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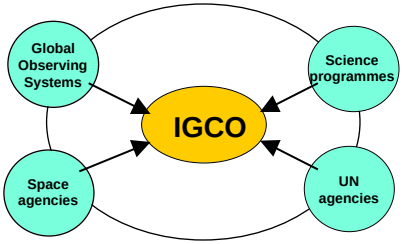

Terrestrial Carbon Observation (TCO) and ADEOS products requirements

Josef Cihlar and Scott Denning

ALOS Science Advisory Panel Meeting,, 2002/05/14-15, Santa Barbara, CA

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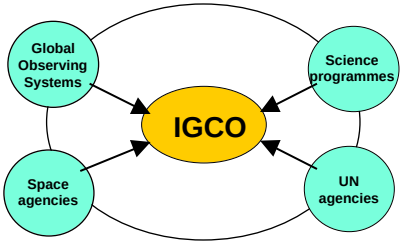

Terrestrial Carbon Observation

- Initiative of IGOS Partners, led by GTOS
- Proposed November 1999, approved June 2001
- Content developed by TCO theme team, implementation plan by TCO design team
- Basic strategy:
  - Component of Integrated Global Carbon Observation
  - Multiple constraint – top down/bottom up
  - Full C accounting

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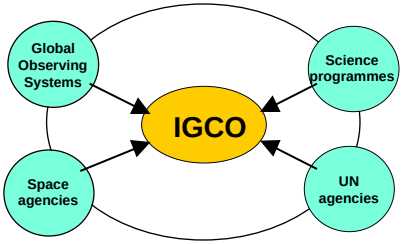

TCO goal and objectives

GOAL: Provide systematic information on the spatial and temporal distribution of terrestrial carbon sources and sinks, and on the role of the terrestrial sinks and sources in the global carbon cycle

OBJECTIVES

1. By 2005, demonstrate the capability to estimate annual net land-atmosphere fluxes at a sub-continental scale (10^7 km^2) with an accuracy of +/- 30% globally, and a regional scale (10^6 km^2) over areas selected for specific campaigns with a similar or better accuracy;
2. By 2008, improve the performance to better spatial resolution (10^6 km^2 globally) and an increased accuracy (+/- 20%);
3. Produce flux emission estimate maps with the highest spatial resolution enabled by the available satellite-derived and other input products.
4. Establish and implement a process of ongoing improvements to ensure the products and information are (i) meet current and future needs and (ii) are obtained in an efficient manner
5. Contribute to capacity building at regional and national levels to acquire and use terrestrial carbon- related data or information

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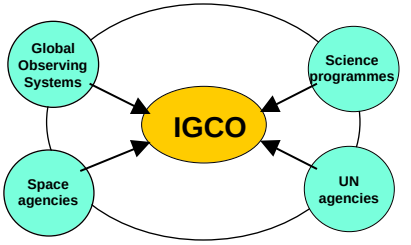

TCO Output products

Integrated fluxes	**Global**	**NBP**	**Polygon (coarse)**	**2003**	**GTOS, WMO, CEOS, IGBP**
	Regional	**NBP**	**Polygon (fine)**	**2002**	**Various**
Ecosystem fluxes	**Global**	**NPP, NEP, NBP**	**~1 km**	**2002**	**GTOS, IGBP, CEOS**
	Regional	**NPP, NEP, NBP**	**≤1 km**	**2002**	**Various**

†

* Source: TCO Implementation Plan

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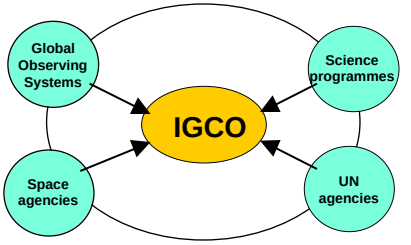

TCO Input products: land cover/use*

Land cover fine	Regional [1]	Cover type[3]	~30 m	2003	3–5 years	TM; HRVIR †	NASA, CNES	NASA, CNES
	Global	Cover type[3]	~30 m	2004	6–8 years	TM HRVIR †	NASA, CNES	NASA, CNES
Land cover coarse	Global	Cover type[3]	≤ 1 km	2001	1 year	MODIS, VIIRS, GLI	NASA, NASDA	NASA; NASDA
Land use (present and history; including management)	Global	Land use	≤ 1 km	2004	5 years	Land cover, other global products	Country reports	FAO, UNEP

* Source: TCO Implementation Plan

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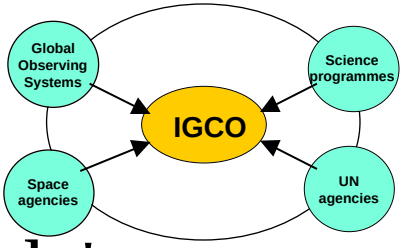

TCO Inputs products: research*

Atmospheric column total	Global	CH4, CO, CO2	~10km	2001–2005	~3 days	MOPITT, TES??	NASA	NASA
Above ground biomass	Global	Biomass	<1km	2005	1 year	VCL, ALOS SAR	NASA, NASDA	NASA, NASDA
Soil moisture	Global	Soil water content	~1 km	2003	1 day	SMOS GLDAS	CNES/ESA?? NASA?	CNES/ESA?? NASA?

* Source: TCO Implementation Plan

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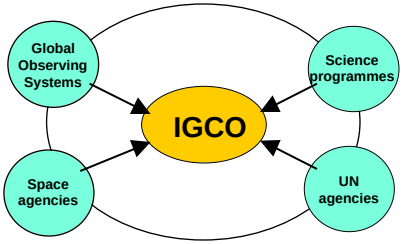

TCO status

- Approval to implementation: June 2001
- Implementation plan: nearly completed (May 2002)
- Implementation mechanisms:
  - Work with existing projects where feasible
  - Initiate new activities to fill gaps

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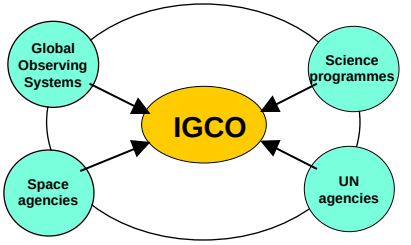

Implementation

Phase 1: Preparatory (1999-2003):

- improved coordination among existing programs and components; improvements in observation methods and observations, data products, and models; beginning convergence of current regional campaigns; studies of improved networks designs; observing technology development; …

Phase 2: 'Coordinated Carbon Observation Period' (CCOP; 2004-2009):

Phase 2a: CCOP pre-satellite CO_2 (2004-2007):

- Better coordinated (current and new) regional programs, increasingly systematic satellite coverage and products, improving density/distribution of in situ observations, improved Output flux products; new satellite data (biomass),..

Phase 2b: CCOP with satellite CO_2 (2008-2010):

- Addition of improved satellite-derived atmospheric CO_2 data sets,…

Phase 3: Pre-operational (2011-2015):

- Improving quality (spatial resolution, accuracy) and reducing costs; further model improvements (focus on improved data assimilation within comprehensive earth system models); reprocessing and evaluating time series; trimming down the observation and modeling strategy to its essential elements and latest techniques; specifying configuration for ongoing observations.

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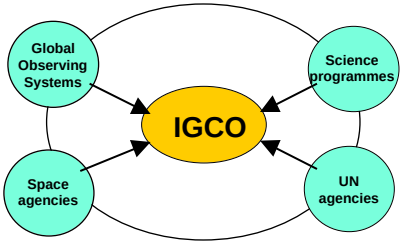

TCO – initial milestones (selected)

2002:

- Establishing TCO Panel, Partners Group, secretariat for TCO

2003:

- TCO methods review and documentation (workshop and report)
- Begin the preparation of coordinated observation period (CCOP)
- **Continue the preparation of global and key regional data products (led by various agencies and programs, and both satellite and in situ- derived data sets)**
- **Assessment of current observation capabilities and Input products**; identify key changes to be made, and pursue improvements with partners
- **Assembly and distribution of key data products** for use in TCO

2004:

- **Enhanced coordinated carbon observation period for carbon** (CCOP) with CEOP, regional studies and others; initial processing and regional carbon source-sink maps

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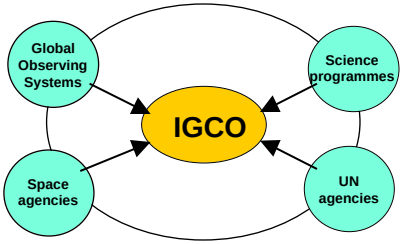
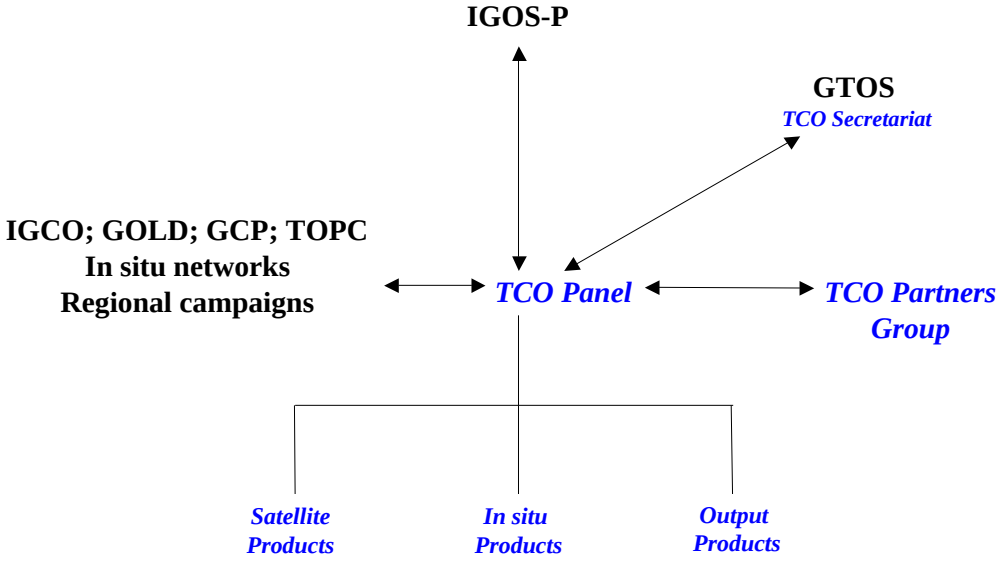


TCO organisational structure



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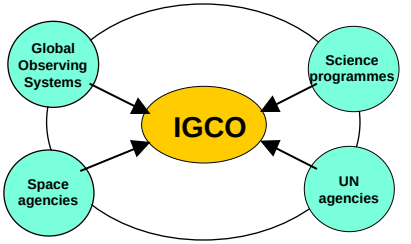

TCO observation requirements (spatial)

- land cover, land use
- biomass, leaf area
- Fire (area, emissions)
- radiation
- atmospheric column (CO_2, CH_4)
- near surface GHG concentrations
- surface fluxes
- C pools and changes

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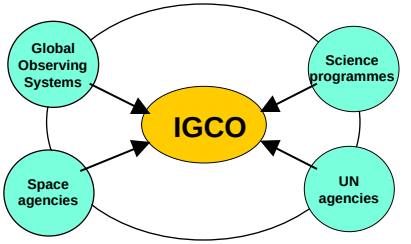

Coarse resolution land cover requirements

- **Why**: land cover and change, for: input to ecosystem models, to identify areas needing more fine resolution coverage, use in satellite data algorithms
- **What**:
  - Cover type or characteristics translatable into cover type or species (%cover, leaf type,..)
  - Fractional composition per pixel
- **How**:
  - consensus on products and methods (esp. validation);
  - harmonise existing efforts;
  - coordinated as part of GOFC/GOLD LC IT activities, to encompass: validation methodology, products validation/documentation/release, involvement of satellite sensor teams (follow-on to LC IT meeting in Toulouse, 2002/02); initially GLC2000, MODLAND products

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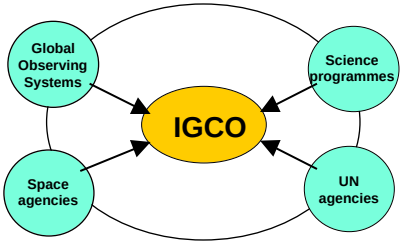

Biomass and biomass change

- **Why**: for input to ecosystem models, to estimate changes in above ground C stocks, to constrain below ground carbon stock estimates, to constrain carbon flux estimates
- **What**:
  - Total above ground biomass and canopy biomass components if feasible
  - Spatial extent – world's forests a priority for SAR
  - Frequency: annual

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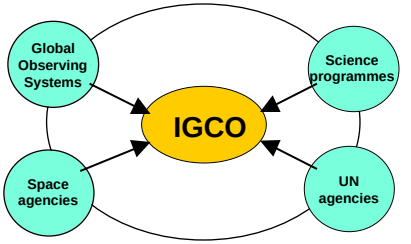

Frozen ground

- **Why**: as input to ecosystem (and hydrological) models; as check on air temperature estimates; not a rock bottom requirement but important
- **What**:
  - Onset and offset of frozen ground
  - Spatial extent: cryosphere zone (pole-ward from ~40^{o}, N hemisph. NB)
  - Frequency: onset and offset (daily, sub-daily requirement TBD)

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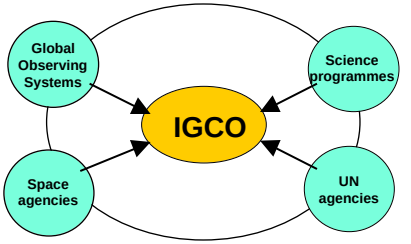

Wetlands

- **Why**: as input to ecosystem models, CO_2 and CH_4 fluxes; a very important requirement
- **What**:
  - Spatial extent and seasonal dynamics of water table
  - Spatial extent: world's wetlands (including forested and agricultural wetlands
  - Frequency: regionally variable – seasonal to every ~ 5 years

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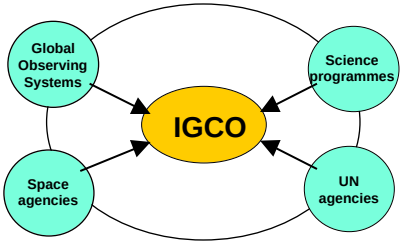

General considerations for ALOS

• Participate in regional studies – carbon and energy/water (Siberia, NACP, Europe, LBA, CEOP, East Asia)

• Complementary role of PALSAR and AVNIR/PRISM

• Work with multiple data sources and sensor types

• Testing current analogue products and defining improvements for ALOS, leading to time series where feasible

• Teams to include modellers

• Products goal: validated geophysical products with errors bars and metadata

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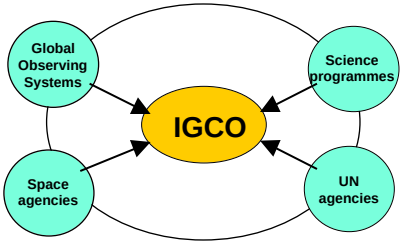

TCO needs from this meeting

- **Understanding/documenting the anticipated -**
  - Products characteristics (extent, frequency, accuracy, availability)
  - Emerging plan to obtain the products
  - C&K needs in developing/improving the products
  - Opportunities for the involvement of the C research community
  - C&K needs re outreach
  - Gaps, issues where TCO might help