



Earth Observation for Weather

International trends & developments

How to promote earth observation
applications?

How to get funding?

Capacity building



0. Introduction

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HCP international:
consulting, marketing of earth observation

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project for promotion & capacity building of
earth observation applications



Earth observation applications

- On the verge of reaching new user communities
- These new user communities need to be involved
- Weakest link / last mile aspects are important
- Marketing needed: promotion & capacity building



Life cycle of products & services

Initialization

System analysis & design

Rapid prototyping

System development

Implementation

Post-implementation



MARKETING EARTH OBSERVATION
PRODUCTS AND SERVICES

PART # 1





Assessment of business & funding opportunities

- Categories of environmental products & services
- Life cycle phase of product or service
- Regional context, level of technological & economic development
- Optimum marketing mix



1. International trends & developments in weather

High-impact weather prediction for:

- Disaster management
- Water management
- Agriculture
- Energy
- Health
- Fisheries
- Aviation / transportation



Improvements in forecasting:

- Time range (nowcasting, short, medium, long)
- Accuracy
- Probability
- Risk (possible damage / lives lost)

Some terms:

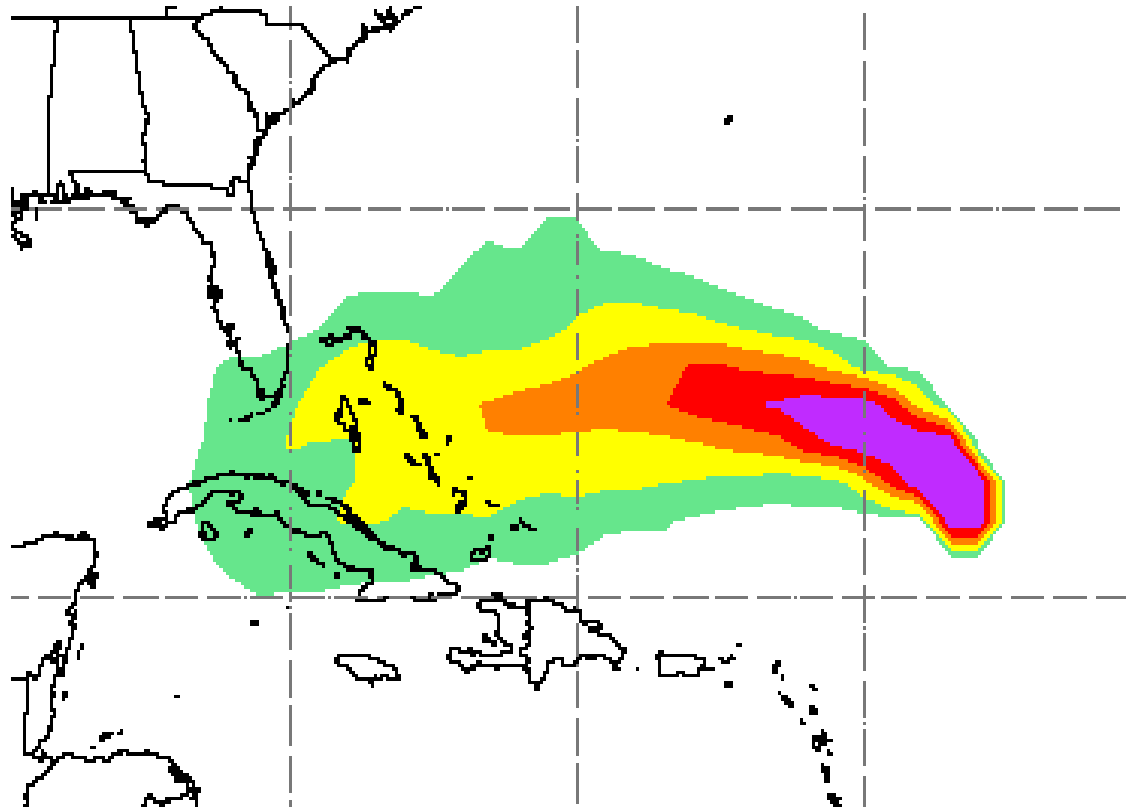
- **Numerical weather prediction (NWP):** application of model(s) using mathematical equations for weather prediction (divide the atmosphere in grid boxes, record data on processes for each grid box and then calculate the future state for that box)
- **Nowcasting:** technique for very short range forecasting (map the current weather, use the speed and direction of movement to forecast the weather a short period ahead)
- **Ensemble forecasting:** estimate risk of particular weather events, using multiple forecasts (by making small alterations to either the starting conditions or the forecast model, or both)

Source: Forecasting the weather (UK Met Office)

World Weather Research Programme:

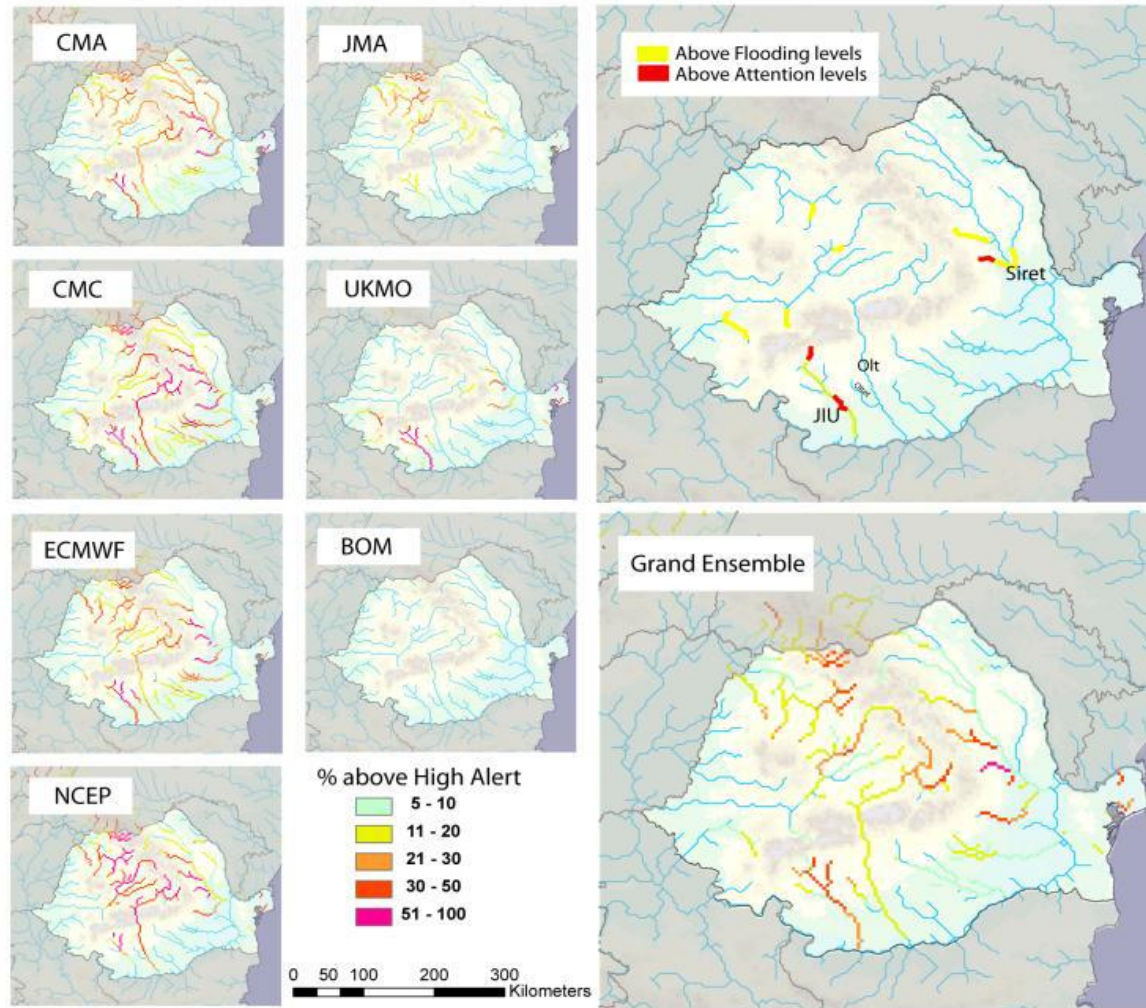
- **Improvement of weather forecasts** in the form of the THORPEX and TIGGE programmes (as part of THORPEX)
- **THORPEX** (The Observing system Research and Predictability Experiment) is an international research programme to accelerate improvements in the accuracy and utility of high-impact weather forecasts up to two weeks ahead
- **TIGGE** (THORPEX Interactive Grand Global Ensemble) provides a data base of ensemble predictions from the leading global NWP centres, for scientific research on predictability and development of probabilistic weather forecasting methods

Example hurricane Ike



Forecasting strike probabilities for Hurricane Ike by combining two TIGGE ensembles

Example flood alerts Romania



Predicting flood alerts for Romania using TIGGE

References TIGGE:

TIGGE Brochure *Short description of the TIGGE programme*

TIGGE Website <http://tigge.ecmwf.int>

Data are available via the TIGGE data portals:

- CMA: <http://wisportal.cma.gov.cn/tigge>
- ECMWF: <http://tigge-portal.ecmwf.int>
- NCAR: <http://tigge.ucar.edu>

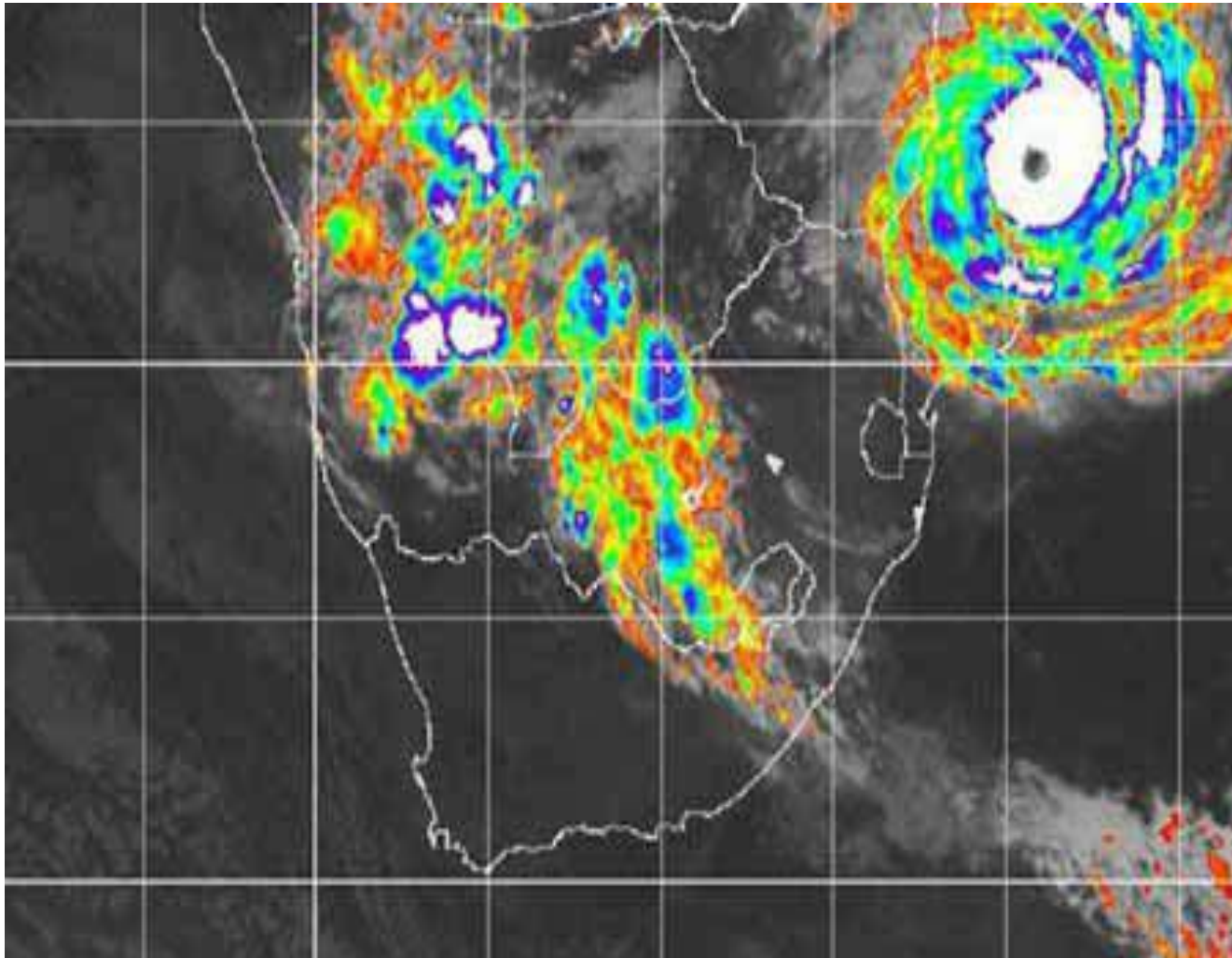
The diagram illustrates the Global Observing System, showing various components and their interactions. Key elements include:

- Polar-orbiting satellite**: A satellite in a polar orbit that scans the entire Earth's surface.
- Geostationary satellite**: A satellite in a geostationary orbit that provides continuous coverage of a specific area of the Earth.
- Aircraft**: A plane flying in the sky, providing data from its instruments.
- Ocean data buoy**: A buoy floating in the ocean, providing data from its sensors.
- Weather ship**: A ship at sea, providing data from its weather instruments.
- Satellite sounder**: A satellite instrument that measures atmospheric temperature and moisture.
- Surface station**: A ground-based station that measures surface weather conditions.
- Upper air station**: A ground-based station that measures upper atmosphere conditions.
- NMS (National Meteorological Service)**: The central hub for receiving and processing data from all these sources.

Arrows indicate the flow of data from the various observing systems to the NMS.

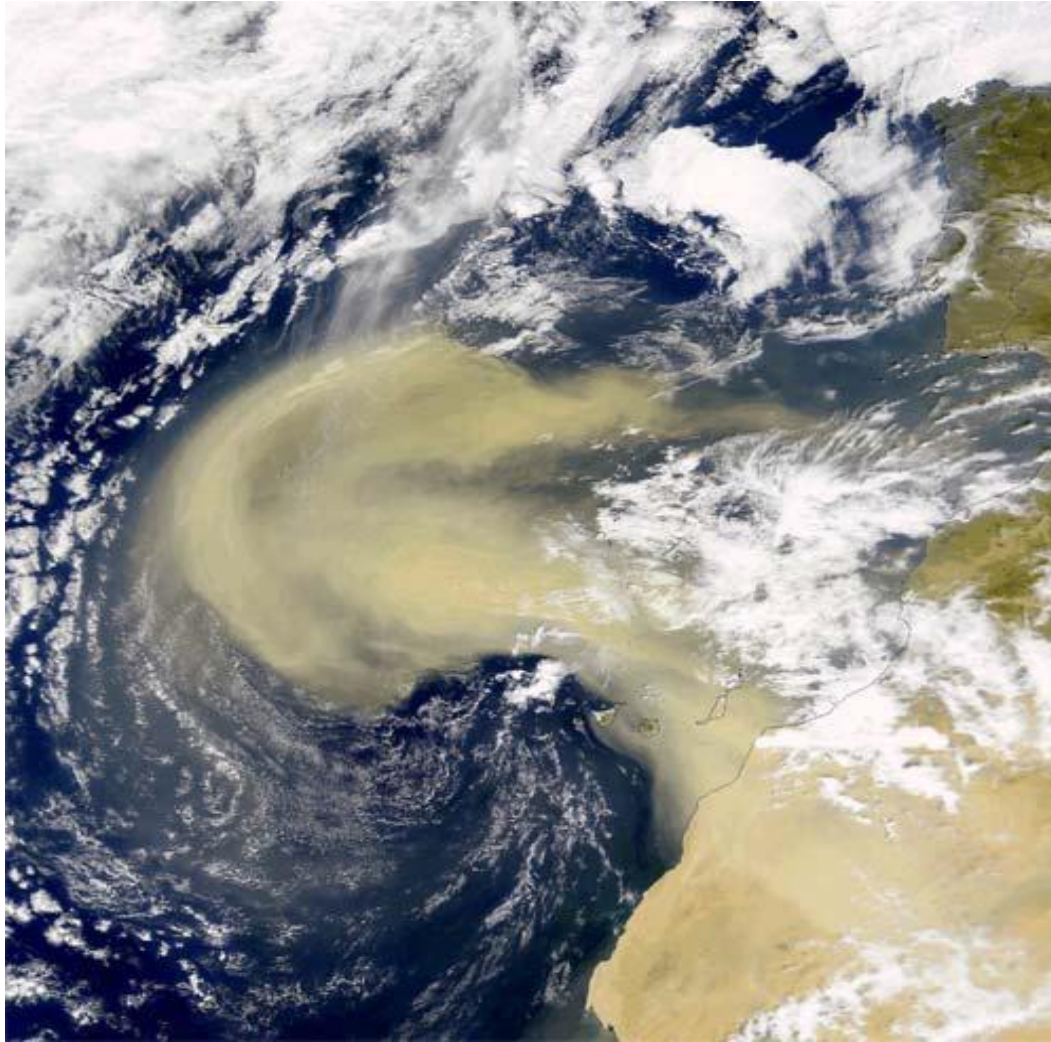
Global observing system

THORPEX example



Tropical cyclone Eline provoking flooding in Mozambique and Madagascar

THORPEX example



Massive sandstorm blows off the northwest African desert (February 26th, 2000)

THORPEX and decision making

societal and economic research and applications

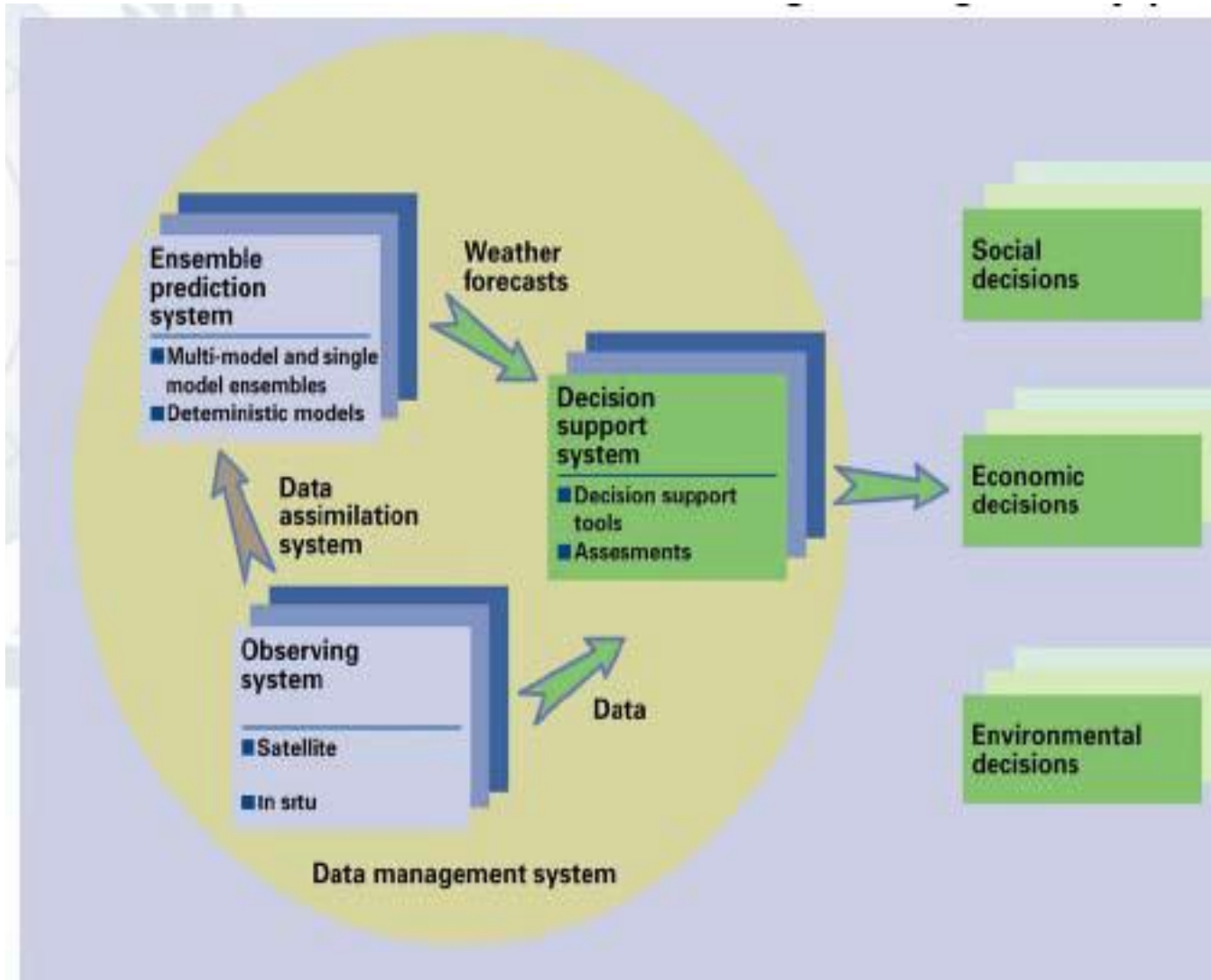
- **High impact weather:** accuracy and timing of forecast should be balanced against size of avoidable loss
- **Communication of uncertainty:** decision makers are very sensitive to false alarms and, at the same time, have a strong need for a high detection rate
- **Verification:** verification results should be presented alongside the forecasts so that users can readily understand the quality of the forecast they are currently using

THORPEX and decision making (2)

needs and recommendations for and from Africa

- Better dissemination of forecast information to reach end users
- Improved insight into how users do interpret and apply (or not) forecast information
- Integrate all stakeholders through interaction to produce suitable information tailored to the user needs
- Facilitate quantification and evaluation of environmental, societal and economic benefits by the end user
- Find the most cost effective combination of observing system, data assimilation, forecast and application procedures (Early Warning System) to improve high impact weather forecasts from user perspective

THORPEX decision support



A global interactive end to end forecasting system for the 21st century

THORPEX references:

International research implementation plan (THORPEX)

The complete research plan

Subseasonal to seasonal prediction – research implementation plan (THORPEX)

Research plan, with attention for climate change, disaster risk management and food security (food supply and markets)

Weather research in Europe – a THORPEX European plan

Research plan for Europe and the Mediterranean, including section on decision making

WWRP/THORPEX African science plan

Science plan for Africa, involving end-users

Climate change & weather references:

Climate impacts on energy systems (World Bank)

How the changing climate impacts energy systems, including need for improved observation networks in developing countries + case studies from Albania and Mexico

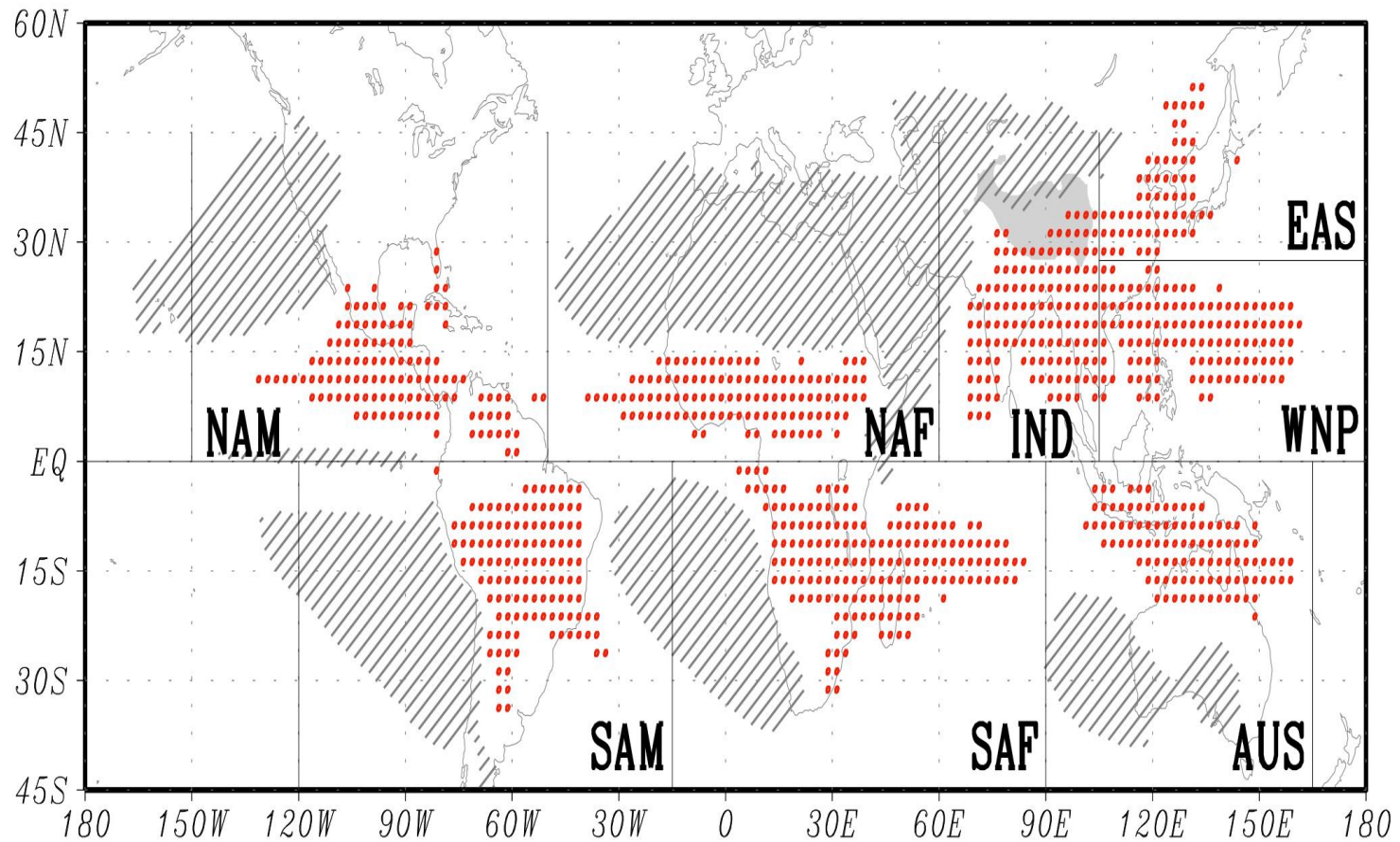
Frequently asked questions (IPCC)

Answers on frequently asked questions on climate change, including the relation between weather and climate change

Reviewing weather and climate services in the Pacific

Review of National Meteorological Services in the Pacific region (mainly small island states)

Monsoons



Approximate location of monsoons across the globe

Monsoon prediction and decision making

- Important for arranging cropping strategy and taking preventive action in potential flooding zones
- Institutional mechanism for communicating climate information to various user departments and agencies is important
- Forecasts should be released that match the lead-time requirements that are relevant to the end-users
- Seasonal forecast products should reflect local climatic zones (rather than administrative regions)
- Government should rethink the value of climate prediction in societal and economic development

Requirements for an effective community response to warnings

- Getting free warning and hazard information
- Receiving warning with sufficient lead time
- Understanding the warning content
- Believing the warning
- Believing that the threat is real
- Knowing when and what appropriate action to take
- Being in a state of preparedness

Monsoon references:

Global monsoon system 2005 (WMO)

Series of articles on monsoon system research

Global monsoon system 2011 (WMO)

Series of articles on monsoon system research, only some chapters are freely available: heaviest precipitation (ch2), intraseasonal variability (ch11), diurnal cycle (ch15), Taiwan monsoon (ch18), modelling monsoons (ch25), atmospheric and oceanic weather (ch29), oceanic processes (ch30)

Global monsoon systems (WCRP)

Introduction to monsoon systems and research efforts



2. Steps to promote earth observation for weather



State-of-the-art

Earth observation is new technology.

Learn technical skills, but when back in professional practice, it has to be put to good use.

That involves 'selling' it.

How to do that?

To whom? Could be your own boss, local authorities, communities, etc.

Categories of products and services

- **Forecasting global/local**
- **Precipitation monitoring / forecasting**
(link with crop modelling)
- **Sand/dust storm forecasting**
(link with health)

Weather products and services are linked to all GEO Societal Benefit Areas and provide input to products and services related to these SBAs

Characterization of EO weather products and services

- Mainly a **public good**, provided by NMOs and international specialized organizations
- Research topics in meteorological phenomena require specialization and are best studied in an international context
- Gains can be obtained by **improving management** of the whole **communication chain** between specialized meteorological agencies and beneficiary (think of timely warning for flooding or agricultural management)
- The **envisaged role for business** (SMEs) consists primarily of the delivery of meteorological products and services of specialized agencies to end users and/or using these as input for other products or services (think of agriculture, water management, health, energy, etc.)

Critical earth observations priorities:

GEO task US-09-01a: Critical earth observations priorities - weather societal benefit area

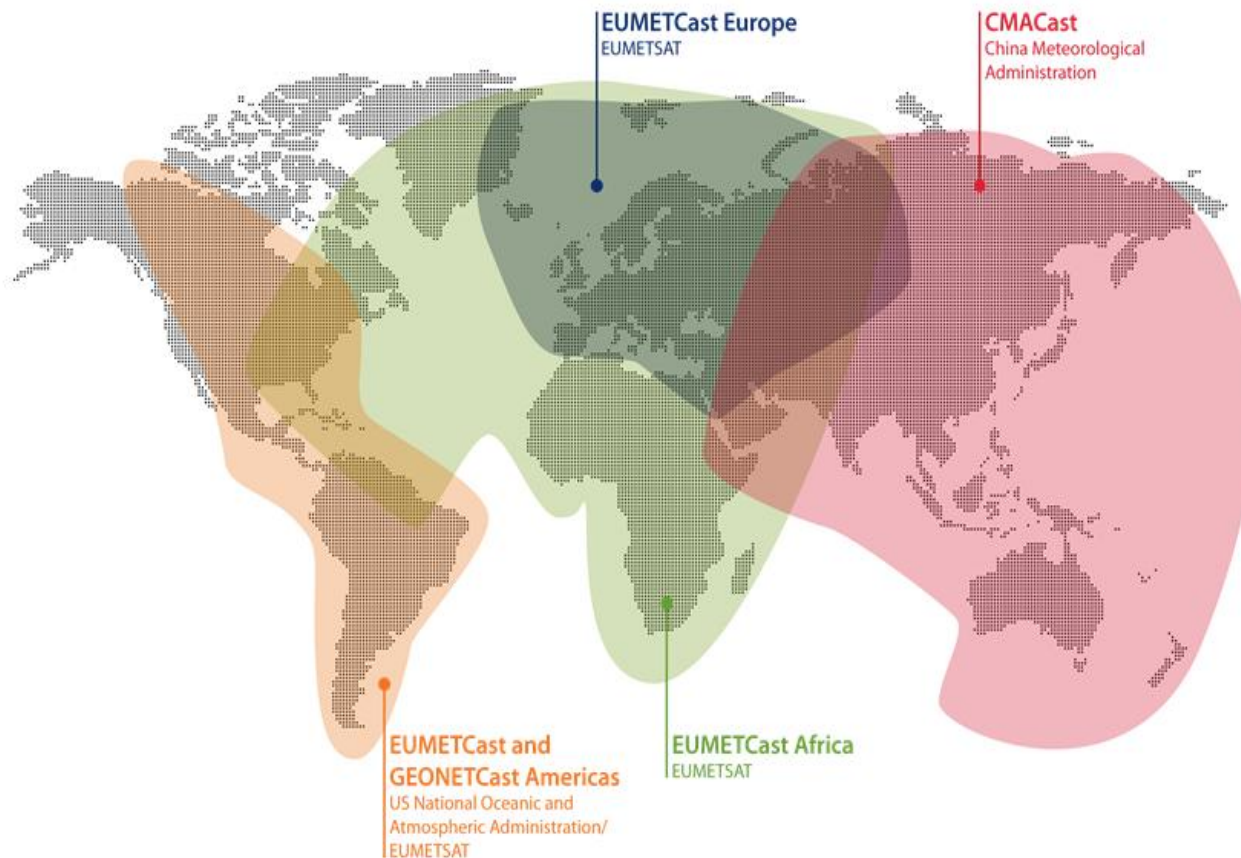
Listing of earth observation priorities, inspired by:

Statements of guidance (WMO)

On: global numerical weather prediction, high-resolution numerical weather prediction, nowcasting and very short range forecasting, seasonal to inter-annual forecasts, aeronautical meteorology, atmospheric chemistry, ocean applications, agricultural meteorology, hydrology, climate monitoring, climate applications and space weather

Example *GEONETCast* GEONETCast

*service that delivers meteorological products and services to end-users
(among other services)*



GEONETCast coverage

GEONETCast references:

GEONETCast – DevCoCast application manual *Description of how to use the system and software with application examples on biomass quantification, crop monitoring, estimation of evaporation, assessing vegetation coverage and sugar cane production, crop growth and yield modelling, net primary production of grassland, rainfall estimates, ocean colour monitoring and coral bleaching risk (sea surface temperature)*

GEONETCast toolbox – installation, configuration and user guide of the GEONETCast toolbox plug-in for ILWIS 3.7

GEONETCast toolbox factsheet XML version 1.2 *Description of all the products and data that can be received and of the features of the GEONETCast toolbox*

Use of GEONETCast for water and food security analysis in Africa *Presentation on GEONETCast applications for water **and** food security with examples from Ethiopia*

Product list GEONETCast Americas



Marketing of earth observation

Marketing of earth observation is difficult.

New technology, few big companies, lots of small ones.

Lots of reports describing the bottlenecks, like reliability, data access, data continuity, etc.

Means that relatively a lot of effort is needed to promote EO.

Points to keep in mind:

- Look for opportunities, where can you have most success in a short time: quick-wins.
- Target the right audience to start with: who would be interested and listen to you?
- Identify the problem that they are trying to solve: is it the same as yours?
- Learn to speak the same language. Example 'adiabatic': this is a term most politicians do not understand and do not care about. Use terms related to profits and losses.
- Look for examples from elsewhere (success stories): solutions that work and are affordable.



*Be patient:
introduction of new technology
and / or applications takes time*



3. How to get funding for your activities



Approach

- Share information on your subject (a thing you are doing) and think that is interesting for your contact, then look for the link. Could this solve a problem for your partner? Are adjustments necessary? Need other parties be involved? Take it from there.
- LEADS, LEADS, LEADS



How?

- Establish your network.
- Look for opportunities.
- Write a good proposal.
- Promise much, but not too much.



Proposal outline

(more detailed version in separate document, see also www.geonetcab.eu)

- | | |
|-----------------------------|--------------------|
| 1. Introduction / relevance | 6. Risk assessment |
| 2. Objective(s) | 7. Time schedule |
| 3. Activities | 8. Budget |
| 4. Output | Annexes |
| 5. Management & evaluation | |



THE REGIONAL ENVIRONMENTAL CENTER
for Central and Eastern Europe



Other references

- Civicus: writing a funding proposal
- Michigan State University: guide for writing a funding proposal
- ESRI: writing a competitive GRANT application
- REC: project proposal writing



Again:

- *SHARED PROBLEM*
- *SHARED LANGUAGE*
- *SHARED SOLUTION*

If all else fails, try to link with a more popular (and easy to understand) topic.



4. Capacity Building



General

Marketing is promotion + capacity building.

Especially for the introduction of new technologies capacity building is important at all levels.

Capacity building is the instrument to increase self-sufficiency and make solutions work.

Think of:

- Different instruments for different levels: workshops for decision makers and awareness raising, detailed technical training for professionals.
- Provide follow-up. Getting funding for good capacity building is difficult: everybody agrees that it is important, but nobody has time.
- Training is usually part of funding of big projects that are managed by big companies or ministries, as a consequence capacity building is forgotten (in the end).
- Aim at small budgets that are available without having to tender.

Examples & references

User guide to ECMWF forecast products

Numerical Weather Prediction (Colorado State)

Lecture in presentation form on numerical weather prediction

Link to **UCAR weather tutorial** (10 lectures in presentation form): <http://www.rap.ucar.edu/general/weathercourse/>

Link to **NavCanada local area weather manuals**

General introduction on meteorology for aviation + description of weather phenomena for different regions in Canada:

<http://www.navcanada.ca/NavCanada.asp?Content=contentdefinitionfiles%5Cpublications%5Cclak%5Cdefault.xml>

See also:

GEONETCast – DevCoCast application manual, GEONETCast toolbox, etc.

More references

A Rough Google Earth Guide

**MEASURE Evaluation Global Positioning System Toolkit
(USAID)**

**Handbook of Research on Developments and Trends in
Wireless Sensor Networks: From Principle to Practice**



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www.geonetcab.eu