WHAT IS A DISASTER?

- A disaster, precipitated by a natural hazard, can be defined as a “serious disruption of the functioning of a community or a society causing widespread human, material economic and environmental losses which exceed the ability of the affected community or society to cope using its own resources” [ISDR 2004]
- A disaster thus arises from the combination of the hazard event or episode, the conditions of vulnerability to that hazard and the inefficiency of capacity or measures to cope with the hazard

WHAT IS A DISASTER contd.

FROM THIS DEFINITION THE TERM NATURAL DISASTER IS AN OXYMORON, AS THE VULNERABILITY AND COPING FACTORS IN THE EQUATION ARE WITHIN HUMAN CONTROL TO SOME DEGREE AND THEREFORE ARE NOT NATURAL

A BROADER VIEW OF A NATURAL RISK

- SINCE DISASTERS ARISE OUT OF A CONCATINATION OF MANY FACTORS, NATURAL AND SOCIAL THEN AN EARLY WARNING SYSTEM SHOULD ADDRESS ALL OF THE FACTORS RELEVANT TO THE PARTICULAR RISK
- FROM THIS PERSPECTIVE, IT IS DESIRABLE TO MONITOR AND PROVIDE EARLY WARNING AND FORESIGHT NOT ONLY ON THE SHORT- TERM PRECIPITATING HAZARDS AND GEOPHYSICAL CONDITIONS BUT ALSO ON THE RELEVANT LONGER-TERM FACTORS SUCH AS DECLINING ENVIRONMENTAL STATE, RISK RAISING DEVELOPMENT PRACTICES AND CAPACITIES,TRENDS IN FOOD MARKETS,SETTLEMENT TRENDS AND MIGRATION, CONFLICT AND HEALTH STATUS.
- THIS INVOLVES A WIDE RANGE OF TIME FRAMES AS ILLUSTRATED WITH A FEW DISASTERS BELOW.....

A FEW STATISTICS WORLDWIDE

- Disaster data is not of very high quality but according to CRED 2005, IFRC 2005, ISDR 2005A, OVER THE LAST DECADE(1995-2004) NEARLY 6,000 DISASTERS WERE RECORDED WITH 900,000 DEAD, USD 738 BILLION MATERIAL LOSSES AND 2500 MILLION PEOPLE AFFECTED.
- MOST DISASTERS HAVE METEOROLOGICAL ORIGINS FROM EXTREMES OF TEMPERATURE, RAINFALL, WIND BUT EARTHQUAKES FEATURE HIGH IN THE DEATH RATES OWING MAINLY TO DEFECTIVE BUILDING DESIGNS
- DISASTERS MISAPPROPRIATELY AFFECT POOR PEOPLE AND POOR COUNTRIES ESPECIALLY THE DEVELOPING COUNTRIES
- THE FLOODS OF 1995, 2010 IN ACCRA,WESTERN AND CENTRAL REGIONS, THE FLOODS IN 2007 IN NORTHERN GHANA, MUDSLIDES ARE STILL FRESH IN OUR MEMORIES. HOW MANY PEOPLE DIED? HOW MANY WERE DISPLACED? ARE THESE RECORDED IN THE STATISTICS OF THE WORLD BODIES?

A FEW REASONS FOR INCREASED DISASTERS

- INCREASING POPULATIONS
- DEGRADATION OF NATURAL ENVIRONMENTS SUCH AS FLODPLAIN SETTLEMENT, COASTAL EXPLOITATIONWETLAND DESTRUCTION,RIVER CHANNELLING, DEFORESTATION, SOIL EROSION AND FERTILITY DECLINE.
- VULNERABILITY TO HAZARDS IS EXACERBATED BY POVERTY, DISEASE, CONFLICT AND POPULATION DISPLACEMENT

ESTIMATION OF LONG-TERM TRENDS IN DISASTERS

- THIS DEPENDS VERY MUCH ON THE PERIOD USED FOR THE DATASET
- COMPARING THE MOST RECENT DECADE(1995-2004) THE CRED SHOWS THAT THE NUMBER OF PEOPLE AFFECTED BY DISASTERS INCREASED BY 1.5 TIMES, ECONOMIC DAMAGE INCREASED BY 1.8 TIMES AND TOTAL DEATHS INCREASED BY 2.0 TIMES. THE INCREASE IN DEATH WAS HEAVILY AFFECTED BY THE 26 DECEMBER 2004 TSUNAMI
- PRIOR TO THAT DATE THERE WAS A DECREASING TREND FROM THE 1950S DUE TO BETTER PREPAREDNESS AND RESPONSE SYSTEMS

KEY REQUIREMENTS OF A GOOD EWS

- EARLY WARNING SYSTEMS REQUIRE A BROAD MULTIDISCIPLINARY KNOWLEDGE BASE, BUILDING ON THE SUBSTANTIAL EXISTING DISCIPLINE-BASED RESEARCH IN THE GEOPHYSICAL, ENVIRONMENTAL AND SOCIAL SCIENCE FIELDS. THERE IS A NEED FOR MORE SYSTEMIC, CROSS-CUTTING AND APPLIED RESEARCH, INCLUDING ON THE FOLLOWING TOPICS:
- DEVELOPMENT AND USE OF GEOSPATIAL DATA MODELS, RISK MAPS AND SCENARIOS,
- COST-EFFECTIVE OBSERVATIONS SYSTEMS,
- DATA GENERATION AND ASSIMILATION (E.G. BATHYMETRY FOR TSUNAMI MODELS),
- IMPROVEMENT OF CORE PREDICTION SYSTEM MODELS AND PREDICTION TOOLS,
- WARNING DECISION SYSTEM TOOLS FOR DISASTER MANAGERS,
- MANAGEMENT UNDER WARNING UNCERTAINTY,
- EVALUATION AND COMPARISON OF WARNING COMMUNICATION METHODS,
- MODELS OF HUMAN RESPONSE BEHAVIOR INCLUDING EVACUATIONS,
- VISUALIZATION OF IMPACTS AND RESPONSE OPTIONS FOR COMMUNITY PREPAREDNESS,
- OPERATIONALIZATION OF THE ‘ALL-HAZARDS’ APPROACH,
- ROLE OF EARLY WARNING AS AN ADAPTATION TO CLIMATE CHANGE,
- WARNING SYSTEM PERFORMANCE, INDICATORS BENCHMARKS, AND
- ECONOMIC ASSESSMENTS OF WARNING SYSTEM EFFECTIVENESS.

EARLY WARNING SYSTEMS AND THEIR ELEMENTS

- THE EXPRESSION "**EARLY WARNING SYSTEM**" IS USED IN MANY FIELDS TO MEAN THE PROVISION OF INFORMATION ON AN EMERGING DANGEROUS CIRCUMSTANCE WHERE THAT INFORMATION CAN ENABLE ACTION TO BE TAKEN IN ADVANCE TO REDUCE THE RISKS INVOLVED.
- ERALY WARNING SYSTEMS EXIXT FOR NATURAL GEOPHYSICAL AND BIOLOGICAL HAZARDS, COMPLEX SOCIO-POLITICAL EMERGENCIES, INDUSTRIAL HAZARDS, PERSONAL HEALTH RISKS AND MANY OTHER RELATED RISK.
- HOWEVER, IN THE PRESENT SETTING, WE ARE CONCERNED WITH GEOPHYSICAL HAZARDS-STORMS, FLOODS, DROUGHTS,LANDSLIDES,VOLCANIC ERUPTIONS, TSUNAMIS ETC AND RELATED HAZARDS THAT HAVE A GEOPHYSICAL COMPONENT, SUCH AS WILD FIRES,LOCUST PLAGUES AND FAMINES
- THE UN-ISDR DEFINES EARLY WARNING AS "THE PROVISION OF TIMELY AND EFFECTIVE INFORMATION THROUGH IDENTIFIED INSTITUTIONS THAT ALOWS INDIVIDUALS EXPOSED TO A HAZARD TO TAKE ACTION TO AVOID OR REDUCE THE RISK AND PREPARE FOR EFFCTIVE RESPONSE (ISDR, 2004)

EARLY WARNING SYSTEMS AND THEIR ELEMENTS CONTD1.

- THE CONCERNS OF EARLY WARNING SYSTEM RESEARCHERS AND PRACTIONERS THEREFORE SPAN THE NATURAL AND SOCIAL SCIENCES AND THEORETICAL PRACTICAL MATTERS.
- TO BE EFFCTIVE AND COMPLET AN EREALY WARNING SYSTEM NEEDS TO INTERACT FOUR (4) INTERACTING ELEMENTS:

1. 1-RISK KNOWLEDGE
2. 2-MONITORING AND WARNING SERVICE
3. 3-DISSEMINATION AND COMMUNICATION
4. 4-RESPONSIVE CAPABILITY

- WHILE THIS APPEARS TO BE HAVE A LOGICAL SEQUENCE, EACH ELEMENT HAS DIRECT TWO-WAY LINKAGES AND INTERACTIONS WITH EACH OF THE OTHER ELEMENTS
- THE 2ND ELEMENT THE MONITORING AND WARNING SERVICE IS THE MOST WELL RECOGNIZED PART OF THE EARLY WARNING SYSTEM BUT EXPERIENCE SHOWS THAT TECHNICALLY HIGH QUALITY PREDICTIONS BY THEMSELVES ARE INSUFFICIENT TO ACHIEVE THE DESIRED REDUCTIN IN LOSSES AND IMPACTS.
- THE HUMAN FACTOR IS THE MOST SIGNIFICANT IN THE EARLY WARNING SYSTEM
- FAILURES IN EWS OCCUR IN THE COMMUNICATION AND PREPAREDNESS ELEMENT. e.g KATRINA 2005, FLOODS IN GHANA

EARLY WARNING SYSTEMS AND THEIR ELE MENTS CONTD2

- IT MUST BE STRESSED THAT IN ORDER TO SUSTAIN THE FOUR ELEMENTS OVER THE LONG RUN, IT IS NECESSARY TO HAVE A STRONG POLITICAL COMMITMENT AND DURABLE INSTITUTIONAL CAPACITIES, WHICH IN TURN DEPEND ON PUBLIC AWARENESS AND AN APPRECIATION OF THE BENEFITS OF AN EFFECTIVE WARNING SYSTEM.
- PUBLIC AWARENESS AND SUPPORT IS OFTEN HIGH IMMEDIATELY AFTER A MAJOR DISASTER EVENT- SUCH MOMENTS CAN BE CAPITALIZED ON TO TO STRENGTHEN AND SECURE THE SUSTAINABILITY OF EARLY WARNING SYSTEMS

ILLUSTRATION OF FACTORS OF RELEVANCE TO EARLY WARNING SYSTEMS AND THEIR TIME FRAMES IN SECONDS(S), MINUTES(M),DAYS(D),WEEKS(W),MONTHS(M) AND DECADES(D)

FACTOR	TIME FRAME S M D W M Y D
SEISMICITY , TSUNAMIS	X X X
WEATHER, FLOODS	X X X X
SOILS RESERVOIRS	X X X
PEOPLE EXPOSED, CONFLICT MIGRATION	X X X X
ENVIRONMENTAL MANAGEMENT &STATE	X X X
INDUSTRY, URBAN INFRASTRUCTURAL DESIGN	X X X
LAND USE PLANNING, CLIMATE CHANGE	X X
CROP PRODUCTION,PRICES RESERVES, FOOD AID	X X X

BASICS OF EARLY WARNING SYTEM(EWS)

RISK KNOWLEDGE

BASIC KNWLEDGE OF RELEVANT HAZARDS AND OF THE VULNERABILITIES OF PEOPLE AND SOCIETY TO THESE HAZARDS

MONITORING AND WARNING SERVICE

A TECHNICAL CAPACITY TO MONITOR HAZARD PRECURSORS, TO FORECAST THE HAZARD EVOLUTION, AND TO ISSUE WARNINGS

DISSEMINATION AND COMMUNICATION

THE DISSEMINATION OF UNDERSTANDABLE WARNINGS AND PRIOR PREPAREDNESS INFO TO THOSE AT RISK

RESPONSE CAPABILITY

KNOWLEDGE, PLANS AND CAPACITIES FOR TIMELY AND APPROPRIATE ACTION BY AUTHORITIES AND THOSE AT RISK.

THE FOUR ELEMENTS OF SYSTEMATIC PEOPLE-CENTRED EARLY WARNING SYSTEM

RISK KNOWLEDGE

- NATIONAL DISASTER MANAGEMENT ORGANIZATION (NADMO)
- LOCAL COMMUNITIES
- NGOS
- OTHERS

MONITORING AND WARNING SERVICE

- GHANA METEOROLOGICAL AGENCY(GMeT)
- HYDROLOGICAL SERVICES DEPT
- NADMO
- ENVIRONMENTAL PROTECTION AGENCY
- GEOLOGICAL SURVEY
- MINISTRY OF INTERIOR
- MINISTRY OF DEFENCE
- MINISTRY OF FOOD AND AGRIC
- NON-GOVERNMENTAL ORGANIZATIONS
- MINISTRY OF LANDS AND NATURAL ROSOURCES
- MINISTRY OF HEALTH
- UTILITY SERVICE PROVIDERS
- NATIONAL DEVELOPMENT PLANNING COMMISSION
- WATER RESOURCES COMMISSION/VBA
- COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
- ETC

DISSEMINATION AND COMMUNICATION

- GHANA METEOROLOGICAL AGENCY(GMeT)
- HYDROLOGICAL SERVICES DEPT
- NADMO
- ENVIRONMENTAL PROTECTION AGENCY
- GEOLOGICAL SURVEY
- MINISTRY OF INTERIOR
- MINISTRY OF DEFENCE
- MINISTRY OF FOOD AND AGRIC
- NON-GOVERNMENTAL ORGANIZATIONS
- MINISTRY OF LANDS AND NATURAL ROSOURCES
- MINISTRY OF HEALTH
- UTILITY SERVICE PROVIDERS
- NATIONAL DEVELOPMENT PLANNING COMMISSION
- WATER RESOURCES COMMISSION/VBA
- COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
- DISTRICT, METROPOLITAN AND MUCIPAL AUTHORITIES
- ETC

RESPONSE CAPABILITY

- NADMO- TECHNICAL COMMITTEES
- MINISRY OF INTERIOR
- MINISTRY OF DEFENCE
- NGOS
- NDPC
- DISTRICT, METROPOLITAN AND MUNICIPAL AUTHORITIES
- OTHERS

SHORTCOMINGS OF THE LINEAR PARADIGM(MODEL)

- SCIENTISTS AND TECHNOLOGISTS ARE TYPICALLY THE CORE STAKEHOLDERS IN EARLY WARNING SYSTEMS, AS THEY ARE THE CUSTODIANS OF THE GEOPHYSICAL AND TECHNICAL KNOWLEDGE BASE UPON WHICH THE WARNING SYSTEM RELIES, AND THEY ARE GENERALLY VERY MOTIVATED TO USE THAT KNOWLEDGE FOR THE GOOD OF SOCIETY.
- AS A RESULT, EARLY WARNING SYSTEMS TEND TO BE LARGELY CONCEIVED AS HAZARD-FOCUSED, LINEAR, TOP-DOWN, EXPERT-DRIVEN SYSTEMS, WITH LITTLE OR NO ENGAGEMENT OF END-USERS OR THEIR REPRESENTATIVES.
- IT CAN BE NOTED, HOWEVER, THAT PEOPLE GENERALLY ARE NOT INTERESTED IN EARLY WARNING SYSTEMS UNTIL SOME PERSONALLY THREATENING EVENT ARISE, AND SO MOST OF THE TIME ARE HAPPY TO LEAVE THE MATTER TO THE EXPERTS.
- WHILE THE PREVAILING END-TO-END LINEAR PARADIGM IS AN ADVANCE ON PREVIOUS TECHNO-CENTRIC CONCEPTS IT NEVERTHELESS RETAINS A NUMBER OF SHORTCOMINGS AS FOLLOWS:

SHORTCOMINGS OF THE LINEAR PARADIGM(MODEL)2

- THE FOCUS STILL TENDS TO REMAIN ON THE HAZARD, WITH LESS EMPHASIS ON THE VULNERABILITIES, RISKS AND RESPONSE CAPACITIES,
- THE DIFFERENT HAZARDS ARE TYPICALLY DEALT WITH BY SEPARATE INDEPENDENT TECHNICAL INSTITUTIONS, WITH FEW SYNERGIES OR MUTUAL BENEFITS BEING SOUGHT
- THE DOMINANCE OF THE EXPERT CAN LEAD TO DIFFICULTIES IN USER APPRECIATION OF SUCH THINGS AS THE MEANING OF THE WARNING, WARNING UNCERTAINTY, THE NATURE OF FALSE ALARMS AND THE NECESSARY RESPONSES TO DIFFERENT TYPES OF WARNINGS,
- THE ROLE OF RESEARCH AND KNOWLEDGE FROM OUTSIDE THE CORE AREA OF EXPERTISE IS OFTEN NOT ACKNOWLEDGED,
- THERE IS LITTLE ENGAGEMENT OR EMPOWERMENT OF THOSE AT RISK IN THE DESIGN AND OPERATION OF THE WARNING SYSTEM, AND HENCE A TENDENCY BY USERS TO LACK ANY SENSE OF OWNERSHIP IN THE SYSTEM AND TO MISTRUST THE EXPERTS AND AUTHORITIES,
- THERE ARE FEW SYSTEMATIC MECHANISMS TO IMPROVE THE SYSTEM THROUGH THE INCORPORATION OF THE KNOWLEDGE, EXPERIENCE AND FEEDBACK FROM USERS AND THOSE AT RISK, AND
- WEAK PUBLIC ENGAGEMENT AND RECOGNITION TENDS TO LEAD TO WEAK POLITICAL AND BUDGETARY SUPPORT FOR THE WARNING SYSTEM.

THE MODEL IN EWS

- THE MODEL PROVIDES THE MEANS TO MAKE PROJECTIONS OF WHAT MIGHT HAPPEN IN THE FUTURE – AND THEREFORE WHAT ACTIONS MIGHT BE DESIRABLE IN RESPONSE.
- MODELS MAY BE AS ELABORATE AS THE PHYSICS-BASED GLOBAL NUMERICAL WEATHER PREDICTION MODELS, OR AS STRAIGHTFORWARD AS 'COMMON KNOWLEDGE' MENTAL MODELS (E.G. THAT THE NOISY APPROACHING TSUNAMI WAVE WILL ARRIVE IN A FEW MINUTE
- THEY MAY BE SLOWLY EVOLVING, AS IN A DROUGHT MODEL WHERE THE LOSS OF SOIL MOISTURE MAY OCCUR OVER MONTHS, OR VERY RAPID, SUCH AS IN AN EARTHQUAKE WHERE THE DIFFERENTIAL SPEED OF ELECTROMAGNETIC SIGNALS RELATIVE TO SEISMIC WAVES CAN BE USED TO AUTOMATICALLY SHUT DOWN A DISTANT SENSITIVE SYSTEM A FEW SECONDS BEFORE DAMAGING STRESSES OCCUR.

THE MODEL IN EWS2

- MODELS ALSO UNDERLIE THE OTHER PARTS OF THE WARNING SYSTEM, SUCH AS THE LIKELY IMPACTS OF A HAZARD, THE WAY WARNINGS ARE COMMUNICATED AND ACTED ON, AND THE DYNAMICS OF EVACUATION PROCESSES, BUT THESE VULNERABILITY AND RESPONSE PROCESS MODELS ARE GENERALLY MUCH LESS DEVELOPED THAN THE GEOPHYSICAL PROCESS MODELS.
- ALL MODELS ARE DRIVEN BY A SPECIFICATION OF AN INITIAL STATE, WHICH MUST BE OBTAINED BY OBSERVATIONS (OR FROM THE OUTPUT OF AN UPSTREAM OBSERVATION-DRIVEN MODEL).
- OBSERVATION SYSTEMS CAN BE EXPENSIVE TO INSTALL AND OPERATE AND ARE OFTEN RATHER INADEQUATE, ESPECIALLY IN POORER COUNTRIES. THE INITIAL STATE IS, THEREFORE, ALWAYS IMPERFECTLY KNOWN, OWING TO IMPERFECT SPATIAL REPRESENTATION, INSTRUMENT ERROR AND ABSENCE OF DATA ON SOME RELEVANT FACTO

THE MODEL IN EWS3

- . THESE UNCERTAINTIES OF THE INITIAL STATE PROPAGATE THROUGH THE MODELS, AND TOGETHER WITH ERRORS IN THE MODEL PHYSICS UNCERTAINTY IN THE MODEL ESTIMATES OF FUTURE CONDITIONS. WARNINGS ARE, THEREFORE, INHERENTLY PROBABILISTIC, EVEN IF BASED ON SOUND PHYSICS AND PRESENTED IN A CATEGORICAL FORMAT
- OF NOTE ARE FORECASTS OF SEASONAL CLIMATE ANOMALIES, WHICH ARE STRONGLY AFFECTED BY SYSTEM NOISE AND UNCERTAINTY, AND CAN ONLY BE REPRESENTED IN PROBABILITY TERMS, AND WHERE IT MUST BE LEFT TO THE END-USER TO JUDGE THE POSSIBLE IMPACT CONSEQUENCES OF THE PROJECTED POSSIBLE CLIMATE OUTCOMES.

MOST COMMON AND CURRENT VIEW OF EWS

- VIEW OF EARLY WARNING SYSTEMS COMPRISES A " WARNING CHAIN", A LINEAR CHAIN", A LINEAR SET OF CONNECTIONS FROM OBSERVATIONS THROUGH WARNING GENERATION AND TRANSMITTAL TO USERS.
- IN THE METEOROLOGICAL COMMUNITY THE TERM 'END-TO-END' WARNING SYSTEM IS OFTEN USED. THE END-TO-END CONCEPT AIMS TO MAKE FORECAST AND WARNINGS MORE RELEVANT AND USEABLE TO END-USERS.
- IT MAKES BETTER PRACTICAL USE OF THE PROBABILISTIC AND WEAKLY PREDICTIVE SEASONAL FORECASTS OF THE EL NINO PHENOMENON

MOST COMMON AND CURRENT VIEW OF EWS2

- IT EMPHASIZES THE NECESSITY TO HAVE ALL THE LINKS IN THE EARLY WARNING CHAIN IN PLACE AND SYSTEMATICALLY CONNECTED.
- AT THE HEART OF ALL EARLY WARNING SYSTEMS IS SOME SORT OF MODEL THAT DESCRIBES THE RELEVANT FEATURES OF THE HAZARD PHENOMENON AND ITS IMPACTS, PARTICULARLY THEIR TIME EVOLUTION
- IT STRESSES **ON FEEDBACKS** WHICH ARE VERY IMPORTANT

THE INTEGRATED SYSTEM MODE FOR EWS

- EARLY WARNING SYSTEMS HAVE EVOLVED IN LINE WITH THE DEVELOPMENT AND APPLICATION OF SCIENTIFIC KNOWLEDGE.
- FOUR DEVELOPMENTAL STAGES CAN BE DISTINGUISHED:
- PRE-SCIENCE EARLY WARNING SYSTEMS. WARNINGS, IF ANY MAY BE BASED ON UNRELATED FACTORS SUCH AS METEOR OCCURRENCE, COULD SHAPES, PLANT FLOWERING OR FRUITING PERFORMANCE, ETC, BUT ALSO MAY BE BASED ON INDIGENOUS OBSERVATIONS OF RELEVANT FACTORS SUCH AS THE STATE OF THE OCEANS OR VISIBILITY OF THE STARS,
- AD HOC SCIENCE-BASED EARLY WARNING SYSTEMS. THESE ARE SYSTEMS SUCH AS ARE OFTEN ESTABLISHED ON THE INITIATIVE OF SCIENTISTS OR COMMUNITY GROUPS CONCERNED WITH PARTICULAR HAZARDS, SUCH AS NEAR-EARTH SPACE OBJECTS, A NEARBY VOLCANO OR A FLOOD-PRONE RIVER,
- SYSTEMATIC END-TO-END EARLY WARNING SYSTEMS. THE BEST KNOWN AND MOST DEVELOPED ARE THOSE OF NATIONAL METEOROLOGICAL SERVICES, FOE WEATHER-RELATED HAZARDS. TYPICALLY THESE SYSTEMS OPERATE UNDER A COUNTRY-WIDE MANDATE AND INVOLVE THE ORGANIZED, LINEAR AND LARGELY UNI-DIRECTIONAL DELIVERY BY EXPERTS OF WARNING PRODUCTS TO USERS, AND
- INTEGRATED EARLY WARNING SYSTEMS. THIS CONCEPT, AS PROPOSED HERE AND ILLUSTRATED IN FIGURE 3, EMPHASIZES THE FOLLOWING CHARACTERISTICS: THE LINKAGES AND INTERACTIONS AMONG ALL THE ELEMENTS NECESSARY TO EFFECTIVE EARLY WARNING AND RESPONSE, THE ROLE OF THE HUMAN ELEMENTS OF THE SYSTEMS AND THE MANAGEMENT FO RISKS RATHER THAN JUST WARNING OF HAZARDS.

CONCLUSION

- AWARENESS AND INTEREST IN DISASTERS AND EWS IS HIGH AND THE TIME IS RIPE FOR BOLD ACTION TO IMPLEMENT THE GLOBALLY COMPREHENSIVE, SYSTEMATIC AND PEOPLE-CENTRED EWS FOR ALL HAZARDS FOR ALL COUNTRIES
- THERE IS A STRONG TECHNICAL AND INJSTITUTIONAL BASIS FOR PROGRESS BUT THERE ARE ALSOE SOME GLARING GAPS AND SHORTCOMINGS THAT NEED TO BE ADDRESSED
- A NEW BROAD “SYSTEMS” AGENDA IS REQUIRED AND MORE NEEDS TO BE DONE TO STRENTHEN THE SCIENTIFIC AND ISTITUTIONAL MECHANISMS INVOLVED AND TO ENSURE PROPER INPUTS FROM BOTH THE NATURAL AND THE SOCIAL SCIENCES.
- EVERYTHING MUST THEREFORE BE DONE TO KEEP FOCUSED ON THE ULTIMATE GOAL- ***THE REDUCTION OF DISASTERS***

REFERENCES

- UN-ISDR
- CRED
- EWC
- HYOGO FRAMEWORK FOR ACTION 2005-2015
- WMO RESOLUTION 40 (CG-XII)
- R. BASHER, UN OCHA
- ETC

THANK YOU

- AYILARI-NAA JUATI
- GHANA METEOROLOGICAL AGENCY
- E:MAIL – juatia@yahoo.co.uk
- a. juati@meteo.gov.gh