

Implementation Strategy of Global Framework for Climate Service through Global Initiatives in AgroMeteorology for Agriculture and Food Security Sector

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ABSTRACT

The Global Framework on Climate Services (GFCS) will guide the development of climate services that link science-based climate information and predictions with climate-risk management and adaptation to climate change. GFCS structure is made up of 5 pillars; Observations/Monitoring (OBS), Research/ Modeling/ Prediction (RES), Climate Services Information System (CSIS) and User Interface Platform (UIP) which are all supplemented with Capacity Development (CD). Corresponding to each GFCS pillar, the Commission for Agricultural Meteorology (CAgM) has been proposing "Global Initiatives in AgroMeteorology" (GIAM) in order to facilitate GFCS implementation scheme from the perspective of AgroMeteorology - Global AgroMeteorological Outlook System (GAMOS) for OBS, Global AgroMeteorological Pilot Projects (GAMPP) for RES, Global Federation of AgroMeteorological Society (GFAMS) for UIP/RES, WAMIS next phase for CSIS/UIP, and Global Centers of Research and Excellence in AgroMeteorology (GCREAM) for CD, through which next generation experts will be brought up as virtuous cycle for human resource procurements. The World AgroMeteorological Information Service (WAMIS) is a dedicated web server in which agrometeorological bulletins and advisories from members are placed. CAgM is about to extend its service into a Grid portal to share computer resources, information and human resources with user communities as a part of GFCS. To facilitate ICT resources sharing, a specialized or dedicated Data Center or Production Center (DCPC) of WMO Information System for WAMIS is under implementation by Korea Meteorological Administration. CAgM will provide land surface information to support LDAS (Land Data Assimilation System) of next generation Earth System as an information provider. The International Society for Agricultural Meteorology (INSAM) is an Internet market place for agrometeorologists. In an effort to strengthen INSAM as UIP for research community in AgroMeteorology, it was proposed by CAgM to establish Global Federation of AgroMeteorological Society (GFAMS). CAgM will try to encourage the next generation agrometeorological experts through Global Center of Excellence



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in Research and Education in AgroMeteorology (GCREAM) including graduate programmes under the framework of GENRI as a governing hub of Global Initiatives in AgroMeteorology (GIAM of CAgM). It would be coordinated under the framework of GENRI as a governing hub for all global initiatives such as GFAMS, GAMPP, GAPON including WAMIS II, primarily targeting on GFCS implementations.

Key words: GFCS, Climate service, GIAM, Climate change, Food security, Agriculture

I. BACKGROUNDS

1.1. Challenges in global AgroMeteorology under climate change

The most impending issue under climate changes and variability is the shortage of human resources with host of experience and expertise which are essential to overcome confronting challenges in agricultural meteorology for food/water securities and sustainable rural developments.

1.2 Requirements for better global AgroMeteorological services

- Urgent Needs : High quality, Value-added, Feasible, Operational,
 - Diverse Applications at Farmer’s site (Quantitative)
 - Value-added Operational Service (Qualitative)

- Feasible Communication Networks (Timely)
- Impending Requirements :
 - High-resolution information production (spatial/temporal/elemental)
 - Feedback Mechanism from Users (bidirectional communication)
 - ICT Resource Sharing Platform (Computing/Storage/Networks/Interface)
- Future Considerations
 - Contribution to NWP models (as information provider)
 - Multi-lingual Translation (efficient sharing of experiences/information)

II. GLOBAL FRAMEWORK FOR CLIMATE SERVICE

2.1. GFCS Pillars

The Global Framework on Climate Services (GFCS,

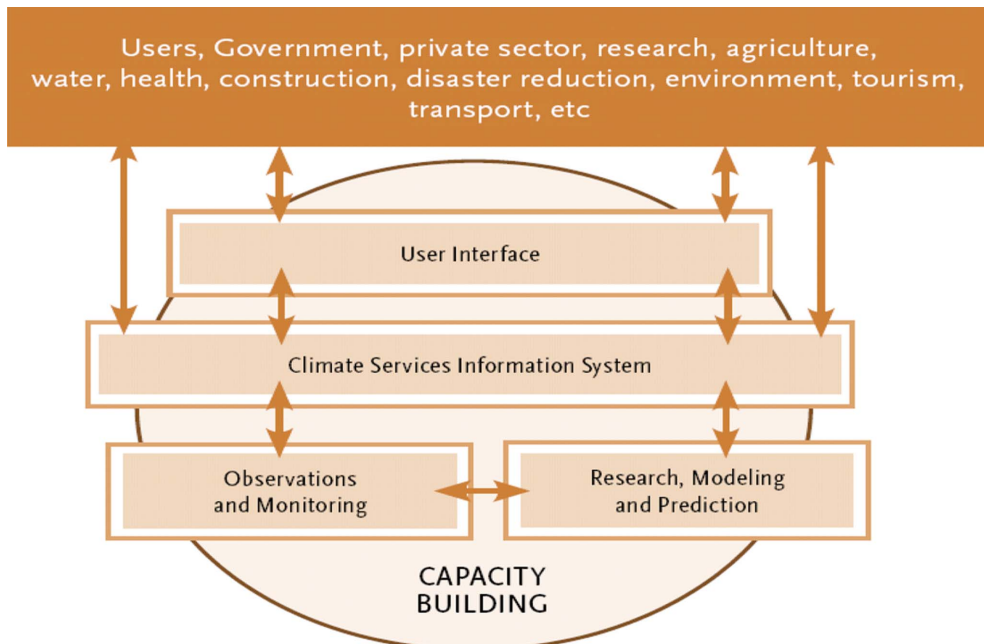


Fig. 1. GFCS Structures with 5 Pillars and user communities.

2013) was proposed during World Climate Conference 3 (WCC-3, 2009) to guide the development of climate services that link science-based climate information and predictions with climate-risk management and adaptation to climate change. GFCS structure is made up of 5 pillars (Fig. 1); Observations/Monitoring (OBS), Research/ Modeling/Prediction (RES), Climate Services Information System (CSIS) and User Interface Platform (UIP) which are all supplemented with Capacity Development (CD).

2.2. GFCS Priorities

1. Capacity building in developing countries (CB)
 - Linking climate service users and providers.
 - Building national capacity for climate services.
2. Strengthening the Climate Services Information System (CSIS)
 - Standardizing products; promoting WIS; facilitating access to, use of GPC products
 - Strengthening regional climate capabilities through establishing and promoting RCCs and RCOFs
3. Building capacity to implement the User Interface Platform (UIP)
4. Improving climate observations in data sparse areas (OBS)
5. Building the capacity of the climate research sector (RES)

2.3. CAgM legacy Systems (CAgM, 2013) with GIAM (Fig. 2)

WAMIS (CSIS , UIP, ..)

- Web portal of World AgroMeteorological Information Service

INSAM (CD, RES, UIP,..)

- on-line International Society of Agricultural Meteorology

NASNET (OBS, Governance ..)

- National Agricultural Meteorological Station Network

RTC (CD, ..) – Regional Training Center

- Education/Training, Roving seminar, Field school, etc.

TECO (RES, UIP..) – Technical Conference

- prior to Congress, ET meetings jointly with RA events/symposium

Pilot projects (CD, CSIS, UIP, RES, OBS, ..)

- regional/sub-regional research/operational programmes

WIS, WIGOS related pilot proposals (CSIS, UIP,

RES, OBS, ..)

- WMO Information System,
- WMO Integrated Global Observing System

III. GFCS IMPLEMENTATION STRATEGIES IN AGRICULTURE AND FOOD SECURITY SECTOR

3.1. Global Initiatives in AgroMeteorology (GIAM)

Corresponding to each GFCS pillar, the Commission for Agricultural Meteorology (CAgM) has been proposing diverse Global Initiatives in AgroMeteorology (GIAM) in order to facilitate GFCS implementation scheme from the perspective of AgroMeteorology - Global AgroMeteorological Outlook System (GAMOS) for OBS, Global AgroMeteorological Pilot Projects (GAMPP) for RES, Global Federation of AgroMeteorological Society (GFAMS) for UIP/RES, WAMIS next phase for CSIS/UIP, and Global Centers of Research and Excellence in AgroMeteorology (GCREAM) for CD, through which next generation experts will be brought up as virtuous cycle for human resource procurements.

3.2. GIAM implementation strategies

- GFAMS : National/Regional societies will be invited as - members. When launched successfully by 2013, a back-to-back convention will be organized prior to CAgM Congress as TECO.
- GAMPP : 1~3 pilot projects from each Regional Association (RA) will be established through cooperation and collaboration with appropriate Technical Commissions (TC) and Regional Associations (RAs) to strengthen regional capacity developments in GFCS implementations.
- GAMOS : consists of GDEWS (Global Drought Early Warning System), GLUMS (Global Land Use Monitoring System), GWHAS (Global Weather Hazard Assessment System), GPPON (Global Plant Phenology Observation Network)
- WAMIS next phase : should be supplemented for H/W resources (servers, storage, network), Contents (service quantity/quality, user interface), Tools (models, GIS/RS, DBMS, analysis, display, communication).
- Global CREAM : Centers of Research and Excellence in AgroMeteorology (India) will be launched in early 2013, jointly with USA (GMU), Korea (NCAM/SNU), Italy (UFL, IBiMET), Brazil (IA), OZ (USQ). It will play roles of ET (including

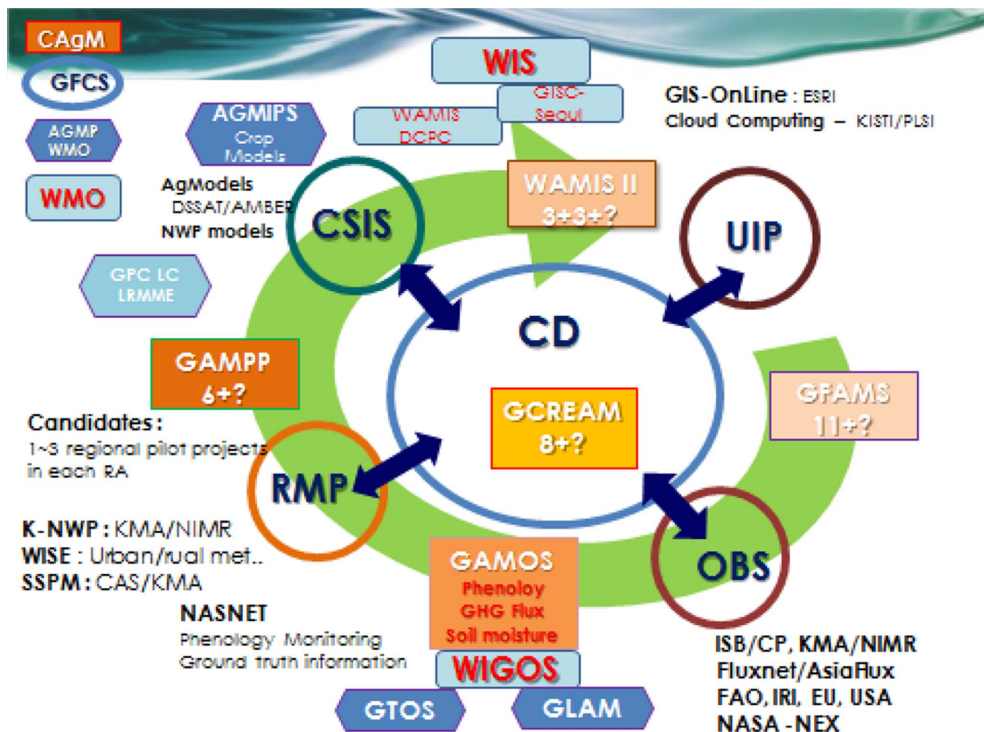


Fig. 2. GFCs Implementation strategy from CAgM Perspectives through collaborations with legacy entities.

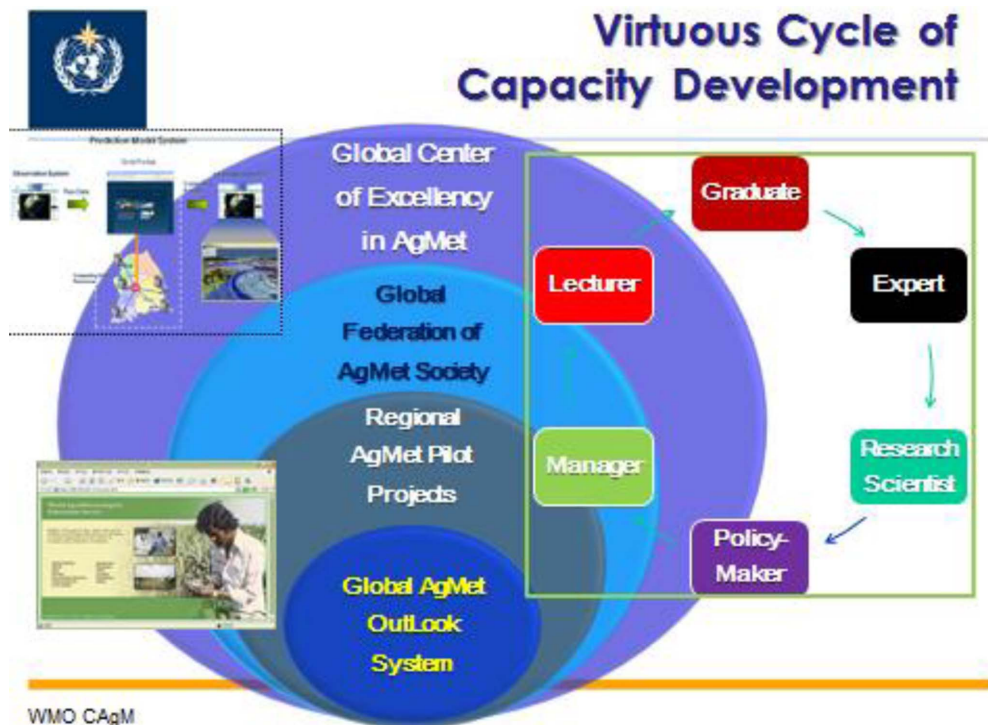


Fig. 3. Overarching strategy for GFCs Implementations through virtuous cycle of capacity development through GIAM.

Graduate program) center, R&D Hub, Secretariat for GFAMS, and additional WAMIS server may be anchored at CREAM partners,

3.3. GFCS implementation scheme through GIAM

Overarching aspect of CAgM (Commission for Agricultural Meteorology of WMO) strategy for GFCS (Global Framework for Climate Service) implementation will be virtuous cycle of capacity developments among resources including infrastructures, humans, governance, etc. (Fig. 3).

- Observation and Monitoring: GAMOS>WIGOS >WIS/DCPC > WAMIS
- Research, Modeling & Prediction: GFAMS>GAMPP>CREAMs >WAMIS
- Climate Service Information System: CREAMs>WIS/DCPC >WAMIS
- User Interface Platform: WIS/GISC>WAMIS
- Capacity Development: GFAMS>CREAMs + WAMIS (Cyber Tutorial)

IV. SYNERGY WITH LEGACY SYSTEMS

4.1. WAMIS as CSIS/UIP

The World AgroMeteorological Information Service (WAMIS) is a dedicated web server in which agrometeorological bulletins and advisories from members are placed. CAgM is about to extend its service into a Grid portal to share computer resources. WAMIS grid portal will become a gateway in sharing information and resources with user communities, dedicated to CAgM as a part of GFCS.

To facilitate ICT resources sharing, WAMIS grid portal will also be a partner of WIS (WMO Information System) umbrella, which is expected to play an essential role to meet future requirements in AgroMeteorology. A specialized or dedicated DCPC of WIS for WAMIS grid portal was requested by CAgM and is under implementation by KMA.

4.2. INSAM as UIP/RES

The International Society for Agricultural Meteorology (INSAM) is an Internet market place for agrometeorologists. Its vision is that agrometeorologists and others having work with agrometeorological components from different disciplines should communicate through INSAM on their activities and results. In an

effort to strengthen INSAM as UIP for research community in AgroMeteorology, it was proposed by CAgM to establish Regional and Global Federation of AgroMeteorological Society (GFAMS).

4.3. RTC as CD

CAgM will try to encourage the next generation agrometeorological experts through Global Center of Excellence in Research and Education in AgroMeteorology (GCREAM) including graduate programmes under the framework of GENRI as a governing hub of Global Initiatives in AgroMeteorology (GIAM of CAgM), but also attracting/mobilizing more scientists from diverse disciplines into the field of agrometeorology through global federation of agrometeorological societies (GFAMS) that will be associated with TECO during CAgM sessions.

V. EXPECTED OUTCOMES & DELIVERABLES (FIG. 4)

5.1. Advanced services

High-resolution information production (data processing)

- Downscaling of climate/observation/forecast/projection data
- GIS-based micrometeorological downscaling technology

NWP-based Forecast services (AgMet forecasting)

- Linking NWP outputs to AgModels for value-added forecasts
- Short-, medium-, long-range, sub-seasonal to seasonal, CC scenario
- Various AgModels : DSSAT, AMBER, etc.

ICT resource sharing platform (ICT infrastructure)

- Computing resources for NWP/AgModel with GIS/RS technology
- User communication interface as information provider and feedback

5.2. ICT Resource sharing system

- Region-specific Service Platforms
 - Currently 3 to at least 6 servers with differentiated functions
- Computing resources for
 - NWPs operation on user domain on time
 - NWP output downscaling to high spatial resolutions
 - User-specific AgModel operation on time

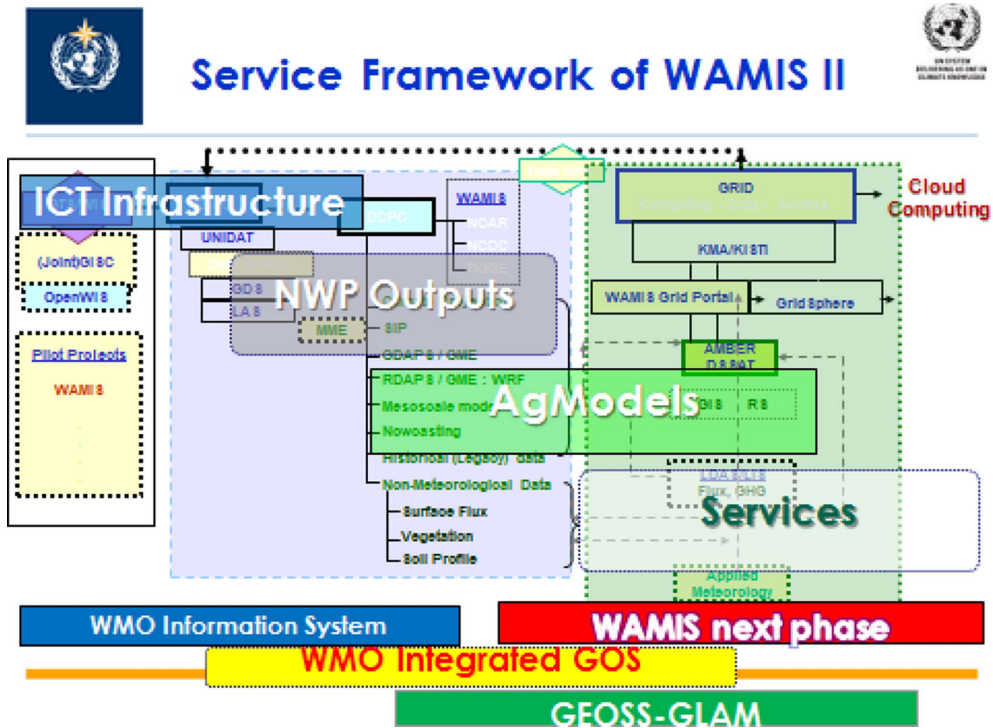


Fig. 4. AgroMeteorological service framework with WAMIS next phase.

- GIS S/W operation
- RS data processing
- Derived products processing
- Large volume of data storage for
 - NWP and AgModel outputs
 - RS/GIS raw and processed data
 - Ground truth data (vegetation, weather, soil)

VI. CONTRIBUTION TO OTHER PROGRAMMES

6.1. GIAM for WIGOS implementation

- Potential contribution to WIGOS implementations
- strengthen existing observation systems by incorporating newly emerging requirements like soil moisture, particularly to enhance supporting services for better climate change monitoring, e.g. phenology, GHG fluxes.
 - facilitating national integration of agrometeorological observation networks (NASNET) over institutions through joint operation/maintenance/governance .
 - mechanizing communication channels with

potential partners/sponsors, inter alia, FAO (GTOS), GEOSS (GEO-GLAM), UNCCD, NASA (NEX), ISB (PC)

Time frame for short-term implementations

- Global Alliance for (plant) Phenology Observation Network (GAPON)
 - 1st Steering Committee Meeting (Nov. 2013, KMA, CCI/CAgM/ISB..).
- Establishment of Secretariat Office to support GIAM by KMA (Nov. 2013)
 - GIAM-Global Initiatives for AgroMeteorology for GFCS implementations
- Restructuring of CAgM Management Group and OPAG into OPAME structure
 - CAgM XVI session in March 2014.

6.2. GIAM with WIS implementation

As WIS evolves to provide a single entry point for any data request, CAgM is trying to extend its service to member countries under WIS umbrella by implementing WAMIS into a Grid portal to share computer resources, especially for emerging countries in which limited IT resources are most critical barriers in

improving its operational services in AgroMeteorology. Since operational agrometeorology requires diverse data and information from different disciplines for better services, future information system for AgroMeteorology should consider accommodating diverse data and information as well.

Since WIS is going to handle only meteorological/climate data including NWP model outputs and to provide only limited functionalities for data processing, archiving, and analysis for the time being, CAgM recognized that it should initiate a dedicated information and resource sharing system to implement WIS for more extended services to members under WIS umbrella. CAgM is, thus, now considering how to implement the sharing of non-meteorological data as well as how to identify the ways of sharing IT resources including human resources for members.

6.3. GIAM with GEOSS

Furthermore, as GEOSS becomes an active component of Earth System science, non-meteorological information sharing should also be considered seriously under the umbrella of WIS if WMO desires play a leading role of data/information Hub for GEOSS in the future. How to solve this problem will be a very critical factor in getting involved in GEOSS. To be a most promising partner of GEOSS, WIS should accelerate its implementation at operational level with the full support by legacy and leading edge technologies, particularly that can be easily extendable and applicable to sharing of diverse types of information from GEOSS. Interactive WAMIS grid portal will play a role of bridging between WIS and GEOSS at the initial stage of these two system developments, because WAMIS should consider handling of non-meteorological data as well as collecting and providing them to GEOSS in its nature at least to some extent.

VII. SUPPLEMENTING ACTIVITIES

7.1. Resource mobilization/allocation

In order to meet impending WMO requirements including strategic plan. Continuous Improvement Initiative, as well as impending issues for implementations on GFCS, WIS, WIGOS, etc. in terms of resource mobilization and allocations for human, financial, infrastructure & governance aspects. CAgM proposes the following options for open discussions: Re-Allocation of Resources to meet impending requirements,

New Resource Exploration to meet emerging requirements, and Re-Organization of CAgM Structures to meet future requirements

7.2. Outreach & Governance for GIAM

New Governance for enhanced AgMet National Service has been under implementation as a part of GIAM: Strengthening multi-institutional governance within a nation, Establishment of regional governance against Climate Change, High level education system for next generation AgMet experts through global collaborations including graduate courses and new concept for Core AgMet Reference Station (national reference site for AgMet - CARS).

7.3. International Project/Program Office

(GFCS Joint Climate & Agriculture/Food Security Project Office, tentative : GFCS JCAPO)

KMA showed its willingness to provide secretariat supports to these global initiatives through a form of international project coordination office (TIGERS), especially as a way of its contribution to successful GFCS implementations at initial stage. It would be coordinated under the framework of GENRI through TIGERS as a governing hub for all global initiatives such as GFAMS, GAMPP, GAPON including WAMIS II, primarily targeting on GFCS implementations, (Fig. 5).

WEB SITES

WMO:<http://www.wmo.int> (2013. 6. 15)

GFCS:http://www.wmo.int/pages/gfcs/index_en.php (2013. 6. 15)

CAgM:http://www.wmo.int/pages/prog/wcp/agm/cagm/cagm_en.php (2013. 6. 15)

WCC-3:http://www.wmo.int/wcc3/page_en.php (2013. 6. 15)

ACRONYMS

AGMP:AgroMeteorology Program of WMO

ESRI:Arc-GIS S/W company

GENRI:Global Environment and Natural Resource Institute, George Mason Univ. USA

GLAM:Global Agricultural Monitoring Network of GEOSS

GMU:George Mason University, Fairfax, Virginia, USA

ISB:International Society of BioMeteorology

KMA:Korea Meteorological Administration

NASNET:National AgroMeteorological Station Net-

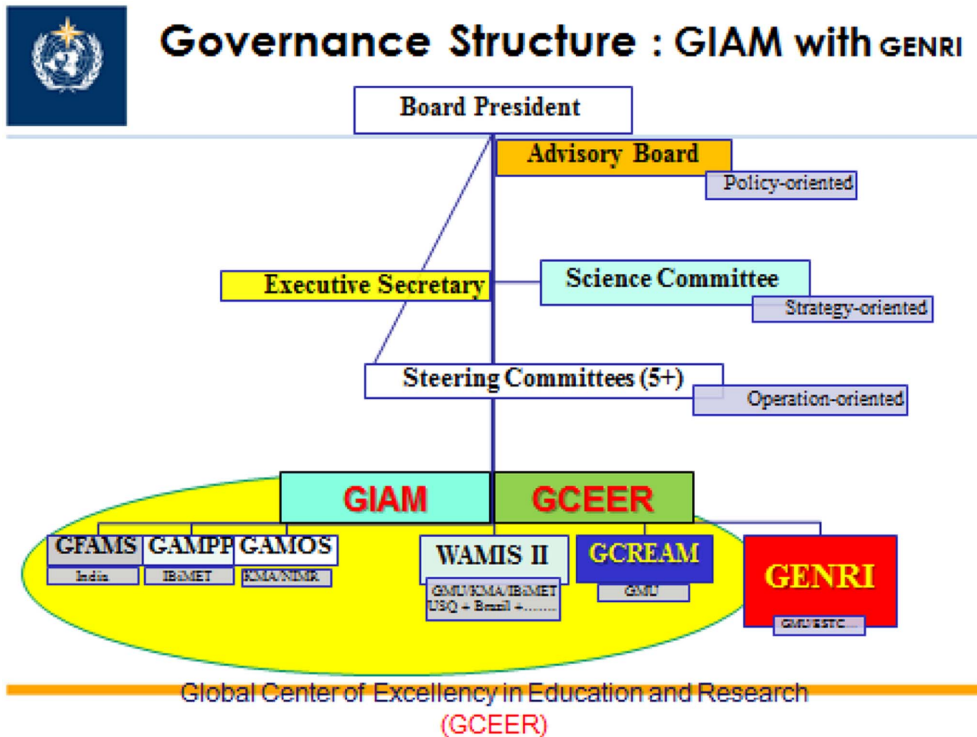


Fig. 5. New governance scheme for GIAM including coordination office with secretariat service.

work

NEX:NASA data Exchange program

NIMR:National Institute of Meteorological Research of KMA

OPAG:Open Panel of Area Group / current CAgM structure

OPAME:Open Panel of AgroMeteorological Expert /proposed CAgM structure

TECO:Technical Conference / convened prior to or in parallel with sessions of WMO

TIGERS:Trans-disciplinary Implementation Governance for Environment and Resource Sustainability

WAMIS:World Agricultural Meteorological Information Service of WMO

WIGOS:WMO Integrated Global Observing System

WIS:WMO Information System - DCPC (Data Center & Production Center), GISC (Global Information Service Center),

WMO:World Meteorological Organization

적 요

“전지구기후서비스체계” (GFCS)는 2009년 제3차 세

계기후회의에서 기후변화 대응 취약 국가와 소외계층에 대해 보다 효율적인 기후정보를 제공하기 위한 전지구차원의 서비스 제공체계 구축 필요성에 대한 공감을 바탕으로 제안되어, 현재 세계기상기구를 중심으로 관련 UN 및 국제기구간 공조를 통해 향후 약 10년 동안에 걸쳐 이를 이행하기 위한 노력을 기울일 예정이다.

GFCS는 과학적 기후정보와 기후예측을 기후변화 적응과 기후위기관리를 상호 연계할 수 있는 기후서비스 개발을 주도하게 된다. GFCS의 기본구조는 5개 주요 요소로 구성되어 있는데, 이에는 관측/모니터링, 연구/모형/예측, 기후서비스정보시스템 및 사용자인터페이스 플랫폼과 함께 이들 모두를 포괄하는 역량개발이 포함되어 있다. 현재 GFCS의 편익분야 중 자연재해경감, 수자원, 보건 분야와 함께 농업/식량안보분야가 4대 우선순위에 포함되어 있는데, WMO의 농업기상위원회 (CAgM)은 동분야에 대한 GFCS의 효율적 이행을 지원하기 위해 GFCS의 5개 요소별로 이를 보완하기 위한 전지구차원 선도적 협력방안(GIAM)을 제안 추진하고 있다. GIAM의 취지는 기존의 기후서비스체계의 개별적 서비스 구조를 통합하거나 미흡한 부분을 보완하는

방법 등 최소한의 추가적인 자원 투입으로 최대 시너지 효과를 도출하는데 중점을 두고 있다. 관측분야는 전구생물계절관측협의체 구축, 연구분야는 지역/전구 농림기상 파일럿프로젝트 도출, 기후서비스분야는 기존 농업기상웹서버인 WAMIS의 지역 및 기능 확대, 사용자인터페이스분야는 기존 사이버농업기상협의체를 보완하기 위한 전구 농림기상학술협의체 구축, 그리고 역량개발분야는 전구농림기상교육훈련센터 구축 등이 추진 중에 있으며, 이들간의 유기적인 연동 지원을 위한 조정기구와 지원사무국의 설립도 기상청에 의해 가시화되고 있으며, 효율적인 운영을 위한 새로운 거버넌스도 미국 조지메이슨대를 중심으로 구축 중에 있다. 한편 GIAM의 성공적인 이행을 위해서는 전산자원 인프라 구축이 선행되어야 함으로 현재 WAMIS를 지원하기 위해서 세계기상기구 정보시스템(WIS)의 자료수집

/생산센터(DCPC-WAMIS) 구축 및 회원국간 전산자원 공유를 위한 클라우드 및 그리드 환경 구축도 기상청과 KISTI/부경대 등의 협조를 얻어 추진 중에 있다. GIAM의 궁극적인 목표의 하나는 차세대 기후변화 대응 농림기상전문가의 양성에 있는데 이를 구현하는 방안으로 회원국의 추천을 받은 후보자를 전구농림기상교육훈련센터 대학원 과정에 학비/수업료 면제조건으로 입학시킨 후, 지역 파일럿프로젝트에 연구원으로 참여, 이를 통해 생활비 등 지원을 받는 한편 농림기상 학술협의체 회원 활동, 국내외 실무그룹 활동 등을 통해 농림기상분야 국제전문가로 양성함으로써 향후 회원국 농업/식량안보분야 기후변화 대응에 절대적으로 필요한 핵심정책연구 담당자로서의 역할을 기대할 수 있을 것이다.