A Near Real Time Monitoring System with CSPP for Mountain Regions

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CSPP/IMAPP Users’ Group Meeting 2015, April 14-16, Darmstadt
Overview

- The EURAC Institute for Applied Remote Sensing
- Receiving Antenna & Ground Segment
- Workflow and Near Real Time performance
- Examples and results
- Outlook - To Do
EURAC Institute for Applied Remote Sensing Technologies for Environmental Monitoring
Institute - Team

CSPP/IMAPP Users' Group Meeting 2015, April 14-16, Darmstadt
• integrated environmental monitoring and assessment

• of mountain regions

• fusing remote sensing techniques with interdisciplinary approaches
Key Environmental Parameter and processes

- Solar Radiation
- Snow Cover
- Evapotranspiration
- Run-off
- Soil Moisture
- Land Cover
- Vegetation Parameters - LAI
- Terrain Movement

- Water Availability
- Protection of Biodiversity
- Sustainable Agriculture + Forestry
- Energy production
- Reduction of Risk + Vulnerability (Natural Hazards, Climate)

Integrated Environmental Monitoring

CSPP/IMAPP Users‘ Group Meeting 2015, April 14-16, Darmstadt
## Essential Climate Variables (ECV)

<table>
<thead>
<tr>
<th>Terrestrial ECV</th>
<th>Observing System (i.e. ESA, others)</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Discharge</td>
<td>In situ networks,</td>
</tr>
<tr>
<td>Water Use</td>
<td>In situ networks, regional remote sensing activities</td>
</tr>
<tr>
<td>Groundwater</td>
<td>In situ networks,</td>
</tr>
<tr>
<td>Lake and Reservoir Levels &amp; Volumes</td>
<td>In situ networks, regional remote sensing activities</td>
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<tr>
<td><strong>Snow Cover</strong></td>
<td>GLOBSNOW</td>
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<tr>
<td><strong>Glaciers and Ice Caps</strong></td>
<td>GLOBGLACIER</td>
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<tr>
<td>Permafrost</td>
<td>Regional activities (i.e. circum-arctic)</td>
</tr>
<tr>
<td>Albedo and Reflectance Anisotropy</td>
<td>GLOBALBEDO</td>
</tr>
<tr>
<td><strong>Land Cover</strong></td>
<td>GLOBCOVER, MODIS land cover</td>
</tr>
<tr>
<td>Fraction of Absorbed Photosynthetically Active Radiation (FAPAR)</td>
<td>GLOBCARBON, MODIS and Seawifs products</td>
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<tr>
<td><strong>Leaf Area Index</strong></td>
<td>GLOBCARBON, MODIS products</td>
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<tr>
<td>Biomass</td>
<td>Regional activities, e.g. Siberia</td>
</tr>
<tr>
<td>Fire Disturbance</td>
<td>Several global products from AATSR or MODIS</td>
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<tr>
<td>Soil moisture</td>
<td>SMOS satellite mission</td>
</tr>
</tbody>
</table>

(Herold&Wulder, GOFC-GOLD)
Integrating approaches

- TecEnv
- Remote Sensing
- Optical
- RADAR
- Proximal Sensing
- MR
- HR
- VHR
- Ground Measurements
- Model application
- Data Processing + Management
- Data presentation
- SDI + WebGIS
- Direct Receiving
- Interdisciplinary Assessment

regional adapted, user oriented research, products and services
Overview

- The EURAC Institute for Applied Remote Sensing
- **Receiving Antenna & Ground Segment**
- Workflow and Near Real Time performance
- Examples and results
- Outlook - To Do
Mountain extreme environment
• Operative since 2009.
• Receiving Station located in South Tyrol in a free obstacle site at 2260 m a.s.l. (Peak of Renon)
• EURAC Ground Segment (GS) in Bolzano manages, processes and archives broadcasted data.
• Visibility mask: all Europe and North Africa
• Ingestion system Thales Alenia and ACS systems

Technical specifications:
• 5.2 m Seaspace antenna dish
• X Band, primary focus configuration
• G/T 28.37 dB/K at 5 degrees elev.
• Satellites and Sensors
  - Terra: MODIS
  - Aqua: MODIS, AMSR-E, AMSU-A, HSB, AIRS
  - S-NPP: VIIRS, ATMS, CrIS, CERES, OMPS
AQUA   TERRA
MODIS
S-NPP
VIIRS

Mission Scheduler + Local Archive

Receiving Antenna & Ground Segment

Core DB and Job Scheduler

- MODIS processing chain (L1B, L2)
- NPP processing chain (RDR, SDR, EDR)
- EURAC products Based on MODIS and VIIRS

Tape Library

DES Data Exchange Server distributes products to the users

EURAC SDI OCG Services Metadata Catalog

DES Data Exchange Server distributes products to the users
NPP data production using CSPP SW

- Raw sensor data
- Multimission Scheduler
- RT-STPS Telemetry Processing System
- Shared Storage
- Visualization – Dissemination Eurac SDI
- CSPP-SDR CSPP-EDR DRL-SPA
VIIRS Snow Workflow

Combining CSPP with DRL SPAs

CSPP SDR
- GITCO
- GMTCO
- SVIxx
- SVMxx

CSPP EDR AOT
- IICMO
- IVAOT

DRL COP SPA
- IVCOP

DRL SnowCov SPA
- VSCDO
- VSCMO
EDR production with parallel CSPP

- RDR in 5 min (RT-STPS)
- CSPP-SDR using 6 cores:
  - 5 min with pre-downloaded ancillary
  - 10 min with ancillary download
- CSPP-EDR with 6 cores: 10 min + SPA Production (± 10 min)
- + EURAC EDR

NRT production of VIIRS EDR
Near Real Time EURAC products
Products and Services

snow cover
- SNOW_daily ALPS
- SNOW_daily EUROPE (in dev.)
- SNOW_cover duration_yearly ST
- SNOW_cover_8d Composite ALPS
- SNOW_cover_16d Composite ALPS

clouds
- Daytime image highlighting clouds and snow for ALPS Res. 500m
- Night-time image highlighting clouds for ALPS Res. 1 Km

air quality
- PM_composite ST
- PM_ground ST
- PM_assimil ST
- PM_composite ER

other
- RGB
- Fire
- VIIRS_NRT
The algorithm exploits only the 250 m resolution bands of MODIS in the red (B1) and infrared (B2) spectrum, as well as the Normalized Difference Vegetation Index (NDVI) for snow detection, while clouds are classified using also bands at 500 m and 1 km resolution.

Daily Snow Maps are published on EURAC WebGIS.
VIIRS EDRs: DNB product

Example of DNB product

DNB on South Tyrol

Normalized radiance
Example of VIIRS RGB
VIIRS EDRs: ETNA eruption (Cloud)

RGB false colour (bands I1, I2, I3) during Etna eruption 14th December 2013
Zoom on the Etna volcano area. Here on the Red band (center) a different color table has been applied to better put in evidence the column of smoke and hash hurled by Etna.
SDI (Spatial Data Infrastructure)

- Simplify data exchange and concurrent access
- Improve data availability
- Minimize data redundancy
- Organize spatial data
- Compliant to standards (OGC, INSPIRE, ISO)
- Consolidated data storage and sharing
- Catalog for efficiently searching data (metadata)
- GIS Desktop applications can use WMS and WFS services for data acquisition
Outlook - To do

- Outlook - To Do
  - ✓ Guarantee environmental monitoring continuity from MODIS
  - ✓ Adaptation to S-NPP data of EURAC products based on MODIS data
  - ✓ Operative NRT chain for NPP (already tested) using CSPP software
  - ✓ Consolidation eomount.eurac.edu dissemination portal (SDI and WebGIS FW)
Thank You

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