



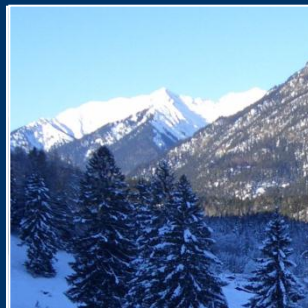
SNOW SERVICES FROM GSE POLAR VIEW



Status and Perspectives
of the snow services

Workshop on
European Satellite Snow Monitoring Perspectives

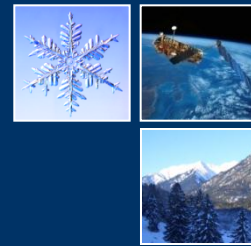
4. December 2012
Darmstadt



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Vista Remote Sensing in Geosciences GmbH,
GERMANY





Polar View Overview

- PV offers integrated **monitoring and forecasting services** in the Polar Regions and parts of the mid-latitudes with **significant snow and ice cover** using satellite Earth observation data
- Services address **operational users** and science needs
 - Improved information for decision making and planning
 - Provide accurate, real-time information
 - Can be customized to meet users' needs
- The PV team includes government agencies, research institutes, system developers, service providers and end users, ranging from government departments, scientific institutions, northern residents, and private sector clients from 12 countries
- Polar View is a **GMES Service Element (GSE)** with ESA funding for 2005 to 2013



Services of Polar View

Sea Ice Monitoring
Iceberg Monitoring
Ice Edge Monitoring



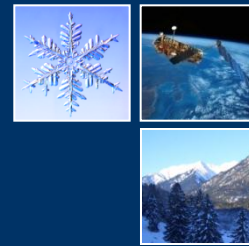
Glacier Monitoring
River Ice Monitoring
Lake Ice Monitoring

**A unique view of
the environment,
the economy,
and safety**

Snow Cover Monitoring

- Polar View's snow services provide the latest information on snow cover and the amount of water stored as snow.
- Service providers supply daily information to involved users working in the fields of early warning detection, climate change analysis, consulting and renewable resources.

Polar View Snow Services Overview



➤ Regional Snow Products

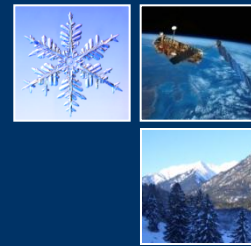
Scandinavian Snow Cover Area Service	Snow Monitoring Baltic Region	Snow Service Central Europe
Daily NRT snow cover area mapping (fraction of snow-covered area during melting period) FSC	Daily NRT snow coverage service (fraction of snow-covered area during melting period) FSC	Snow Cover Mapping Central Europe and Alps & provision of Snow Water Equivalent SCA & SWE
KSAT, Norway	SYKE, Finland	VISTA, Germany

Since 2010:

- **Combined Product:** Pan-European snow map
- **Online Portal:** Access to multiday products of the regions and the entire area
www.snowsense.de



Consolidated Polar View Pan-European Snow map

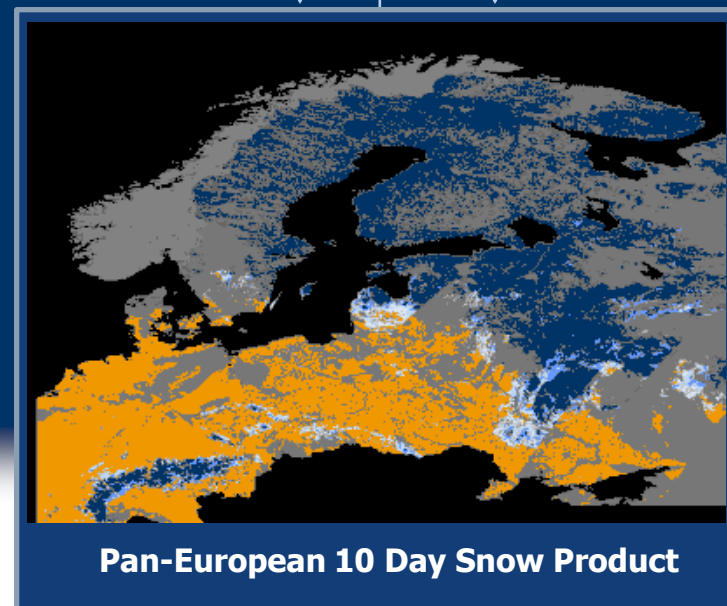
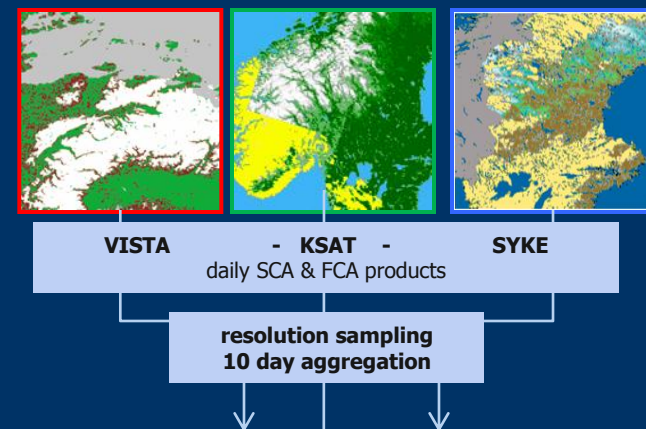


Features of the combined product

- Multiday products of the snow cover from daily & higher resolution results of the service providers
- Minimum cloud cover achieved applying a 10 day composite (= mean value)
- Common spatial resolution ($0.05^\circ \sim 5 \text{ km}$)
- Snow cover fraction represented in 5 classes
 - + snow free + no data / clouds
- Common Lat / Lon projection
 - Applicable for Google Earth / Maps

Free access via **Polar View Snow Service Portal**

- Data from Winter 2009/10 onwards available
- Pan-European and regional products





Polar View

Snow Service Portal

Snow Covered Area

Choose Area / Service



☒ Combined Map

☐ Central Europe

☐ Baltic Region

☐ Scandinavia

Choose Period

21 May 10 - 31 May 10

Legend

Fractional Snow Cover 10

- snow free
- slightly snow covered
- partly snow covered
- mainly snow covered
- fully snow covered
- clouds or no data

☐ Baltic Region

☐ Central Europe

☒ all

Contact

Choose Period

28 Feb 10 - 10 Mar 10

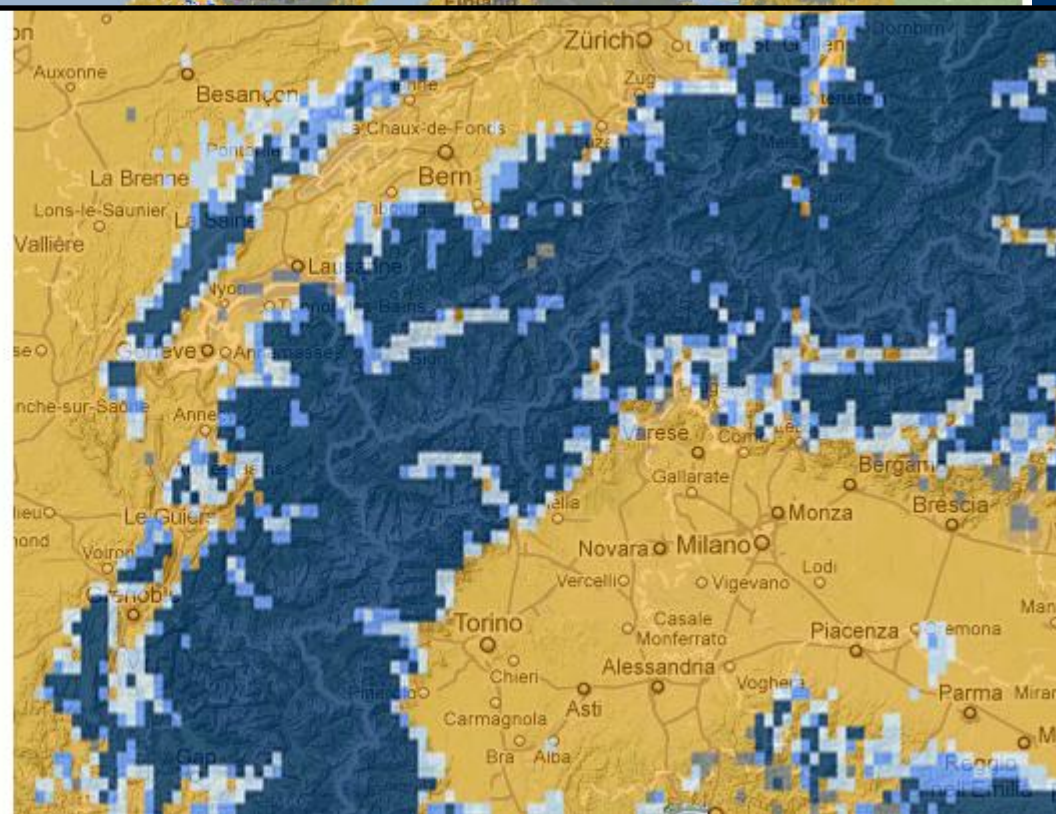
Legend

Snow Cover Multiday Composite

- | | |
|-----------------------|------------|
| snow free | 0% |
| slightly snow covered | 1% - 25% |
| partly snow covered | 26 - 50% |
| mainly snow covered | 51% - 75% |
| fully snow covered | 76% - 100% |
| clouds or no data | |

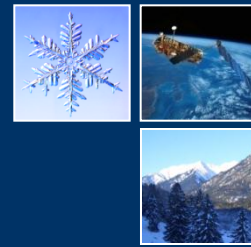
Info

Home



Snow Cover Mapping and Snow Line Information

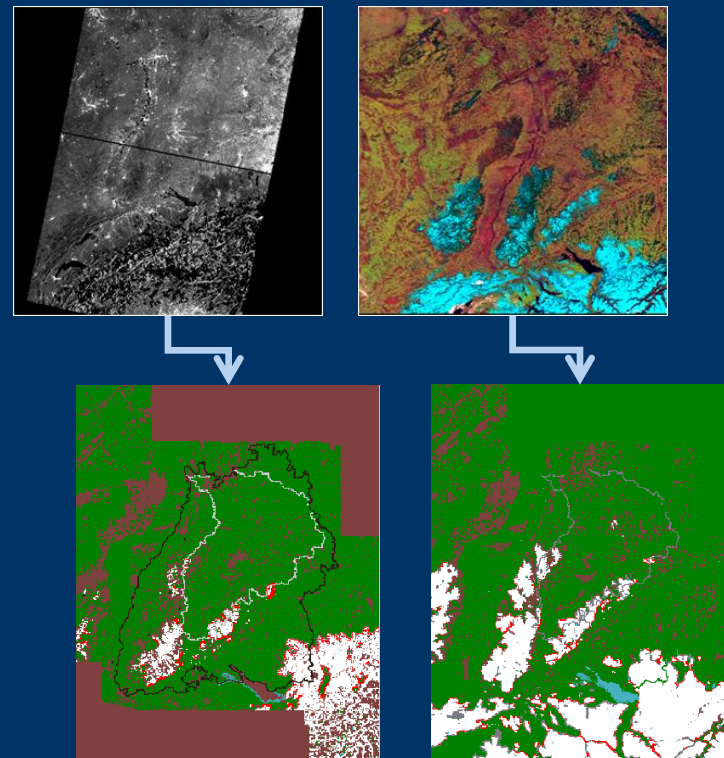
Snow Service Central Europe



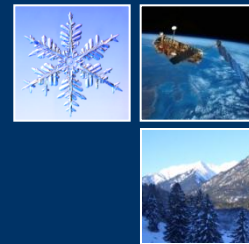
❖ Snow Covered Area

- Using operational NRT optical and SAR satellite data
- Detection of snow cover, snow line, snow free areas
- Catchments in Central Europe and the Alps
- User defined product formats to achieve best possible integration in users operations
- Service developed with flood forecast centers
- Daily information update
- Basic product resolution 1km
- Products delivery via password protected FTP service

ENVISAT ASAR - METOP-A AVHRR



- Various export products

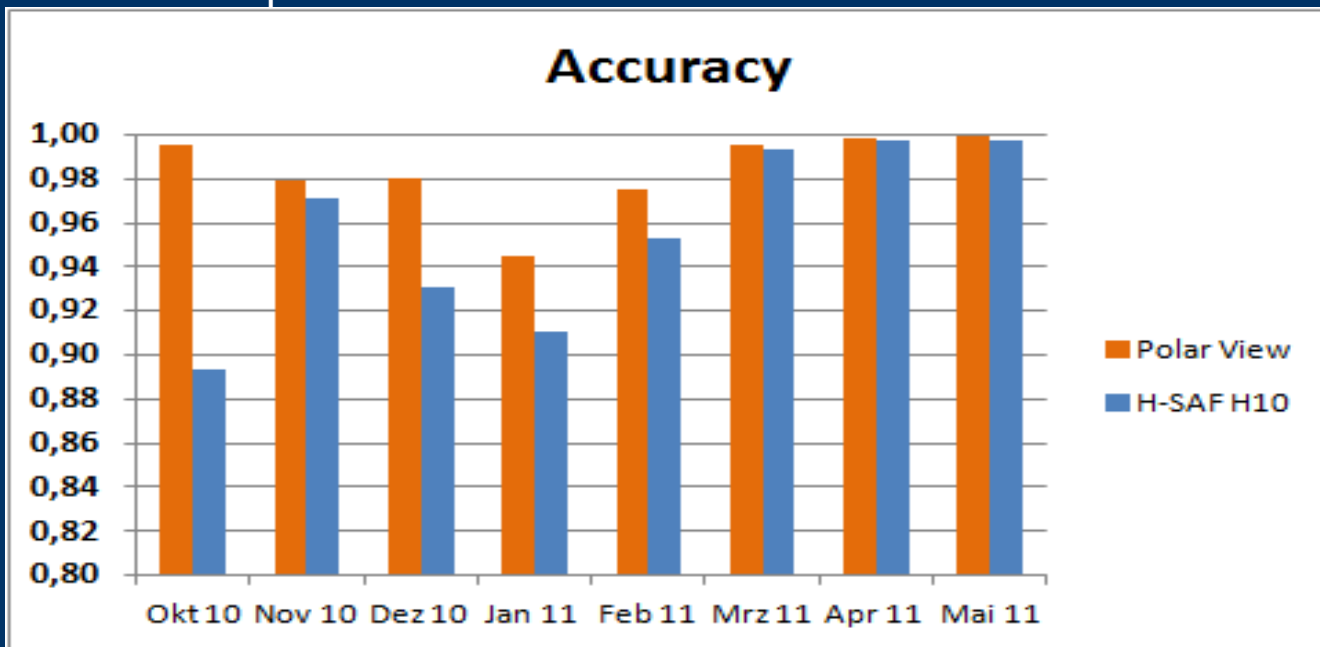


Validation Example

Snow Service Central Europe and H-SAF H10

❖ Validation Germany / Rhine Area

- SCA products 2010 / 2011 vs. station measurements (DWD)
- + in comparison to EUMETSAT H-SAF H10

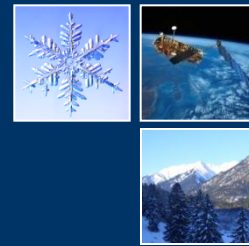


Polar View Snow Product

<i>POD</i>	0.971
<i>FAR</i>	0.100
<i>POFD</i>	0.008
<i>ACC</i>	0.991
<i>CSI</i>	0.876
<i>HSS</i>	0.929

Data basis: Rhein catchment Subset 1.Oct. 2010 – 31 May 2011; 55.000 / 115.000 data pairs

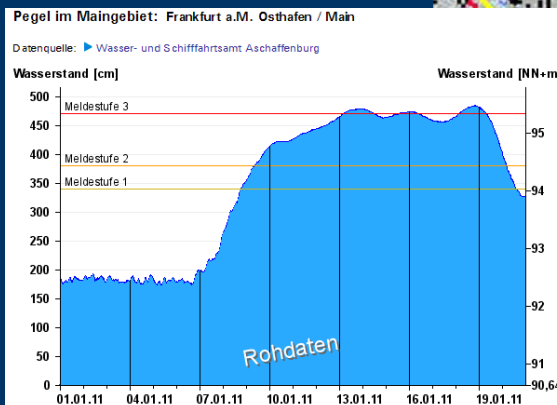
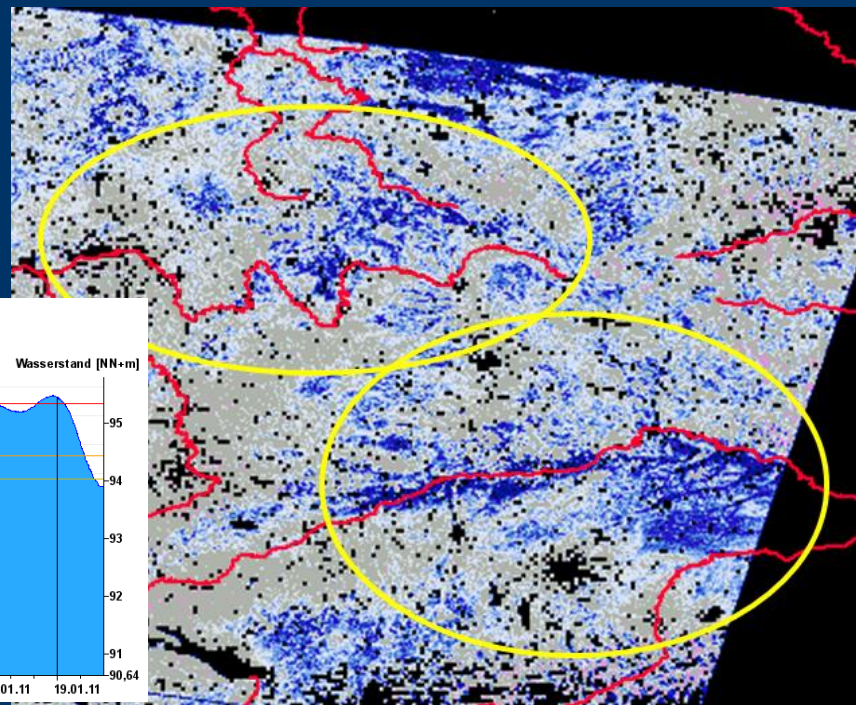
Wet Snow Mapping Snow Service Central Europe



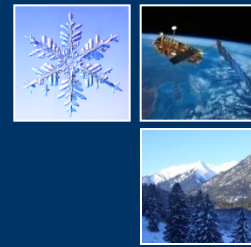
❖ Wet snow mapping

- Detection of areas with melting snow
- NRT ENVISAT ASAR monitoring indicates starting snow melt and flood risk
- Preparation for Sentinel-1 and TerraSAR ongoing (national project)

Flood event of river Main
at Frankfurt / Germany
January 2011



Snow Water Equivalent Snow Service Central Europe

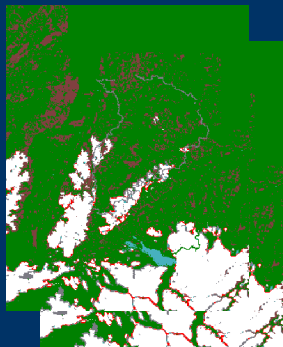


❖ Snow Water Equivalent

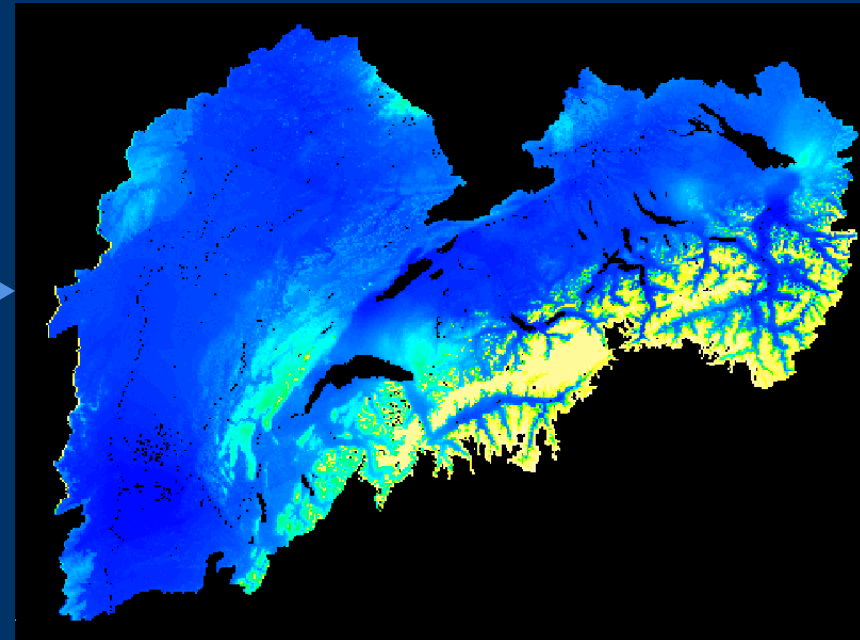
- Derived using joined EO observation and physically modeling
- 1 km resolution

SCA Information

Meteo-Data



Snow & Hydro Model (PROMET)
spatial distributed, raster based, hourly calculations



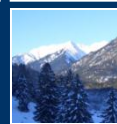
Downstream Services

Snow Storage, Runoff, Hydropower

HYDRO SENSE

Spatial evolution of the service area

Snow Service Central Europe



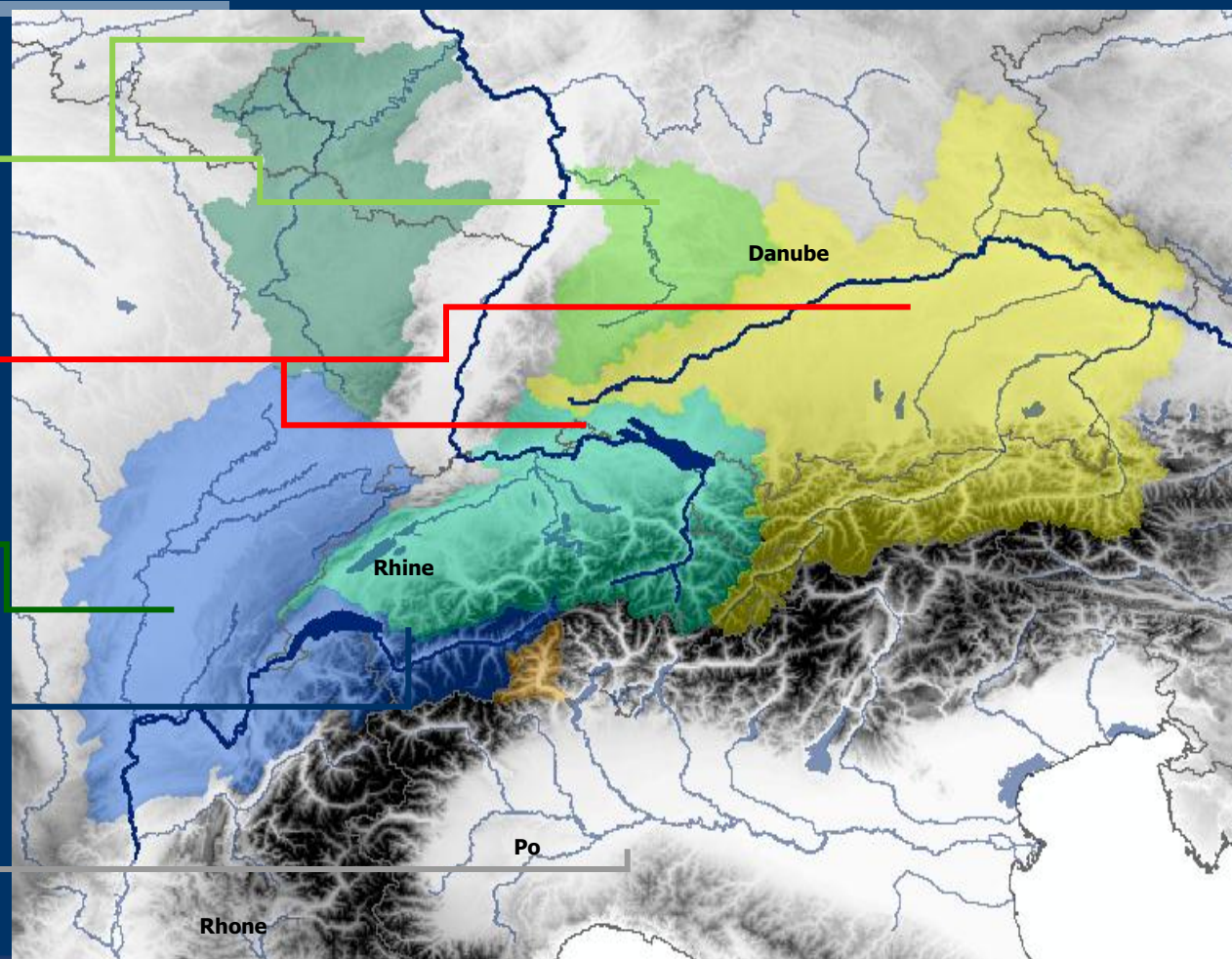
Since 2000
+ Neckar
+ Mosel

Since 2006 / 2007
+ Upper Rhine
+ Upper Danube

Since 2008
+ Rhone

Since 2009
+ Rhine

Since 2010
+ Central Europe



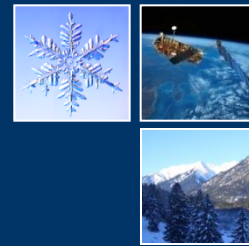
Products are provided catchment-wise (SCA & SWE)

Involved Users in Snow Service Central Europe

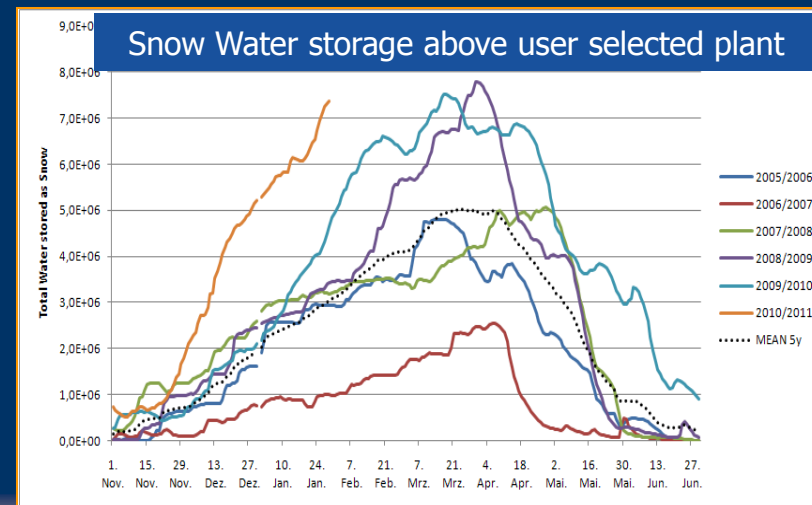
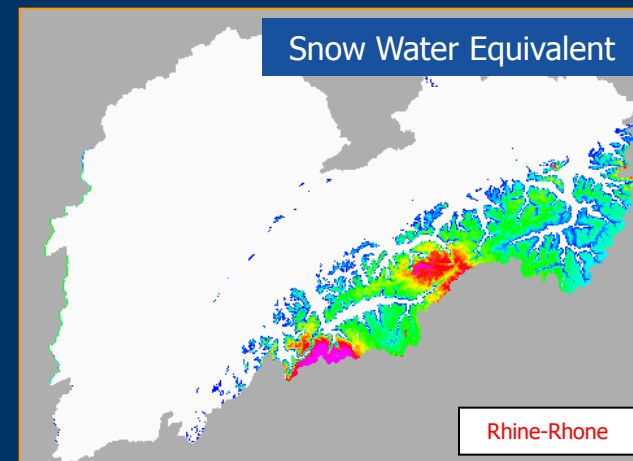


- ❖ Users of the Service - based on Service Level Agreements
 - Flood Forecast Center HVZ Baden-Württemberg, Karlsruhe (D)
 - Flood Forecast Center LUWG Rheinland-Pfalz, Mainz (D)
 - Federal Institute of Hydrology BfG, Koblenz (D)
 - Amt der Vorarlberger Landesregierung, Bregenz (A)
 - Wasserwirtschaftsamt Weilheim, LfU Bayern (D)
 - WSL Institute for Snow and Avalanche Research SLF, Davos (CH)
 - LMU Munich (GLOWA / SMOS cal/val)
 - VISTA internal (HydroSense)
- Public use of data:
 - Polar View Snow Service Portal
- ❖ Commercial users of hydro power downstream service

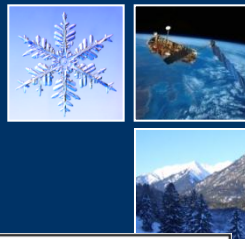
Downstream Products based on Snow Service Central Europe



- ❖ Hydrological information based on snow cover information from satellite product and model (PROMET) calculations
- Assessment of water balance components
- Snow Water Equivalent (spatial and temporal distribution)
- Water stored as snow in catchments or above hydropower plant



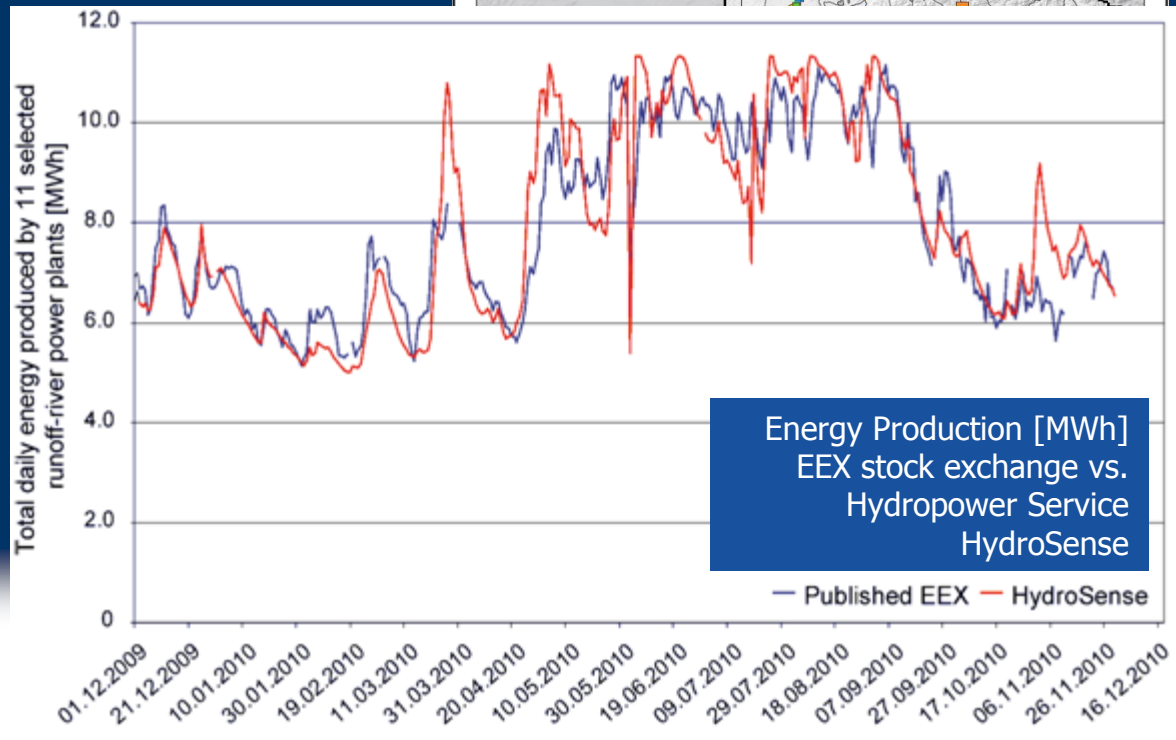
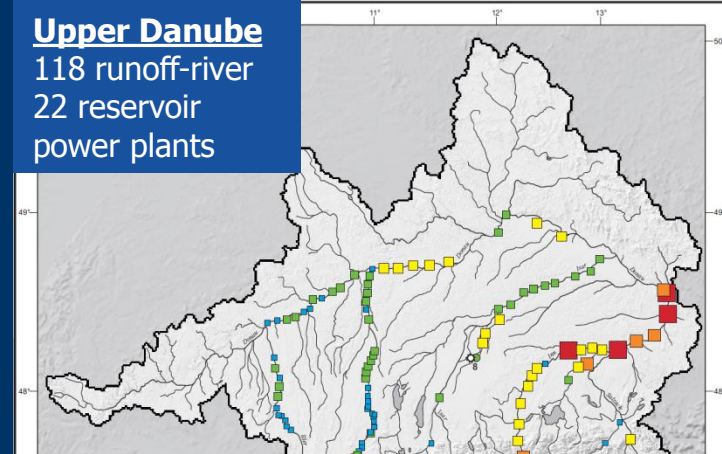
Downstream Products based on Snow Service Central Europe



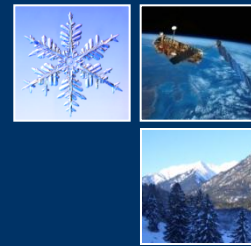
❖ Extension of service by runoff and hydropower module

- Simulation of runoff concentration
 - ground water flow & water transfers
 - lake retention & reservoir management
- Hydropower module
 - e.g. Upper Danube
- Forecast module
- Potential of the renewable energy as daily information
- Day ahead run-of-the-river power forecast

Upper Danube
118 runoff-river
22 reservoir
power plants



Specific characteristics of Polar View Snow Services



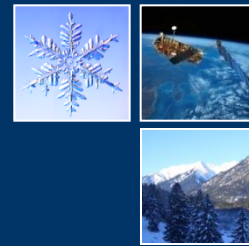
❖ Service Experience

- During the last 7 years of service an **annual number of about 1200 snow maps** for the different areas and users could be achieved
- The **Polar View Snow Service Portal** provides easy access to the public on services and achievements of the GMES initiative Polar View
- Successful enhancement to **Snow Water Equivalent (1km) for Central Europe**

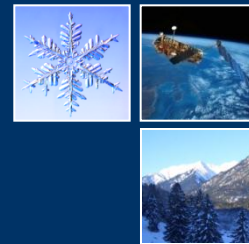
❖ User Integration

- Polar View snow services serve a important **source for the decisions** of large group of users (flood forecast, hydrology, hydropower, Northern residents..)
- Snow products had been developed in close cooperation with the individual users to meet their **requirements and operational needs** and **built up confidence during service operation**

Perspective GSE Polar View



- ESA funding for Polar View will end in 2013
- Sustainability by transition to GMES services (e.g. GMES Marine Service MyOcean) of single services partly achieved
- Polar View was formally incorporated under the name **Polar View Earth Observation Ltd.** in the UK in 2011, to carry on coordination, communication and promotion in the domain of polar research and service provision
- The regional services for Scandinavia and the Baltic Region of the Polar View Snow Services successfully transited to the FP7 project CryoLand
- The continuation of the Snow Services Central Europe, for hydrology, including SWE and hydropower provision is pending



Thank you for your attention...

Polar View Snow Service Coordination

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www.snowsense.de

Presentation of the

- Snow Service Portal and
- the downstream services during the coffee break