Background to Proposal of Our Industrial Partners:
HALO and Infrastructure Requirements for the GMES Backbone

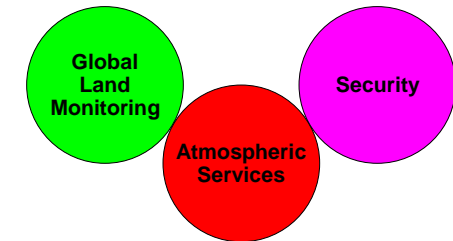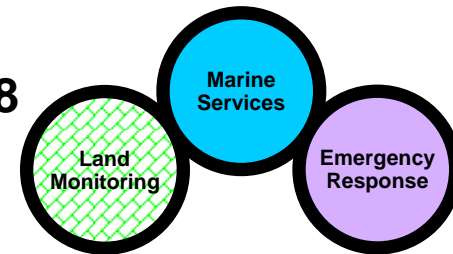**Johannes Kaiser & Anthony Hollingsworth**

ECMWF

Overview of Presentation

- **Introduction: Objectives, HALO Study Logic**

- **System Layout**

- **Data Flow Characterisation**

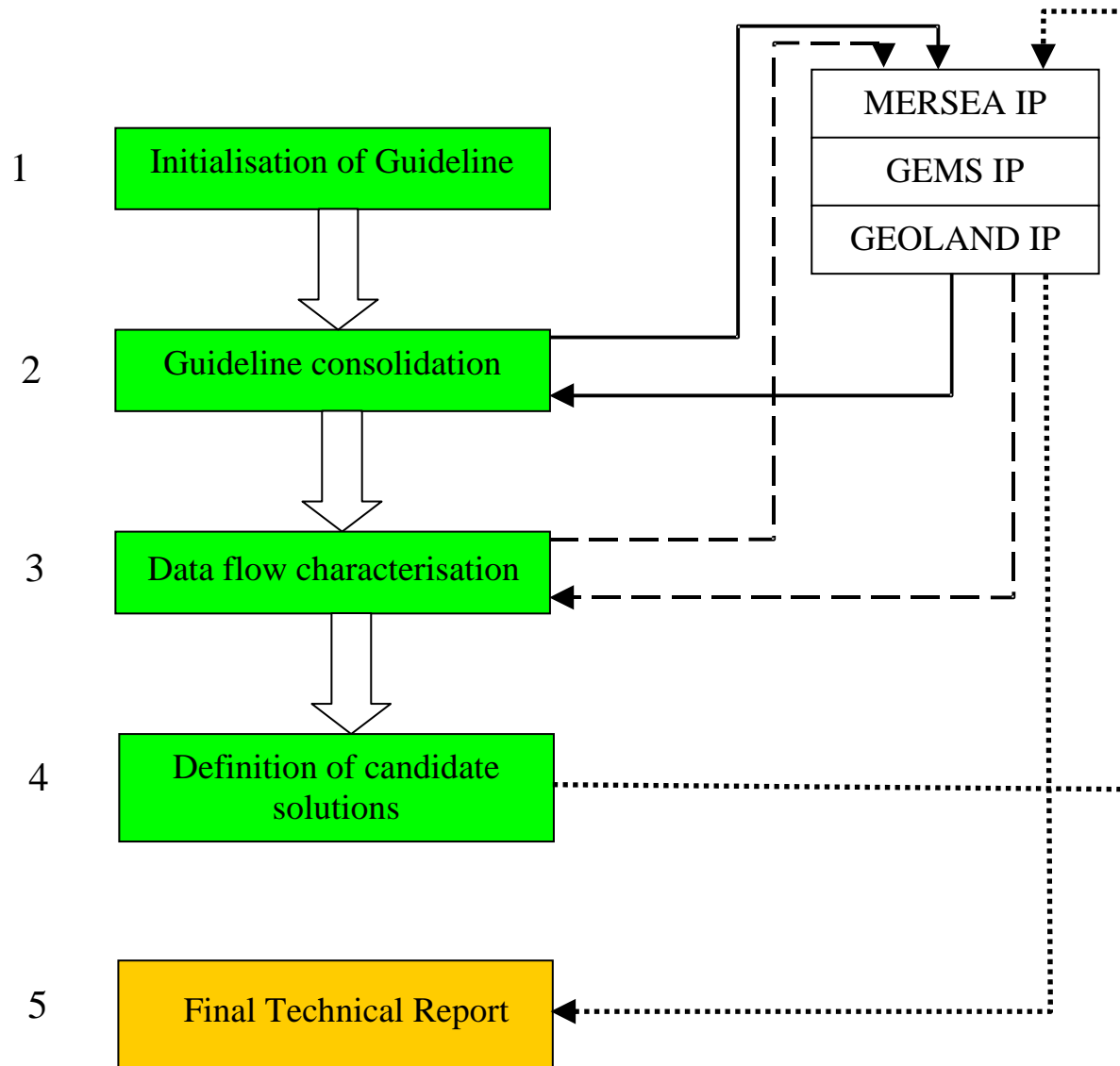- **2nd Workshop Conclusions**

- **Developments in 2006**

Introduction:
Objectives, HALO Study Logic

HALO – GMES Specific Support Action (SSA)

- **Harmonised coordination of Atmosphere, Land and Ocean integrated projects of the GMES backbone:**
  - Integrated Projects (IPs) GEMS, GEOLAND, MERSEA
  - project lifetime: spring 2004 – spring 2007

- **GMES Fast-Track Pilot Services to be operational from 2008**
  - **Marine Services (IP MERSEA follow-up)**
  - **Land Monitoring (IP GEOLAND-Europe follow-up)**
  - **Emergency Response (IP RISK-PREVIEW follow-up)**

- **Proposed GEMS Fast-Track Pilot Services to be operational from 2009 onwards**
  - **Global Atmospheric Service (IP GEMS follow-up)**
  - **Global Land Monitoring (IP GEOLAND-Global follow-up)**
  - **Security**

- **HALO aims at formulating agreed recommendations to EU and IPs for the** joint transition to operational status **of the IP's global monitoring systems.**
  - **Scientific analysis of links between the IPs**
  - **Coordinated solutions for the infra-structure in operational mode**

Iterative Development of the Infrastructure Candidate Solutions

1   Initialisation of Guideline

2   Guideline consolidation

3   Data flow characterisation

4   Definition of candidate solutions

5   Final Technical Report

MERSEA IP

GEMS IP

GEOLAND IP

Progress of the Candidate Solution Definition

2004 Reports:

"ECMWF's data and products for GMES"

"geoland data and products for GMES"

"MERSEA data and products for GMES"

"GEMS data and products for GMES"

2005 Reports:

"Interacting parts of GEMS, MERSEA and geoland: Data, products and infrastructure"

"HALO Guideline"

"Infrastructure candidate solutions overview"

2006 Draft Report:

"Recommendation Document including Common Interface Candidate Solutions"   *to be discussed at this workshop*
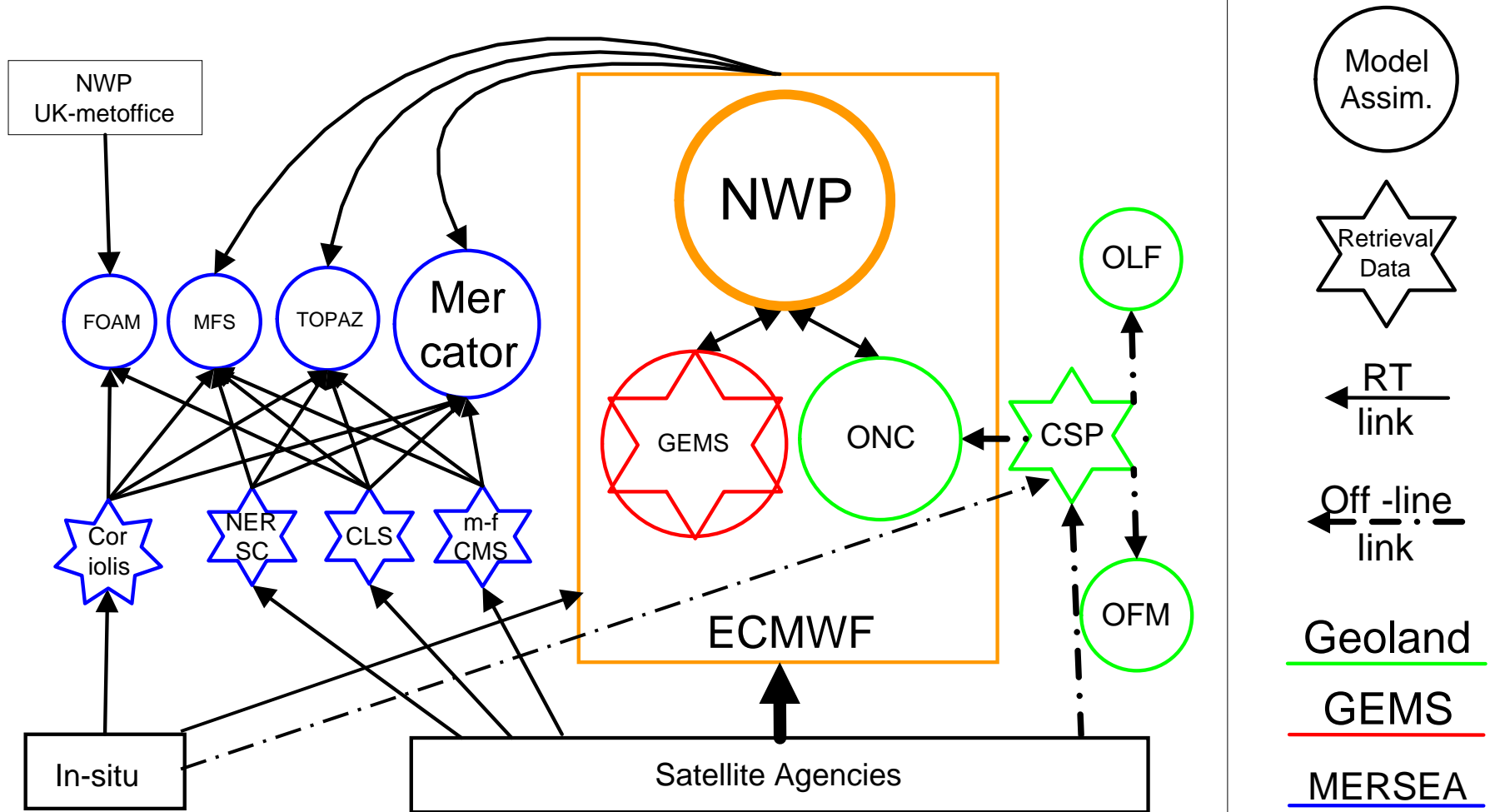
Spring 2007 Reports:

"Recommendation Document including Common Interface Candidate Solutions" (by Alcatel/Astrium)

"Final Technical Report" (by IPs)

System Layout

Current System of IPs (2006)

GMES Vision 2009:
Core Services + Downstream Services
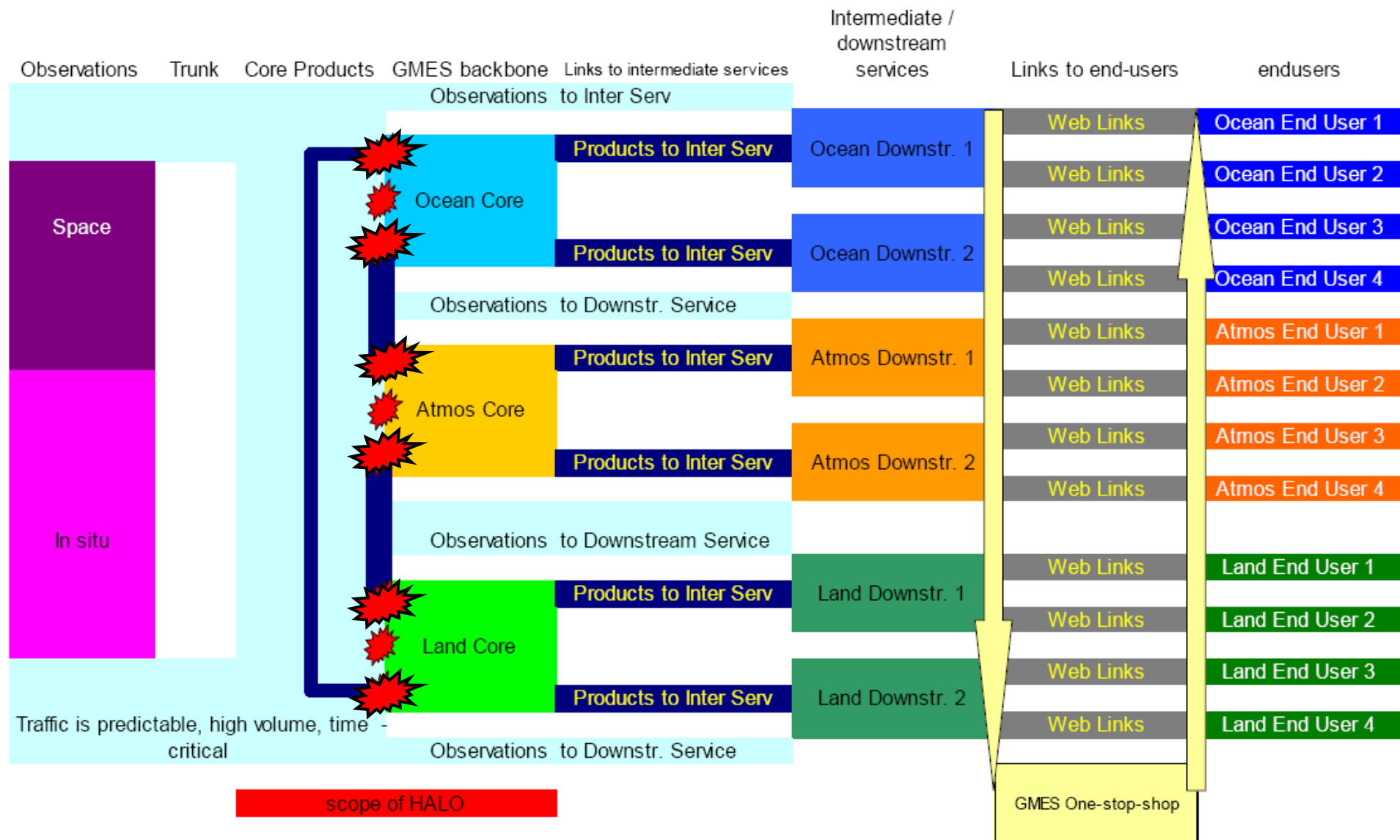
Data Flow Characterisation

Data Categories used in the HALO Reports

- **categories of exchange**
    - **internal:** within one IP
    - **interacting:** between two IPs
    - **external:** between an IP and a third party

- **observation categories**
    - **in-situ**
    - **satellite-based**

- **delivery mode**
    - **real-time / near-real time**
    - **regular**
    - **on-demand / offline**

MERSEA data flow: Interacting, External, Internal

Data flow	Source	Destination	Delivery Mode	Theme/Product
Meteorological forcing fields	ECMWF	Ocean Model Centre	Regular distribution, real-time analysis and forecasts, Regional High resolution models	Meteorological forecast/NWP Bulletin
GEMS global aerosol products	ECMWF	Mersea retrieval centres	to be checked, initially research mode only	Atmospheric Aerosol data for atmospheric corrections in retrieval
Satellite data	ESA, EUMETSAT, NASA, NOAA	MERSEA Satellite TEP	Regular	Along track, validated
Satellite products	SAT -TEP, GHRSST, SSALTO, OSI/SAF	Ocean Model Centre	Regular	Merged, gridded, validated products
In-situ observations	GDAC, RDAC, ARGO, GTSPP, DBCP,	In-situ Data Centre	Regular + On-demand	High quality controlled, merged gridded products, climatology
In-situ observations in real time	ARGO	In Situ - TEP	Real Time flow	ARGO data in real -or near real - time, with QC flags
In-situ observations in real time	In Situ - TEP (from ARGO)	Ocean Model Centre	Real Time flow	ARGO data in real -or near real - time, with QC flags
In-situ observations in real time	In Situ - TEP	?	Real Time flow	GSUD / VOS, Ocen time series / BBCP

geoland Data Flow: Interacting, Internal

Data flow	Source	Destination	Delivery Mode	Theme/Product
Meteorological forcing fields for land surface models	**ECMWF**	**Geoland-ONC**	**Regular**	**Air temperature/humidity, wind speed, precipitation, incoming radiation (short and longwave)**
Geoland Global products	**Geoland-CSP**	**GEMS**	**Regular + On-demand**	**Generic Land Cover (300 m – 1 km resolution**
Geoland CSP-OFM vegetation CO2	**GEOLAND-OFM**	**GEMS @ ECMWF**	**to be checked, initially research mode only**	**Land use change and forest fires**
geoland ONC vegetation CO2	**GEOLAND-ONC @ ECMWF**	**GEMS @ ECMWF**	**to be checked, initially research mode only**	**Vegetation data as input for emission models (biogenic and fires): CO2 fluxes, above-ground biomass, stomatal conductance**
GEMS global aerosol products	**ECMWF**	**geoland retrieval centres**	**to be checked, initially research mode only**	**Atmospheric Aerosol data for atmospheric corrections in retrieval**
Geoland Global Gobal products	**Geoland-ONC @ECMWF**	**GEMS @ ECMWF**	**Regular + On-demandTo be checked, initially research mode only (TBC)**	**Biogeophysical Parameters (Rainfall for water cycle, burned area, active fire and LAI for trace gas emission)Vegetation data as input for emission models (biogenic and fires) (TBC)**
Satellite forcing fields for land surface models	**Geoland-CSP**	**Geoland-ONC**	**Regular**	**Improved precipitation fields and incoming radiation (short and longwave)**

geoland Data Flow: External

Data flow	Source	Destination	Delivery Mode	Theme/Product
Satellite data	ESA EUMETSAT NOAA / NASA	Geoland-CSP	Regular + On-demand	Satellite observation to infer information about the land surface, in three areas : vegetation, radiation, water
in-situ data	Meteo	Geoland-CSP	Regular + On demand	Rainfall
In-situ data	Research labs	Geoland-CSP	On demand	Validation data for Vegetation, radiation, soil moisture products
Satellite data	SPOT Image, NASA	Geoland-CSP	On demand	Validation data for Vegetation & Land cover products
Satellite data to be assimilated	ESA EUMETSAT NOAA/NASA	Geoland-ONC	Regular + On-demand	Satellite observation to infer information about the land surface and the vegetation status.
In-situ data for validation	Fluxnet	Geoland-ONC	On-demand	CO2 and water fluxes
In-situ data for validation	GAW	Geoland	On-demand	radiative surface fluxes

GEMS Data Flow: Interacting

Data flow	Source	Destination	Delivery Mode	Theme/Product
Geoland CSP-OFM vegetation CO2	**GEOLAND-OFM**	**GEMS @ ECMWF**	**to be checked, initially research mode only**	**Land use change and forest fires**
geoland ONC vegetation CO2	**GEOLAND-ONC @ ECMWF**	**GEMS @ ECMWF**	**to be checked, initially research mode only**	**Vegetation data as input for emission models (biogenic and fires): CO2 fluxes, above-ground biomass, stomatal conductance**
GEMS global aerosol products	**ECMWF**	**Mersea retrieval centres**	**to be checked, initially research mode only**	**Atmospheric Aerosol data for atmospheric corrections in retrieval**
GEMS global aerosol products	**ECMWF**	**geoland retrieval centres**	**to be checked, initially research mode only**	**Atmospheric Aerosol data for atmospheric corrections in retrieval**
Meteorological forcing fields	**ECMWF**	**Ocean Model Centre**	**Regular distribution, real-time analysis and forecasts, Regional High resolution models**	**Meteorological forecast/NWP Bulletin**
Meteorological forcing fields for land surface models	**ECMWF**	**Geoland/ONC**	**Regular**	**Air temperature/humidity, wind speed, precipitation, incoming radiation (short and longwave)**
Geoland Global products	**Geoland-CSP**	**GEMS**	**Regular + On-demand**	**Generic Land Cover (300 m – 1 km resolution**

GEMS Data Flow: External, Internal

Data flow	Source	Destination	Delivery Mode	Theme/Product
Satellite data	**ESA, EUMETSAT, NOAA / NASA (UNI-BREMEN,**	**ECMWF**	**operational**	**Raw radiances and satellites products on atmospheric species concentration and fire count/ burnt area**
in-situ data	**Scattered provider (NILU, EEA, national and regional**	**ECMWF MPI KNMI RAQ Centres**	**regular**	**In situ observation for validation**
CO_2 concentration	**www.cmdl.noaa. gov, gaw.kishou.go.jp**	**GEMS @ ECMWF**	**on demand**	**validation data for CO_2 assimilation. open access on the internet.**
GEMS global products	**ECMWF**	**GEMS RAQ Centres (6)**	**operational**	**Boundary conditions for reginal air pollution models**

Issues at End of 2005

- **large data volumes. The largest are:**

Recipient	Origin	Data Rate [GB/day]
GEOLAND-CSP	various satellite agencies	16
MERSEA	various satellite agencies	11
GEMS	various satellite agencies	7
GEMS Regional Modelling Centres	GEMS-global @ ECMWF	7

- **diverse in-situ data providers**
  - **e.g. for GEMS:** CarboEurope, NOAA-CMDL, FLUXNET, ALE-GAGE-AGAGE, WDCGG data centre, WMO/GAW, WOUDC, DWD, SHADOZ, MOZAIC, DLR, IPSL, NILU, NDSC, EMEP, NILU, IMPROVE, AERONET, PHOTONS, WDCA, Brewer network, NUIG, ARM, SIRTA, NJKDSC, BSRN, SURFRAD, NASA, HELCOM, OSPAR, CREATE, DAEDALUS, GMES-GATO, Met-Monieur, AIRBASE, …
  - **Is there a role for WIN and ORCHESTRA?**

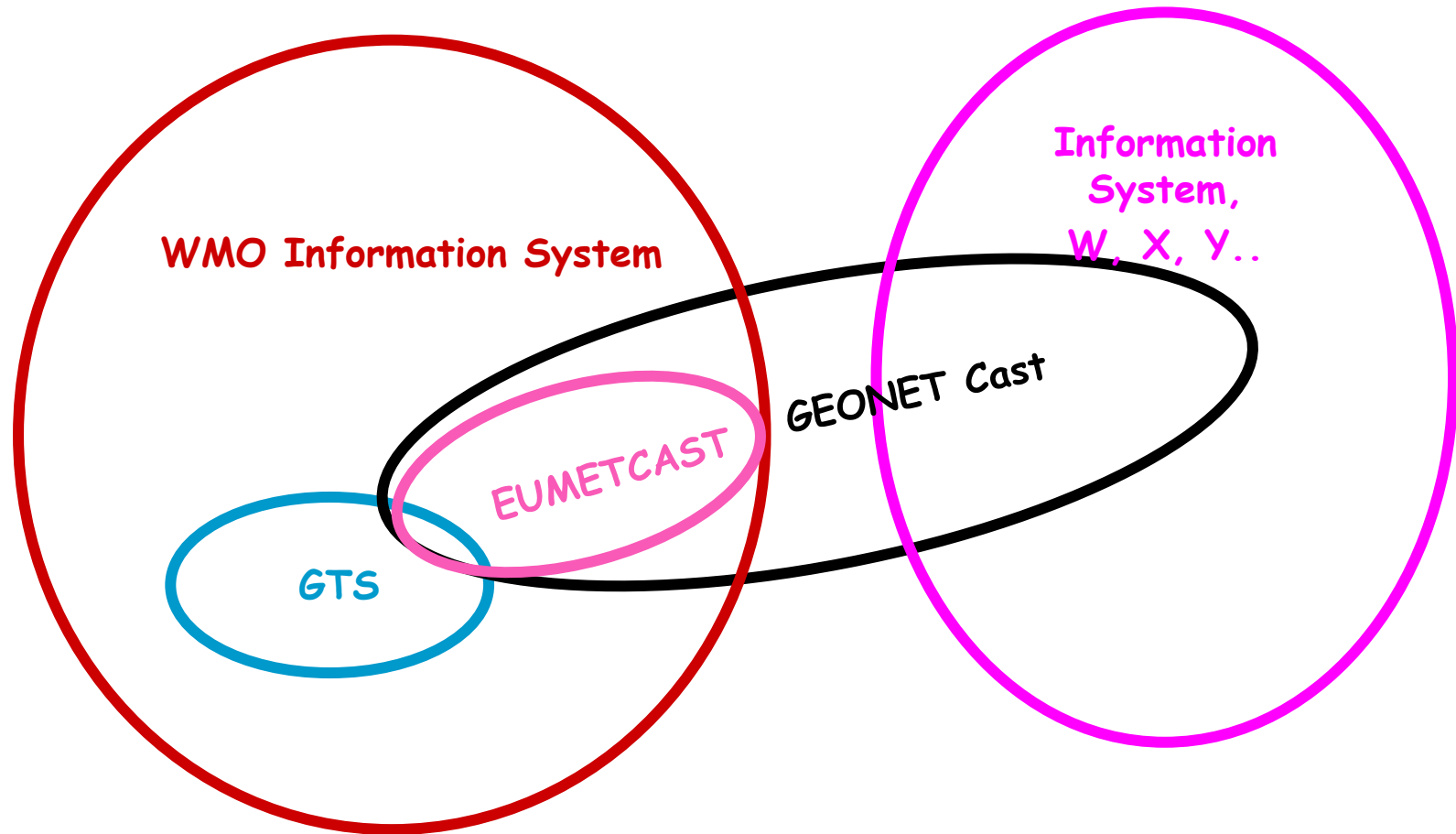- **common interface/portal for all products by core services?**

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2nd HALO Workshop Infrastructure Conclusions
(December 2005)

Selected Conclusions on Infrastructure Candidate Solutions

1. need description of two alternative technical solution candidates
   - one using the existing meteorological network, ie GTS
   - another EUMETCast
   - Does WIS encompass both GTS and EUMETCast?
2. compare the two solutions:
   - commonalities and differences
   - advantages and limitations
3. Data policy implications of the two solution candidates shall be pointed out.
4. an additional HALO meeting to decide on a solution recommendation
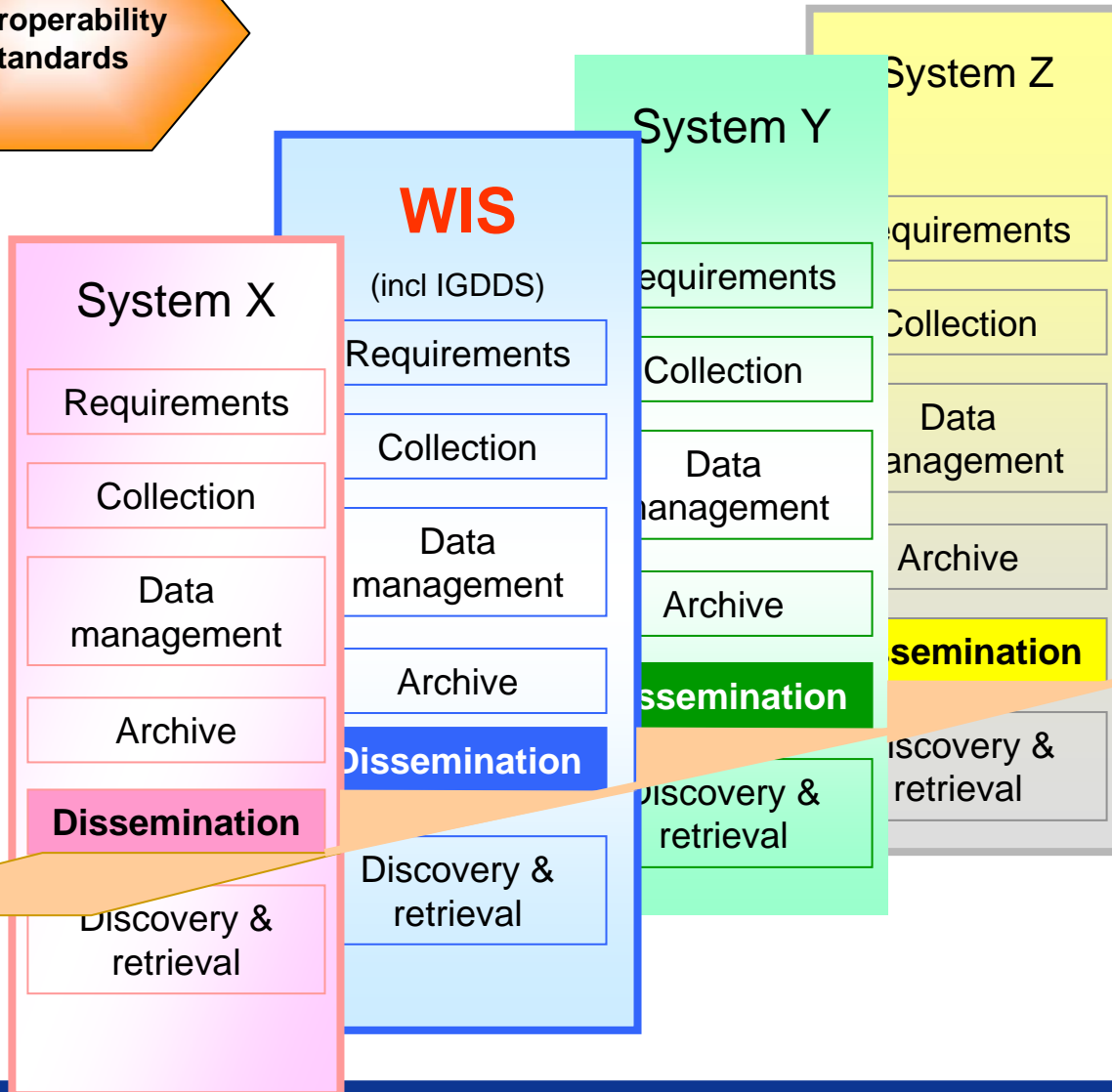5. focus the discussions on solutions for the operational real-time data flow

Developments in 2006

Interoperability of WIS with other Systems

GEO-Information Systems within GEOSS

Common set of interoperability standards

WIS
(incl IGDDS)

System X

Requirements
Collection
Data management
Archive
Dissemination
Discovery & retrieval

Requirements
Collection
Data management
Archive
Dissemination
Discovery & retrieval

System Y

Requirements
Collection
Data management
Archive
Dissemination
Discovery & retrieval

System Z

Requirements
Collection
Data management
Archive
Dissemination
Discovery & retrieval

Geo-Netcast

July 2006 Views on the Potential for Future Developments for GMES and WMO Information System (i)

- **The EU-funded SIMDAT/MET software will be used by WMO partners to implement Europe-wide WIS capabilities.**

- **The EU-funded SIMDAT/MET software can also be used by GMES partners to implement WIS-like capabilities for GMES.**

- **Substantial benefits for all users could be achieved through direct collaboration between GMES & WMO on a shared system.**

- **WMO welcomes collaborations with communities such as GMES to share / develop WIS capabilities.**

- **A joint effort by GMES partners and European WIS partners would accelerate the implementation of a joint Europe-wide GMES/WIS information system.**

July 2006 Views on the Potential for Future Developments for GMES and WMO Information System (ii)

- **A joint Europe-wide GMES/WIS information system will require**

  - **Negotiation of certification with WMO system**

  - **New software (adapters) to provide access to own data repositories**

  - **Implementation of metadata standards to describe data and data policy**

  - **Implementation of virtual organisation to address security issues – authentication, authorisation, data policy…**

  - **Implementation of physical infrastructure to connect to GISC**

  - **Et cetera…..**

NOW

Which infrastructure candidate solution(s) do our partners from Astrium and Alcaltel suggest?