land, and animal/water interfaces such that their cultures become part of geophysical conveyance of specific expressions or entity categories of time series of cartographic information, which can be accessed through series of satellite imagery.

Coherent temporal resolution level one--CTR_1 was used to evaluate real objects (geometries with little or no appreciable or measurable changes over a long span of time)^t, such as land use categories. CTR_1 uses latency of time to conveys symbolic surface intelligence such as history, culture, and other properties of the surface. It has a mathematical expressions of the form: $P(t_1 - t_0) \approx \Delta P = 0^t$. This resolution supports solid Earth modeling (SEM), which does not show appreciable changes in P = digital elevation model (DEM), digital terrain model (DTM), and digital surface model (DSM). Therefore, P has ***idempotent*** properties such as culture, or the probability that the properties have changed after time *t tends to zero*. The CTR_1 of SEM serves statistical constructs of geophysical sensitivity to land use/cover change. Data from Landsat satellite system facilitate analysis or indicators of this property, that the solid Earth and its component surfaces are not changing appreciably.

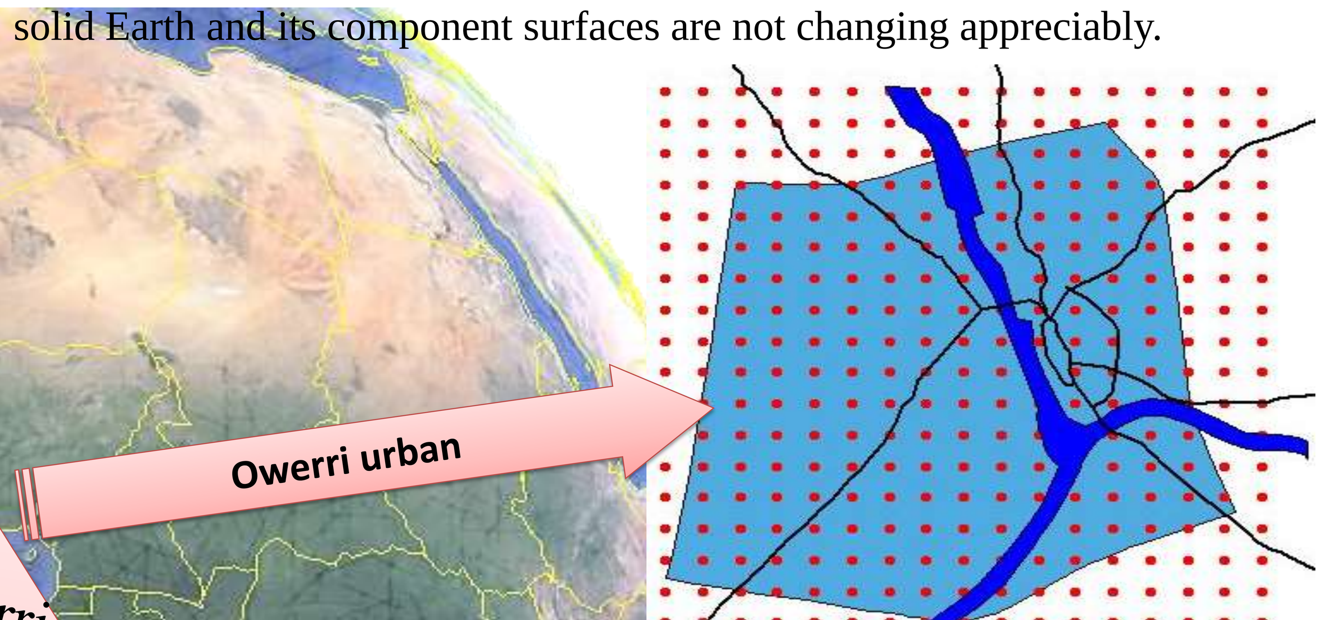


Figure 2. Owerri Urban

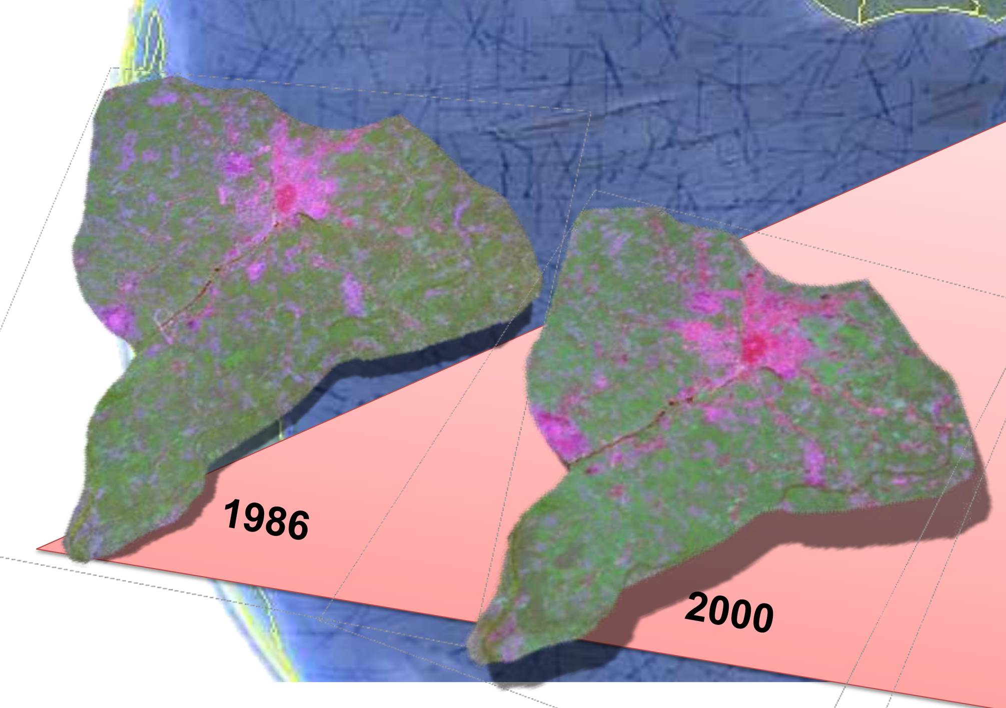
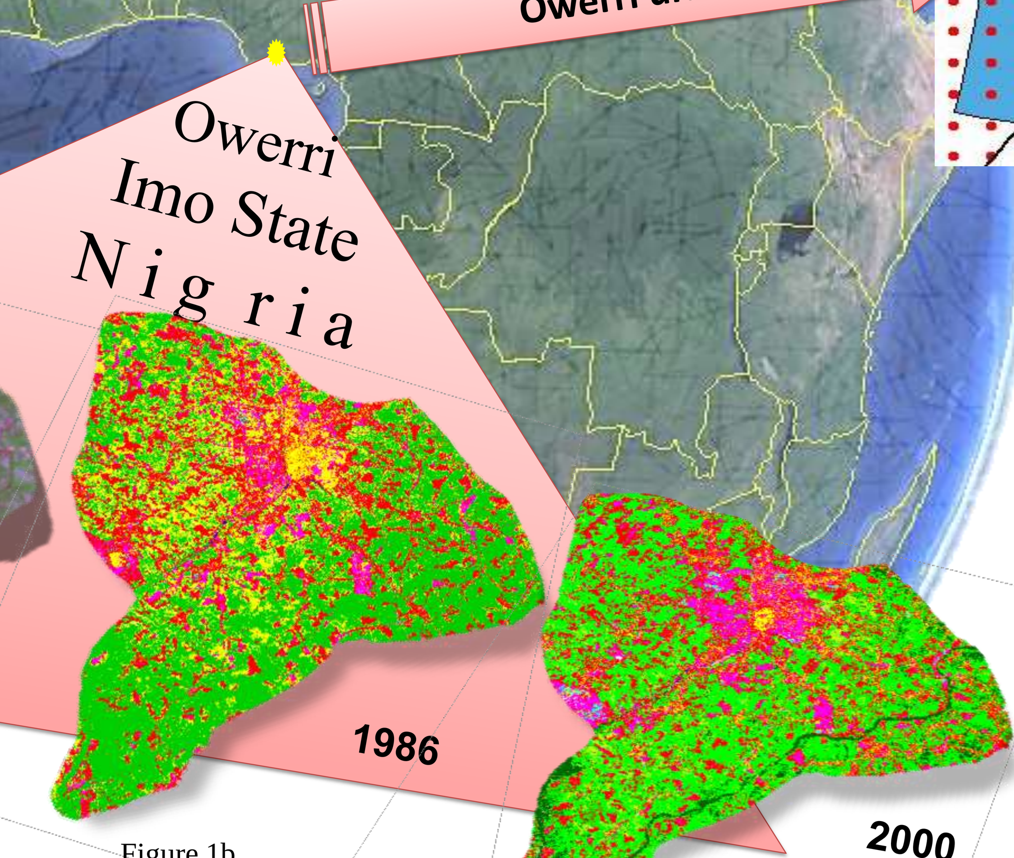


Figure 1a. 1986 TM and 2000 ETM **Landsat** imagery of Owerri County,
Land use and land cover observations of entities with non-appreciable change.
(Conveyance of cultural and symbolic intelligence may be sensitive to climate).



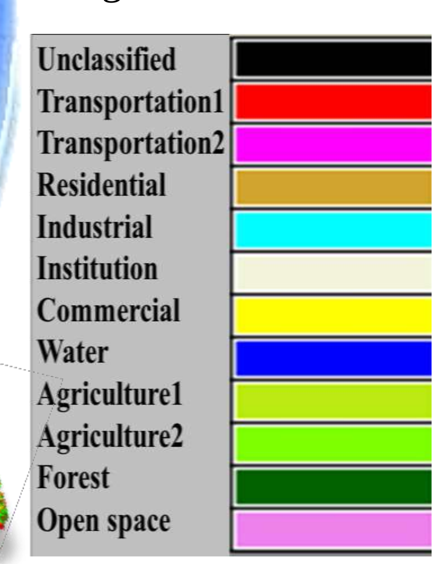


Figure 1b.
Classification of the1986 TM and 2000 ETM **Landsat** imagery of Owerri County.
CTR_1 of the land use/cover was used for to evaluate the sensitivity of the physical environment to climate change

Remote sensing is the tool with the benefits of *solar radiation* to transmit, store, and transport surface water, *temperature*, and *wind circulation. Solar radiation also act on atmospheric and soil moisture contents*, *precipitation*, and *soil water* as sensible heat, in the atmosphere, in water, and on land. This capacity affects the vapor, liquid, and solid states of water to facilitate cartographic thematic information that generates relationships such as local and global hydrologic cycle, which is part of land use/land cover relationship. Time series of cartographic information with continuous or iterative change build on linear relationships of the rates of change associated with different entities. With the fact that the rates of change are frozen in time, they can be used to estimate, quantify, or predict behaviors of global hydrologic cycle, such as the rates of evaporation from surface water, evapotranspiration, and atmospheric moisture and precipitation, as these are primary sources of fresh water considerations in land use and water management. The Terra and Aqua satellites have great instrumentation for measuring these surface relationships.

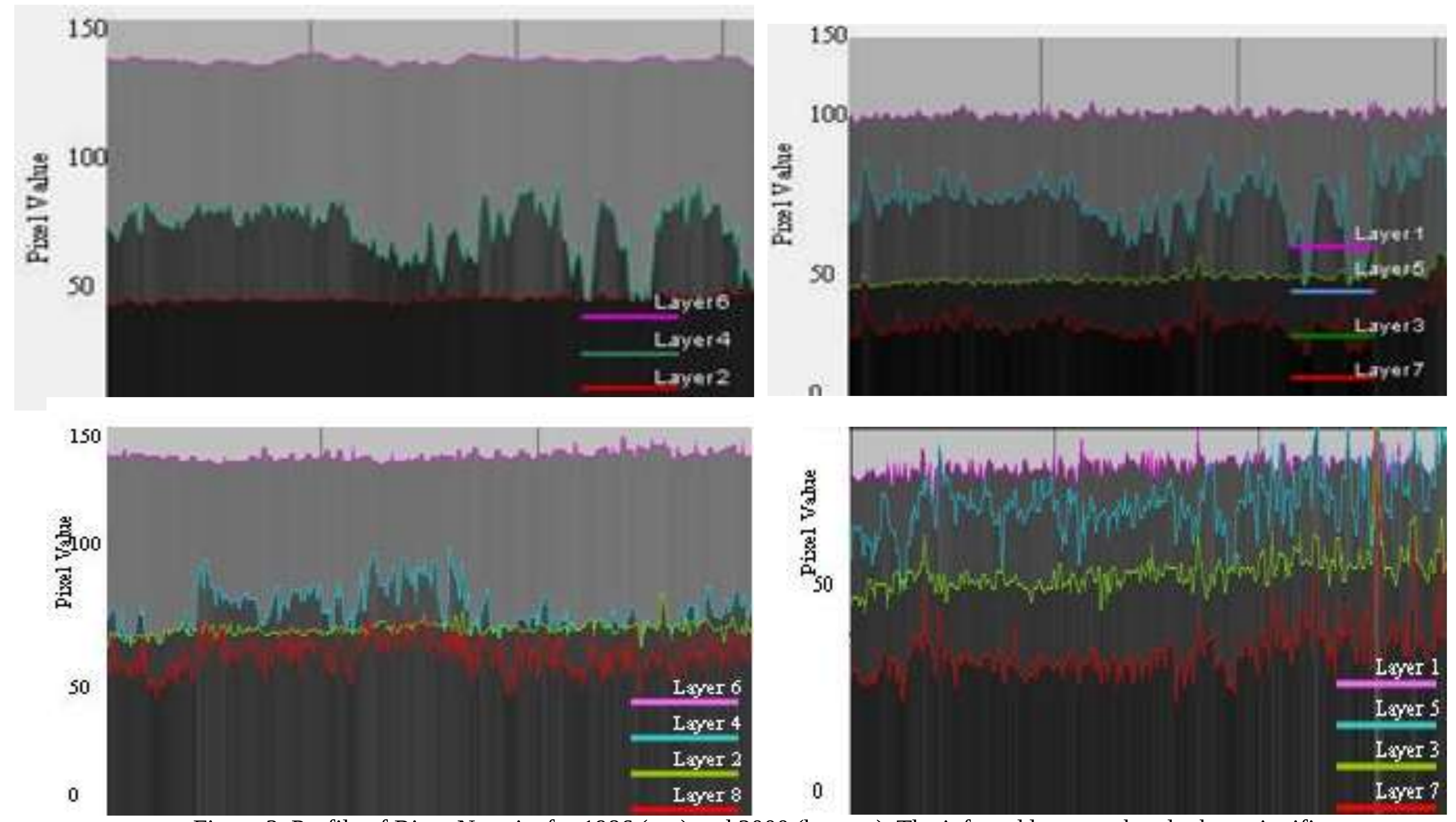


Figure 3. Profile of River Nworie for 1986 (top) and 2000 (bottom). The infrared lavers or bands show significant changes in the hydrologic culture of the river, which includes agricultural and population demands

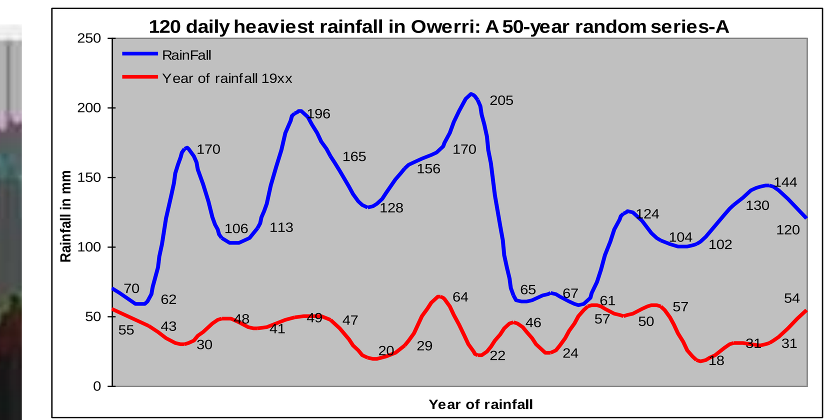


Figure 5. Modulation of rainfall data
(20 of 120 data points, in Owerri urban)

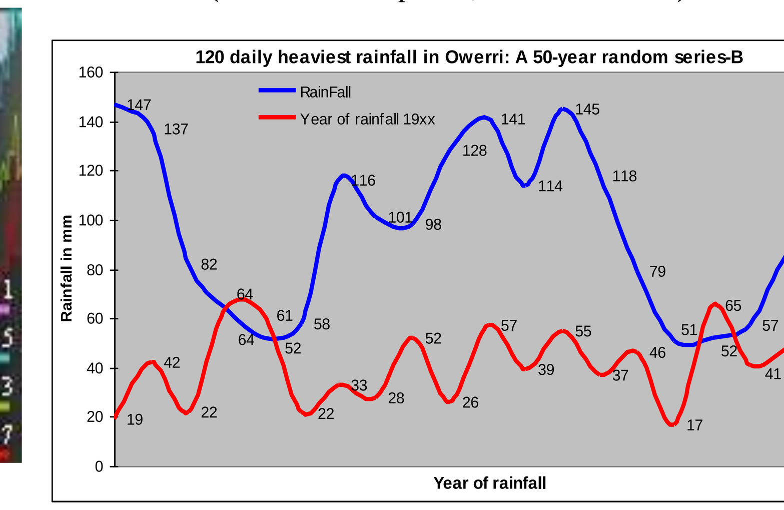


Figure 6. Modulation of rainfall data
(40 of 120 data points, in Owerri urban)

The geophysical conveyance of time-specific cartographic information builds on CTR_2 for ***continuous change*** expressions that affect surfaces of air/land, air/water, and water/land interfaces. For example, population or wind speed resolution in time (Figure 4). This conveyance is impressive on surface canonical correlations and autocorrelations. It implicates convoluted relationships that express complexity and difficulty of continuous change and has mathematical expressions of the forms: $(f * g)(s) = \int_{-t}^{t} f(x)g(s-x)dx$ for continuous observations, and $(f * g)(s) = \sum_{x=-t}^{t} f[x]g[s-x]$ for discrete observations. The shift relates to the response optimization and is vital to the solutions.

Information from the visible bands, **RGB** (0.45μm to 0.69μm) is time-sensitive to pigment chlorophyll activities. The infrared bands (0.76μm to 12.5μm), with clearer surface contrasts, are also time-sensitive and goal oriented in mapping reality. These expressions provide solutions for consumptive use of global freshwater supply/demand response to climate change, where the response is the CTR_2 of reality, expressed as the shift (s-x) in the above equation.

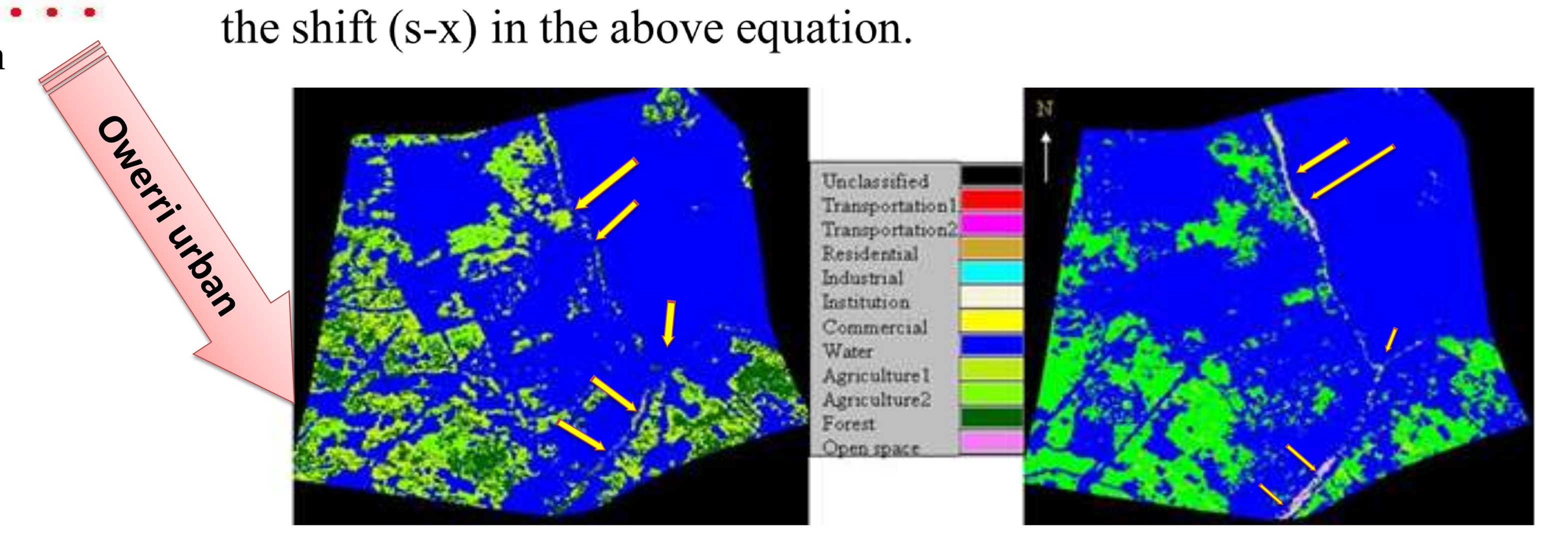


Figure 4. Simulated water demand over supervised classification of Owerri urban land use, in relation to its forest, agricultural, and population demands. (The infrared bands showed less water/land and water/vegetation contrasts in 1986 than in 2000 to implicate water loss in 2000, where water/vegetation contrast is more obvious).

To improve early detection, mitigation, and detrimental geophysical impacts such as draught or flooding will require CTR_3 of *rapid changes* that affect surfaces of air/land, air/water, and water/land interfaces, which emphasize comprehensive observations of mixed pixels. The CTR_3 conveys discrete or transitional relationships, where discrete rapid changes build on any central tendency, such as average or frequency of occurrences, while transitional changes build on probability. Detection, mitigation, or impacts were computed as synchronized averages of the temporal resolutions with parametric data logging time induction. The data were first logged to local, regional, and national scales, where global scales are derived. Among entities that cause rapid changes like, temperature and precipitation create meteorological changes and define climate. The primary tool for early detection is the timing of rapid changes in temperature, humidity, and chemical composition of aerosols, especially terrestrial aerosol such as LUAD and hygroscopic relative humidity particles (HRHP). Sources of terrestrial aerosol relate to expected Impacts in any physical location. The conveyance of time-specific cartographic information on CTR_3 points to when the air above a land use loads the aerosol particles, of different properties, such as non/greenhouse gases, with cloud formation. This is one reason acid rains are possible derivatives of orographic rainfall; equatorial regions have high percentage cloud cover and heavy rainfalls; desert regions have little or no rainfalls, and Polar Regions are cold. Weather satellites have high technological capabilities in sensing rapid changes in weather and meteorological phenomena (Figure 5 &6).

For prediction of possible impacts, the classification of terrestrial and extraterrestrial aerosol particles becomes obvious. The probability of classification of the change (P(x), establishes the fact of two probabilities (probability of detection P(*d*) and recognition P(*r*) of the rapid changes). The CTR_3 builds on P(x), which depends on the additive contributions of P(*r*) given P(*d*). Thus, P(*c*) = P(*d*) + P(*r*). The determination or conveyance of transitional probability for a memory Markov chain relates more to model relationships of natural phenomena, where transitional probability is used to compute the next state that represents the effects of the rapid changes. And for discrete observations, the ***average*** values of rapidly changing phenomena can be derived from satellite imagery. For example, mean monthly rainfall rates within 30-60 kilometers (18 to 36 miles) downwind of some cities were on ***average***, about 28 percent greater than the upwind region due to urban heat islands [**6**]. The CTR_3 Rapid changes convey the knowledge of transition probability, where the fluctuation of entity rhythms modifies the transition, such as in scintillation or surface speed of flowing water body [**7**]. Measurements of such quantities can be taken from space by satellite the TRMM's precipitation sensors.

Conclusion: The Landsat 7 satellite instrumentation on the Earth Observation supports great visual image capability of the Earth's, which are now instrumental in tracking surface changes and quality of entities. Time must freeze cartographic information with accessible latency, to enable the HyspIrI approach/techniques to remote sensing to measure any surface expression or culture.

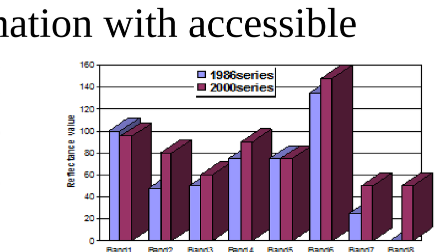


Figure7. A surface reflectance profile of River Nworie in Owerri urban

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