



Earth Observation for Climate Change

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

Coordinator GEONetCab:
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 management products & services
- Life cycle phase of product or service
- Regional context, level of technological & economic development
- Optimum marketing mix



1. International trends & developments in climate change



Goals

- Increased resilience of communities with respect to climate variability
- Increased adaptive capacity of natural and managed systems under current and predicted climate variability

Mainstreaming adaptation to climate change in agriculture and natural resources projects (World Bank)

Data needed for monitoring (from “Climate knowledge for action”)

Atmospheric (over land, sea and ice)	Surface	Air temperature, Precipitation*, Air pressure, Surface radiation budget, Wind speed and direction*, Water vapour.
	Upper-air	Earth radiation budget (including solar irradiance)*, Upper-air temperature*, Wind speed and direction*, Water vapour*, Cloud properties*.
	Composition	Carbon dioxide*, Methane*, Other long-lived greenhouse gases*; Ozone* and Aerosol properties*, supported by their precursors.
Oceanic	Surface	Sea-surface temperature*, Sea-surface salinity*, Sea level*, Sea state*, Sea ice*, Surface current, Ocean colour*, Carbon dioxide partial pressure, Ocean acidity.
	Sub-surface	Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity, Oxygen, Tracers, Phytoplankton.
Terrestrial		River discharge, Water use, Ground water, Lakes*, Snow cover*, Glaciers and ice caps*, Ice sheets*, Permafrost, Albedo*, Land cover (including vegetation type)*, Fraction of absorbed photosynthetically active radiation*, Leaf area index*, Above-ground Biomass*, Fire disturbance*, Soil moisture*, Soil carbon.

* Those to which satellites make an important monitoring contribution

Data Portals

Climate change knowledge portal

<http://sdwebx.worldbank.org/climateportal/index.cfm>

Climate change explorer <http://weadapt.org/knowledge-base/using-climate-information/the-climate-change-explorer-tool>

Climate wizard <http://www.climatewizard.org/>

UNDP adaptation learning net <http://www.adaptationlearning.net/>

IPCC data distribution center <http://www.ipcc-data.org/>

Earth System Grid <http://www.earthsystemgrid.org/home.htm;jsessionid=92341D76DB0CDDDB7EE13A2D59C9B80D5>

Approach

- Choose entry points such as food security or risk management
- Identify champions = most appropriate counterpart
- Show vulnerability patterns & socio-economic impact
- Adaptation: different levels of possible regret (no, low, high) -> aim at no regret, high impact

Mainstreaming adaptation to climate change in agriculture and natural resources projects (World Bank)

The Role of Science

- Improved projections, predictions and monitoring of multidecadal global to regional climate changes
- Stronger scientific foundation for adaptation and mitigation
- Improved predictions of high-impact weather and climate
- Science-based support to responses and planning
- Developing national and international climate services
- Education and capacity building

An Earth-system prediction initiative for the twenty-first century (AMS)

Important aspects related to carbon accounting programmes, such as REDD

- MRV: measurement, reporting, verification
- Control of emissions leakage (displaced emissions): reduction in one place leads to higher emission in another area
- Closely related to tenure questions
- Payment for ecosystem services (PES)
- Communication with and involvement of villagers
- Approved methodologies for verified carbon standard (VCS)
- Land use / land cover baseline, using GIS and remote sensing
- Phases, approaches, tiers and steps for measuring / assessing REDD

Response strategies

- Reactive adaptation
- Anticipatory adaptation

Climate change: impacts, vulnerabilities and adaptation in developing countries (UNFCCC)

- **Africa**: temperature ↑, rainfall ↓, droughts ↑, floods ↑
- **Asia**: temperature ↑, rainfall ↓ (except Central Asia), droughts ↑, cyclones ↑, heat waves ↑
- **Latin America**: temperature ↑, rainfall ?, glaciers ↓, landslides ↑, floods ↑, hurricanes (Caribbean) ↑, heat waves ↑
- **Small island developing states**: temperature ↑, rainfall ↑ or ↓ (depending on region), cyclones ↑

Lessons from experience

- Climate change needs to be treated as a major social and economic risk to national economies (not just environmental)
- Addressing short-term vulnerabilities is the best strategy for preparing for long-term impacts
- Important role for communities and private sector in climate risk management (involve in planning and implementation of adaptation)
- Full buy in from regulatory agencies is needed
- No-regrets strategies and “soft” solutions embedded in more sustainable natural resources management should be pursued where they are available

Managing climate risk (World Bank)

Adaptation at the farm level

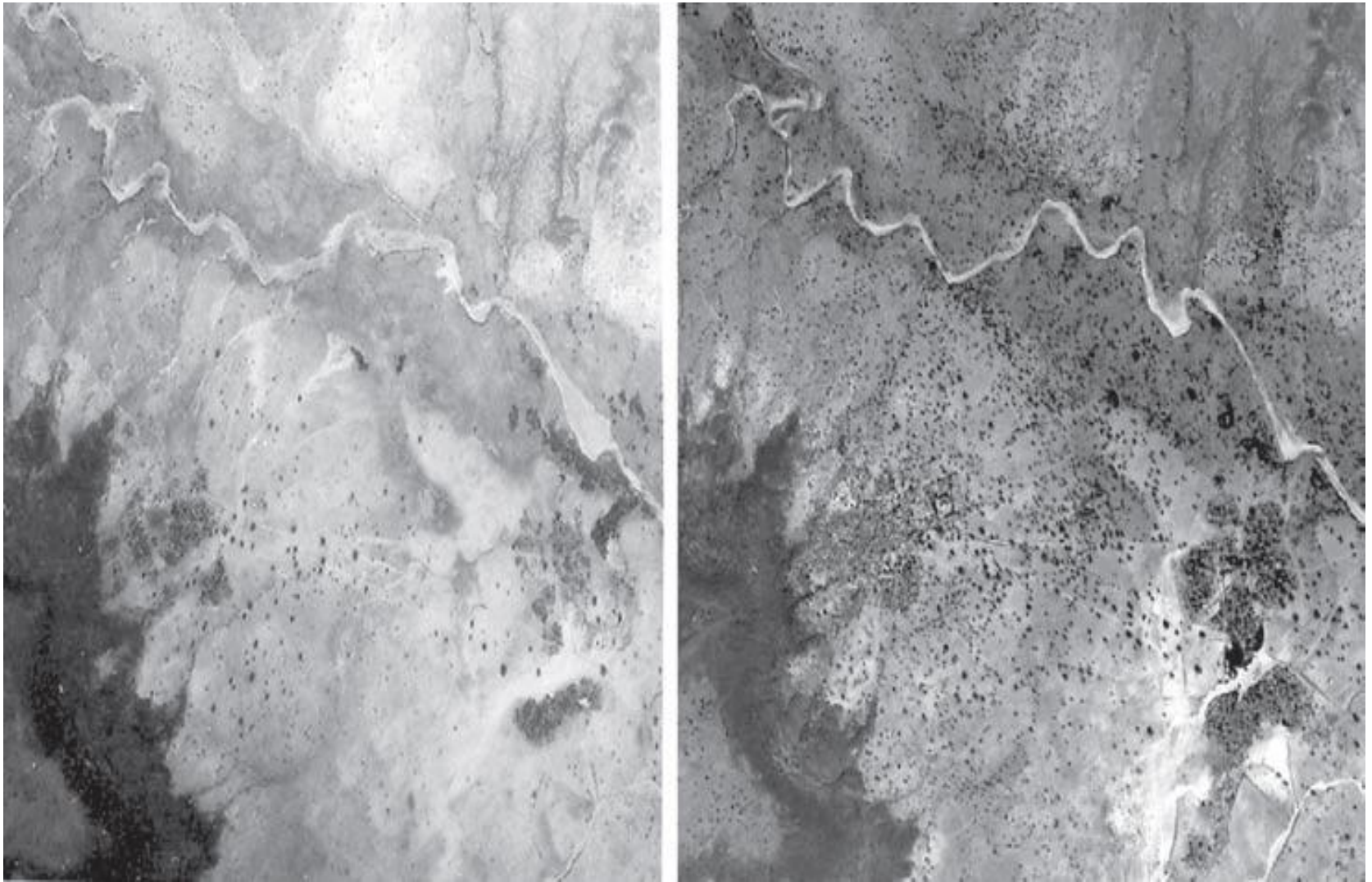
- Crop calendar shifts and crop changes
- Soil and water management changes
- Fertilizer use / land use decisions
- Water, labour, capital use (intensive or not, efficiency)

Needed:

Climate information, seasonal climate forecasts, early warning, infrastructure, insurance, technology development (crop varieties, irrigation technology)

Mainstreaming adaptation to climate change in agriculture and natural resources projects (World Bank)

It can be simple



Trees planted in Niger for soil conservation (left 1975, right 2003)

More references on monitoring:

Climate knowledge for action, a global framework for action – empowering the most vulnerable *Advocating a Global Framework for Action, consisting of a User Interface Platform, Climate Services Information System and three components: observations and planning, research modelling and prediction, capacity building*

Climate and land degradation (WMO) *Overview of trends, causes and measures (including remote sensing for agroclimatic mapping)*

Guidelines on analysis of extremes in a changing climate in support of informed decisions for adaptation (WMO) *Guide on datasets, observations, analysis and toolkit(s)*

WCRP (GEWEX, CliC, CLIVAR, SPARC) documents *Reports on clouds, implementation plan and achievements, fact sheets on sea level rise and monsoons*

State of the climate in 2011 *Very detailed overview of the state-of-the-art in climate research, related to the year 2011*

River basins and climate change report 2012 *Overview of climate change in river basins + case studies*

More references on adaptation:

Mainstreaming climate change adaptation into development planning: a guide for practitioners (UNDP/UNEP)

Guide for policy formulation, including adaptation indicators

Forest service roadmap for responding to climate change (USA) *Approach towards adaptation, mitigation and sustainable consumption)*

Planning for climate change: leading practice principles and models for sea change communities in coastal Australia *Study on possible adaptation measures for coastal climate change*

Integrating agriculture, forestry and other land use in future climate regimes *Overview of possible adaptation measures, including the use of remote sensing*

World Bank studies on coastal cities in Northern Africa *Reports on risks and possible actions, see also GEONetCab disaster management toolkit*

More references on carbon accounting:

Forest carbon accounting, overview and principles

General guidelines, stresses importance of remote sensing

Analysing REDD+, challenges and choices

Detailed overview of approach, methodology, guidelines and performance indicators

More general references:

Kick the habit (UN)

General introduction on climate change and what you can do as an individual

Acting on climate change: the UN system delivering as one

Overall description of UN strategy

Climate change science compendium

Comprehensive popular overview of climate science

Managing the risks of extreme events and disasters to advance climate change adaptation – summary for policy makers (IPCC)

Short description of risks and adaptation options for decision making



2. Steps to promote earth observation for climate change



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

- monitoring and modelling (global/regional -> greenhouse gases, arctic environment, oceans, agriculture, weather)
- carbon accounting
- prediction and mitigation of effects

Main advantages of using satellite data for climate change

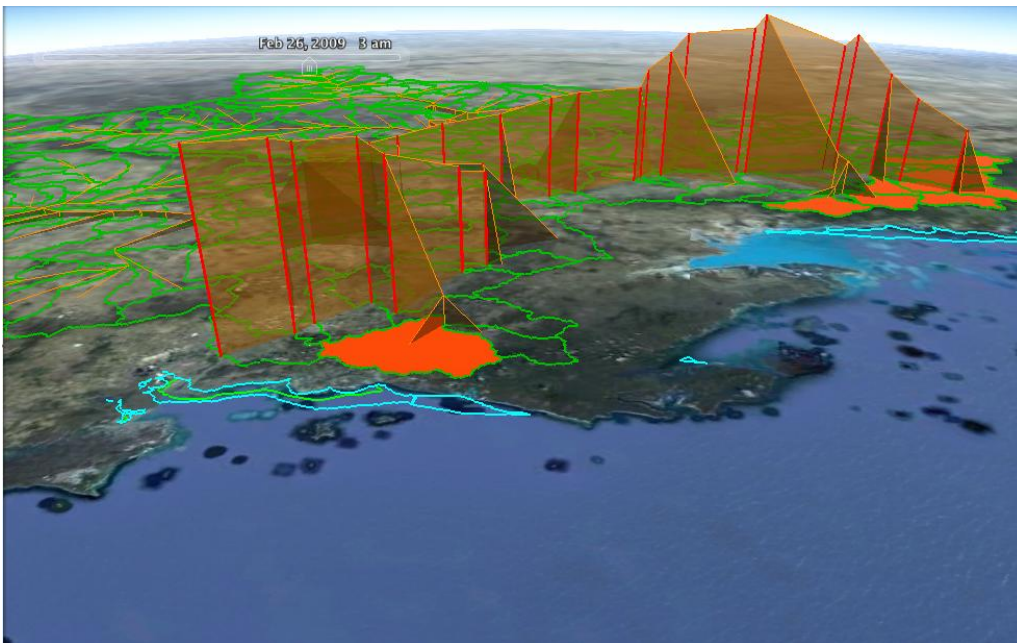
- Year-round data collection, also when field data collection is not possible (remote locations, bad weather conditions)
- Reduced costs when compared to traditional field data collection methods in remote environments (land cover classification for example).
- Remote sensing systems can capture a synoptic view of the landscape and oceans, to more adequately characterise dynamics.
- Remote sensing provides additional information that can supplement more intensive sampling efforts and help extrapolate findings

From: Space technologies and climate change, implications for water management, marine resources and maritime transport (OECD)

Visualization with Google Earth

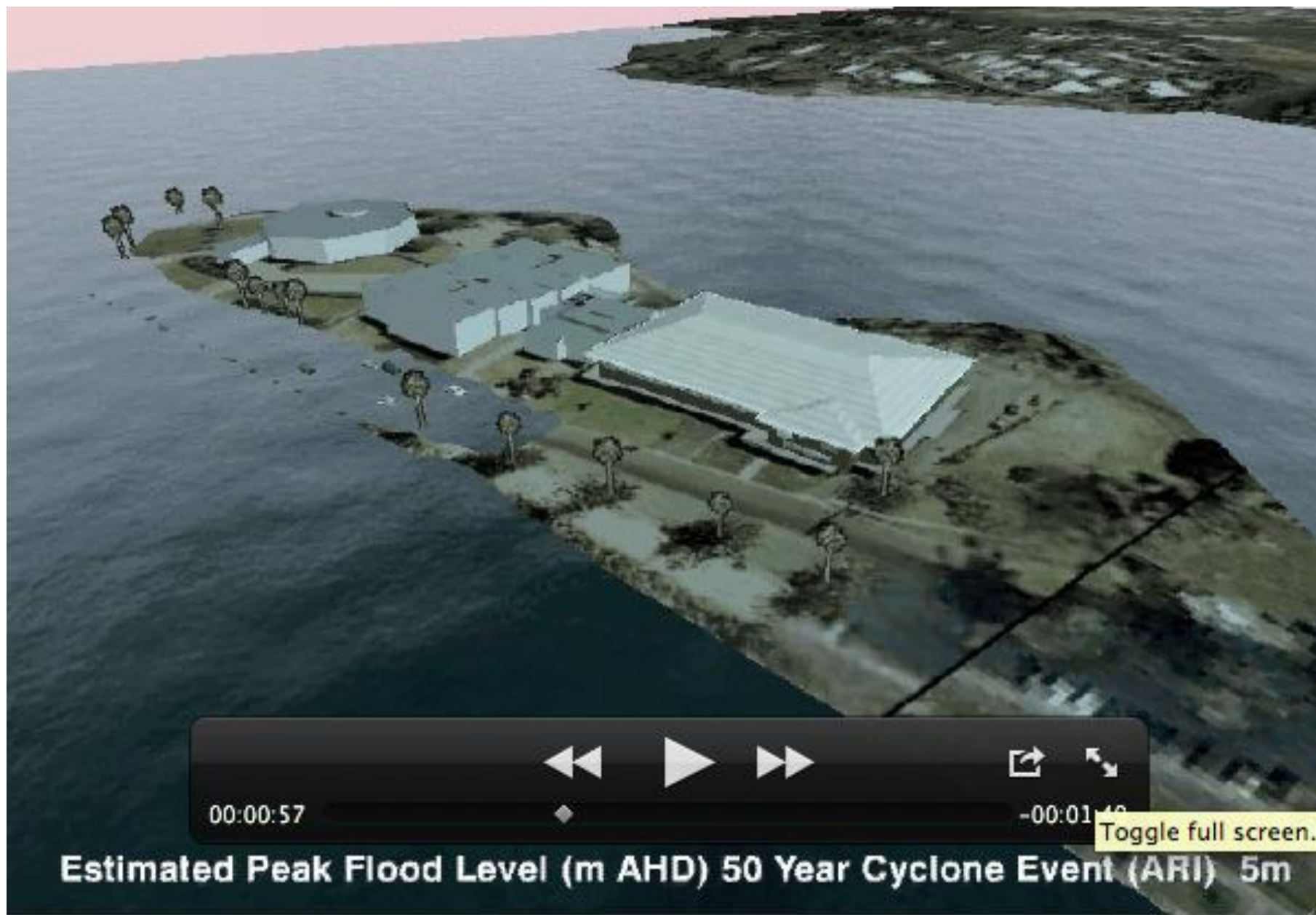
Using digital globes to visualize climate change impact ->

testing Google Earth applications to visualize climate change in Australia + community forest monitoring (Google Earth + handheld GPS)



Climate impact water cycle presentation (Australia)

4D water visualization potential in Google Earth



Monitoring references:

Capacity development and integration of local knowledge for climate change impacts and vulnerability assessment (Philippines) *SimCLIM and impact models for climate change preparedness at the local level*

Accelerated changes of environmental conditions on the Tibetan plateau caused by climate change *Changes in temperature, NDVI, wind and heat flux over the last decades, derived from remote sensing*

Changes in land cover, rainfall and stream flow in Upper Gilgel Abbay catchment, Blue Nile Basin (Ethiopia) *Study on changes over the last decades based on several satellite images*

Global biophysical datasets (NASA) presentation *Overview of results/trends of different satellite measurements related to climate change*

More monitoring references:

GEO Carbon showcase:

<http://www.youtube.com/watch?v=cmS3RergtP4>

GMES climate change: <http://www.youtube.com/watch?v=ujDU6hyn-vg>

General climate change: <http://preview.grid.unep.org>

GEO Task US-09-01a: Critical Earth Observation priorities – climate societal benefit area *Overview of observation needs for research, modelling, policy formulation and decision making*

EUGENE climate change status quo and workshop report *Overview of data and information requirements, actors, models, outputs and gaps*

Example: change in annual runoff by 2041-2060, relative to 1900-1970 in %

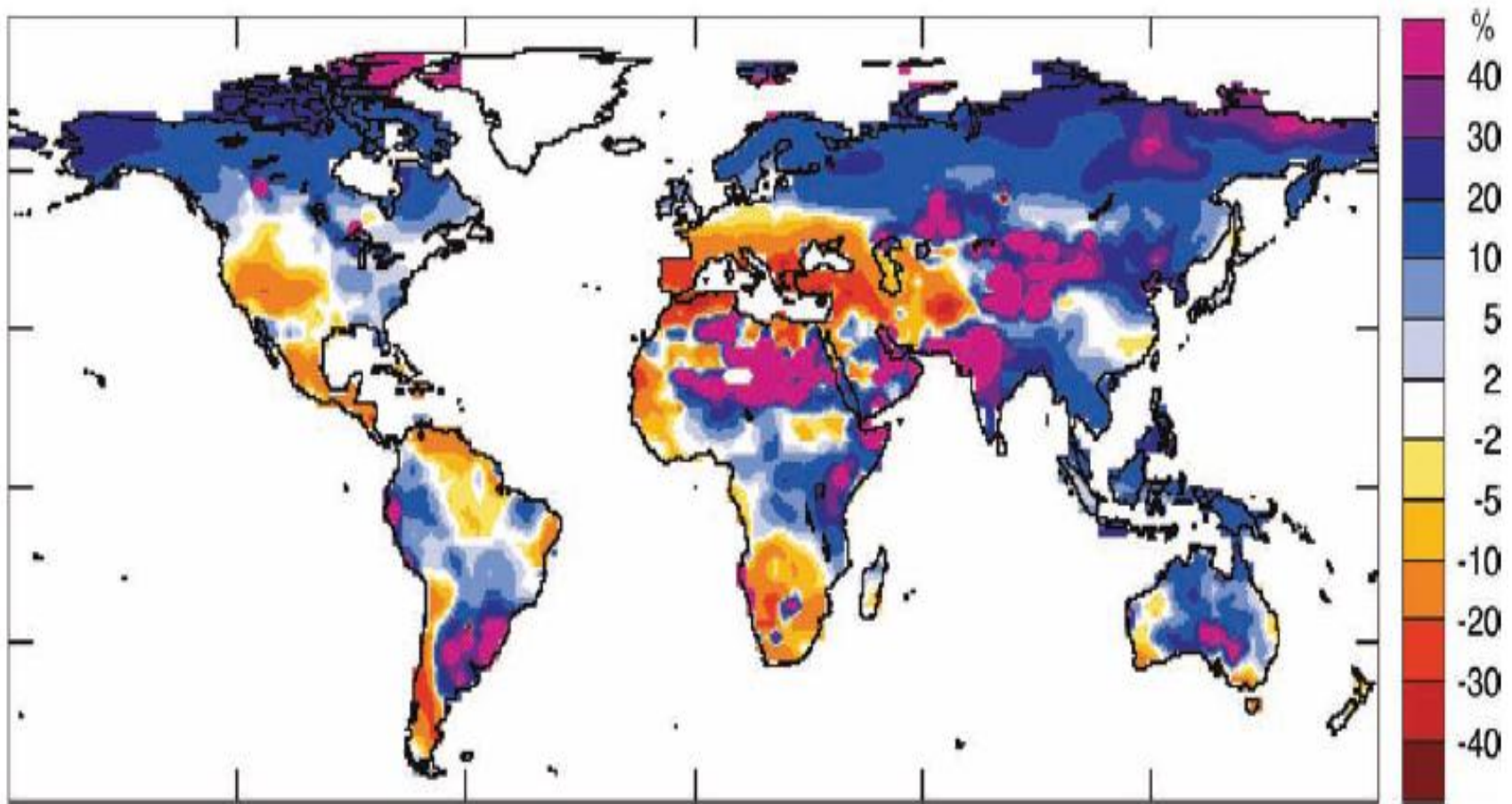
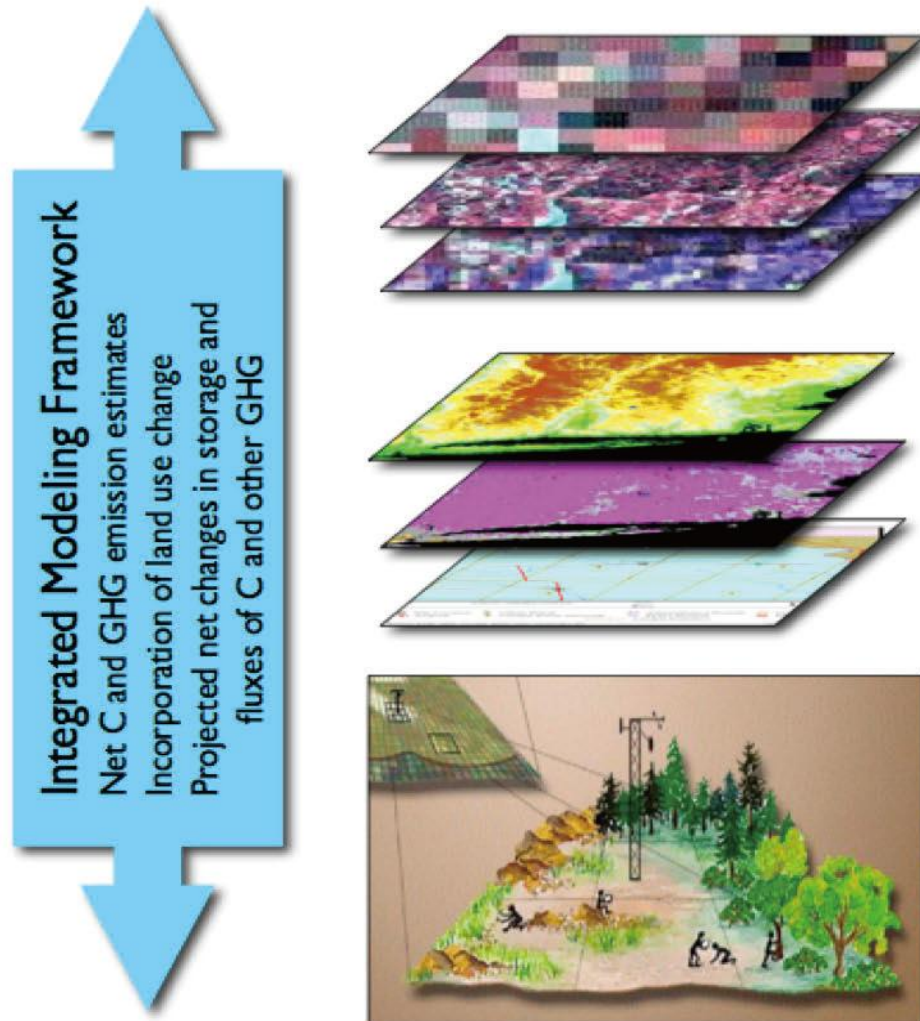


Figure 3.4. Change in annual runoff by 2041-60 relative to 1900-70, in percent, under the SRES A1B emissions scenario and based on an ensemble of 12 climate models. Reprinted by permission from Macmillan Publishers Ltd. [Nature] (Milly et al., 2005), copyright 2005.

From: Water resources climate change presentation (Japan)

GEO Carbon Strategy: modelling framework



Global satellite imagery

- MODIS, AVHRR
- MERIS, vegetation, Seawiffs
- ETM+, SPOT, ASTER
- SAR data
- MISR Local Mode
- IKONOS (Scientific Data Purchase)
- "GeoCover '90s TM

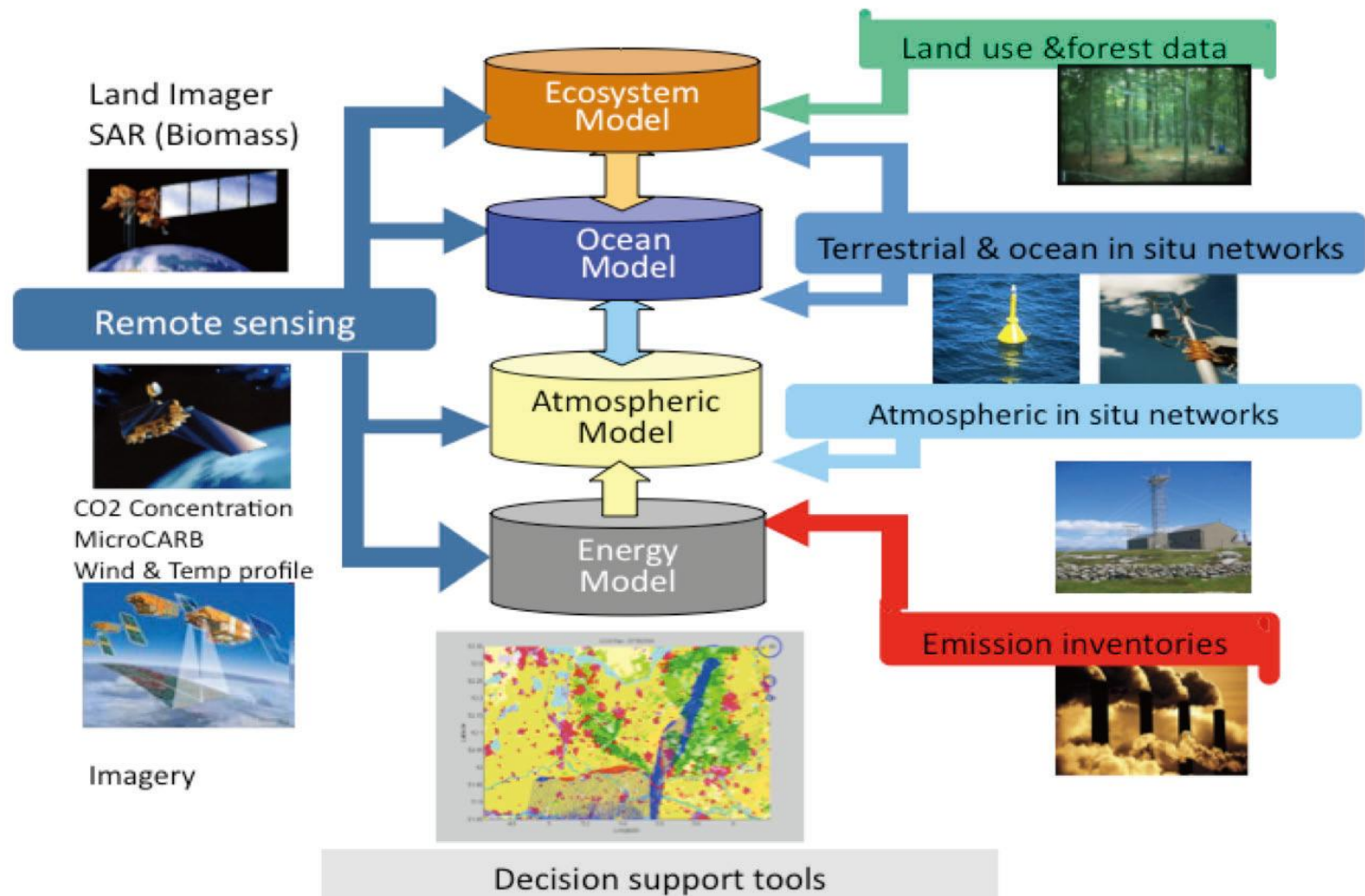
Ancillary layers

- elevation, slope
- land cover
- reference layer
- climate
- soil maps

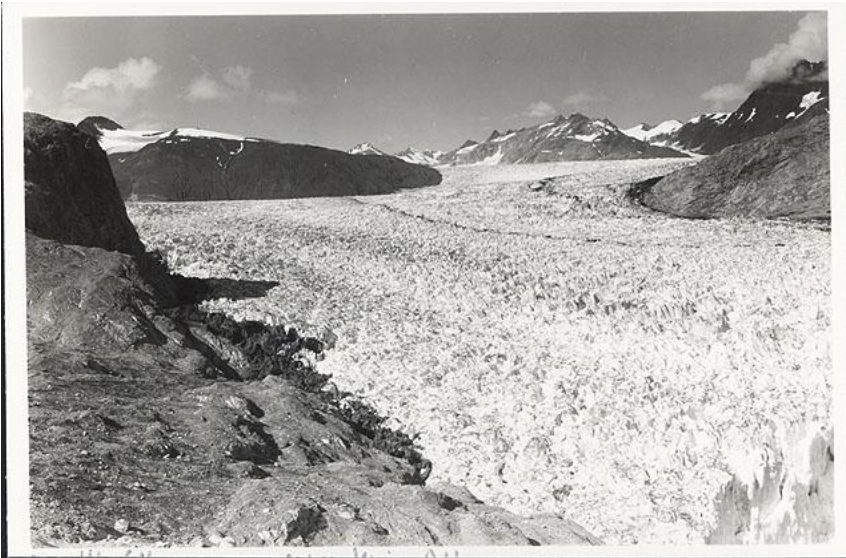
Field data

- Flux towers
- soil moisture, ecological processes
- Respiration chambers,
- Biometry, LAI, ap flow
- in situ land use information
- collaboration information
- site level field surveys

GEO Carbon Strategy: decision support tools



Support change detection



Muir glacier, Alaska – August 1941



Muir glacier, Alaska – August 2004

Adaptation references:

NASA regional integrated sciences and assessments annual report 2011 *Examples of successful earth observation applications for climate change preparedness, mainly in the areas of drought and water management*

Tearfund CEDRA toolkit *Step-by-step guide to define community climate adaptation activities in developing countries*

Important adaptation topics: disaster risk management & food security, see:

- **GEONetCab disaster management toolkit**
- **GEONetCab crop modelling toolkit**

Carbon accounting references:

GMES brochures on forest carbon tracking & arctic monitoring

Bolsa floresta progress report *Use of remote sensing (INPE, Planet Action) for monitoring community REDD activities in Brazil*

SARvision presentation *REDD+ examples from Guyana and Surinam and oil palm example from Malaysia*

Global and regional land cover and land change monitoring: progress and needs (Wageningen) *Overview of land cover change and carbon stock monitoring*

Field examples of community forest carbon mapping *Chapters from book on community forest management*

Community forestry as a prerequisite for REDD *Overview of requirement, possibilities and difficulties of community forestry, including the use of remote sensing*

More carbon accounting references:

Carbon accounting example Madagascar (Planet Action) *Land use analysis, above-ground biomass assessment with LIDAR, soil organic carbon mapping with satellite imagery, scenario development, scaling up from project level to national level* http://www.planet-action.org/automne_modules_files/polyProjects/public/r8299_93_reddpilot_project_goodplanet_madagascar_17dec10.pdf

Global Forest Observation Initiative (GFOI) implementation plan *Overview of requirements, possibilities and difficulties of community forestry, including the use of remote sensing*

GOFC-GOLD sourcebook *Exhaustive overview of assessing carbon stocks and emissions, detailed description of methodology*

Other references:

Land administration options for projects involving payments for carbon sequestration *Article on remote sensing and participatory land tenure identification for payment for ecosystem services, examples from Brazil, Mozambique and Indonesia*

GIS for climate change (ESRI)

Climate change is a geographic problem (ESRI)
Practical examples and approach



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 'ECVs': this is a term most managers do not understand and do not care about. Use terms related to mitigation and adaptation.
- 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 | |



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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

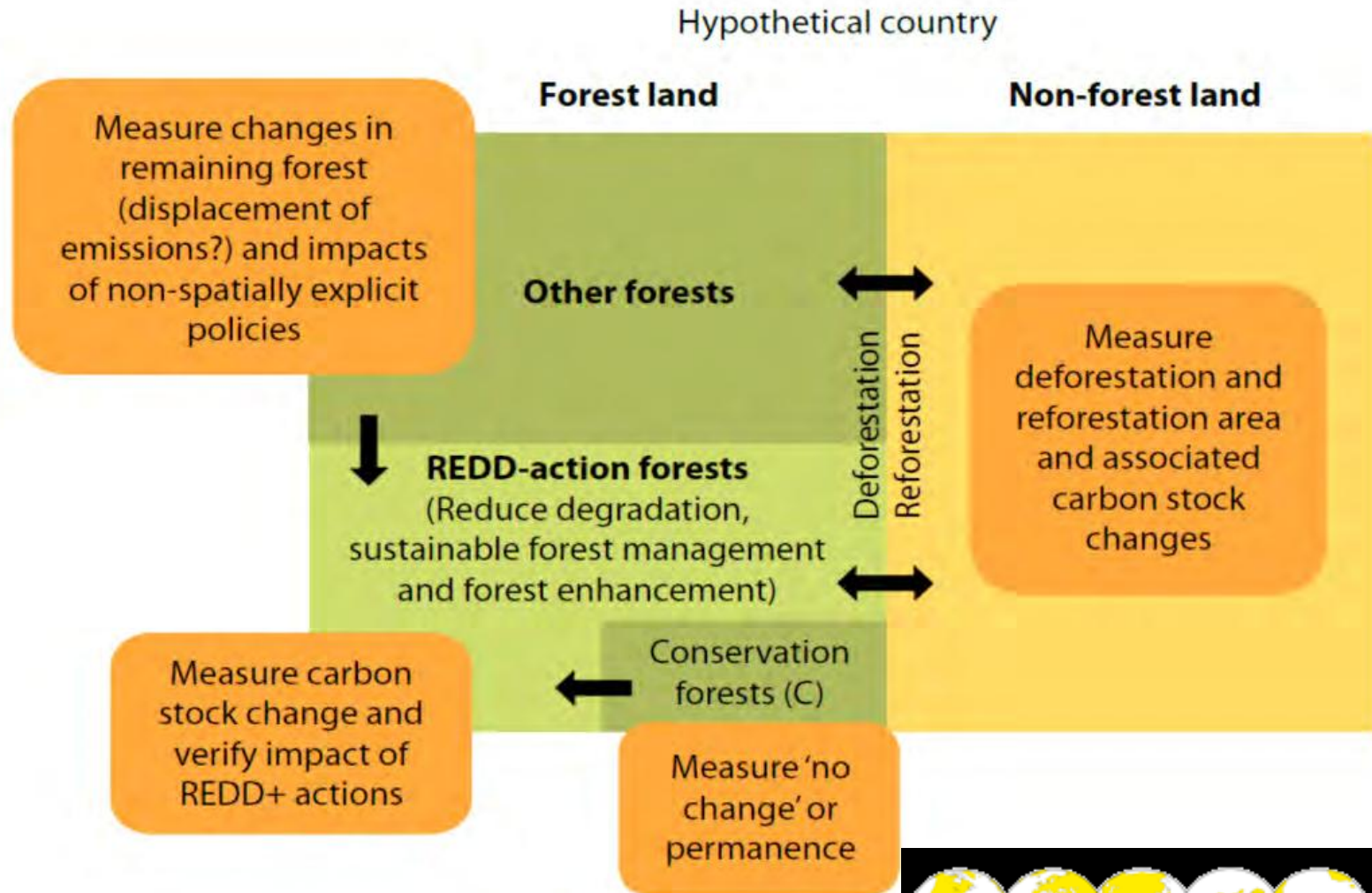
global change SysTem for Analysis, Research & Training: START
provides guidelines and training opportunities related to climate change issues

Tearfund CEDRA toolkit *Step-by-step guide to define community climate adaptation activities in developing countries*

GEONetCab capacity building web www.geonetcab.eu
compilation of tutorials, references, open-source software, etc.

GEO Portal: www.earthobservations.org

START: biodiversity and climate change training



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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