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Press Release

Newton's theory goes airborne – First Quicklooks of the Airborne Prism Experiment (APEX)

July 2, 2009; Zürich (CH), Mol (B) and Emmen (CH)

In a joint Swiss-Belgian effort, a combined scientific and industrial consortium is building a new class of an airborne imaging spectrometer for environmental monitoring: the Airborne Prism Experiment (APEX). Airborne imaging spectrometers measure and map the Earth surface in many, contiguous spectral bands, allowing to retrieve relevant spatial information on the state of the environment.

APEX is built as a pushbroom dispersive imaging spectrometer recording more than 330 spectral bands contiguously. The principle of APEX relies on the dispersion of light using prisms as described in Isaac Newton's Treatise of Light in 1704. Today's computing power, software and detector technology allow flying this theory in a spatial fashion on an aircraft, creating continuous images of the Earth's surface.

APEX will contribute to the systematic mapping and monitoring of environmental parameters and processes at unprecedented accuracy. These include – but are not limited to – mapping of soil mineral composition, total suspended matter in lakes, plant pigments and non pigments (Water, Protein, Chlorophyll, Lignin, Cellulose, Nitrogen, etc.), vegetation structure, hydrocarbon content, net and gross primary production, aerosol concentration, and atmospheric water vapour.

A typical APEX mission acquires 934 km² of the Earth's surface at 2x2 m spatial resolution. Multiple missions can be integrated in one flight. 1000 pixels are recorded across-track with a data rate of 0.42 GBytes/km flight path. Flexible spectral configurations (user defined binning patterns) allow a maximum of 534 spectral bands to be acquired simultaneously, while a typical setup contains 115 spectral bands ranging from 380-1000 nm, and 199 spectral bands ranging from 900-2500 nm. An advanced calibration procedure allows delivering spatially and radiometrically coherent measurements for each pixel.

APEX experimental flights have been carried out in the course of June 2009 in the framework of an ongoing acceptance procedure. APEX flight opportunities and data

will be available to the scientific community, research institutions, and commercial users as of 2010.

Under the scientific lead of the University of Zurich (Zurich, CH) and VITO (Mol, B), an industrial consortium was contracted through the European Space Agency's (ESA) PRODEX programme to implement APEX. The industrial consortium is headed by RUAG Aerospace (Emmen, CH) with subcontractors such as OIP Sensor Systems (Oudenaarde, B) and Netcetera AG (Zurich, CH). Special contracts were issued by ESA for the development of a shortwave-infrared detector (Sofradir, F), and a calibration facility at the German Aerospace Center (DLR, Oberpfaffenhofen, GER). The initial APEX operations were performed using a leased aircraft from the German Aerospace Center. A variety of European research aircraft will be used in the future to cover all APEX flight operations.

About

The University of Zurich (CH) is one of the leading research universities in Europe and offers the widest range of study courses in Switzerland. Its Remote Sensing Laboratories (RSL) are specialising in Earth System Science assessment using remote, state-of-the-art physical measurements, models and products. By taking into account the impact of the human dimension on the Earth System, RSL's approaches have become policy and stakeholder relevant.

VITO (B) is a leading independent European research and consulting centre for the development of sustainable technologies in the area of energy, environment, materials and remote sensing. VITO's strength has been its pursuit of applied and practical research and development, which is relevant for industry and public authorities.

RUAG (CH) is an international Aerospace & Technology and Defence & Security specialist with strong technological expertise. The Group's holding company is based in Berne (Switzerland). RUAG has production sites in Switzerland, Germany, Austria, Hungary and Sweden.

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Images

Full resolution images are located here: <ftp://ftp.geo.uzh.ch/pub/schaep/APEX/>

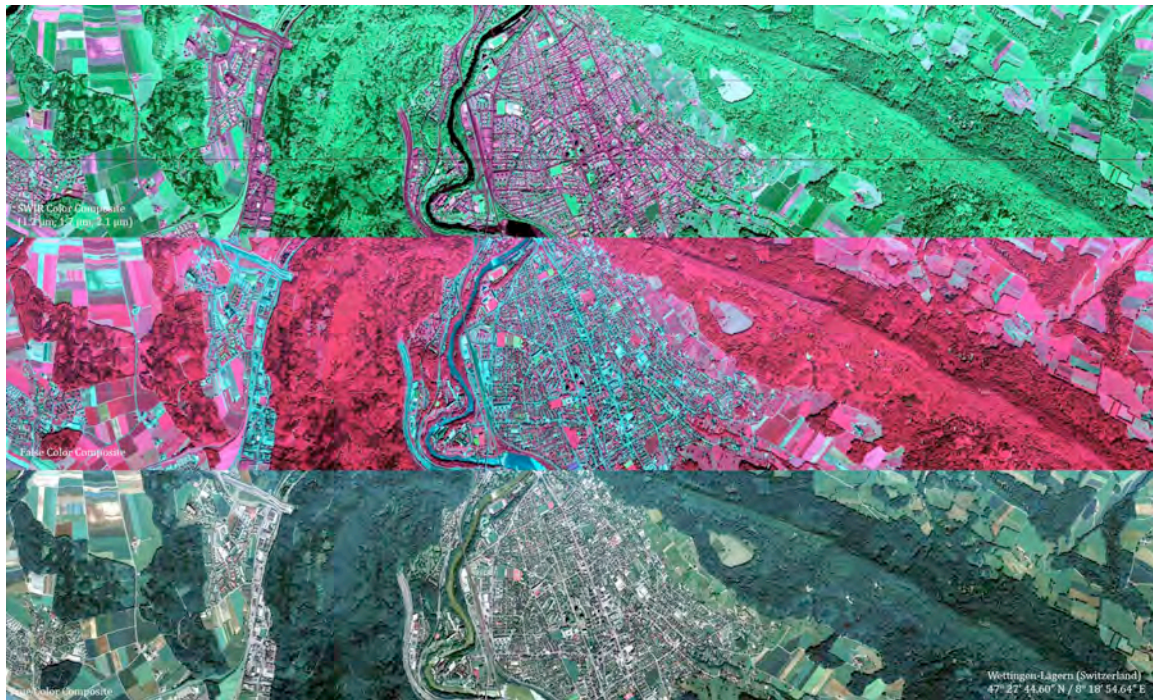
APEX Logo



Quicklook 1 - Switzerland

Wettingen-Lägern (47° 27' 44.60" N / 8° 18' 54.64" E / 408 m asl) is a Swiss city located in the Canton of Aargau with a population of 20'000. The APEX quicklooks show a transect from West (left) to East (right) comprising the Baregg highway tunnel (E60 / A1 Zurich-Berne), the city of Wettingen with the Limmat river and the Lägern mountain (859 m asl).

APEX images are 1000 pixels across track and 4964 pixels along track. One pixel represents 2.5x2.5 m spatial resolution in this image and is recorded in more than 300 spectral bands. The three images represent three different color combinations: bottom is a true color combination with the visual appeal of our eye. Middle is a false color combination, having one spectral band in the near infrared region of the electromagnetic spectrum. Top represents a shortwave infrared (SWIR) color combination, with spectral bands centred at absorption lines of vegetation structure (1.2 μm), hydrocarbons (1.7 μm), and cellulose (2.1 μm). The two black lines at one third of each image represent hair wires glued on the slit for calibration purposes. They will be removed prior to operational acquisitions. The images are stored in compressed JPEG format and do not represent physical measurements anymore.



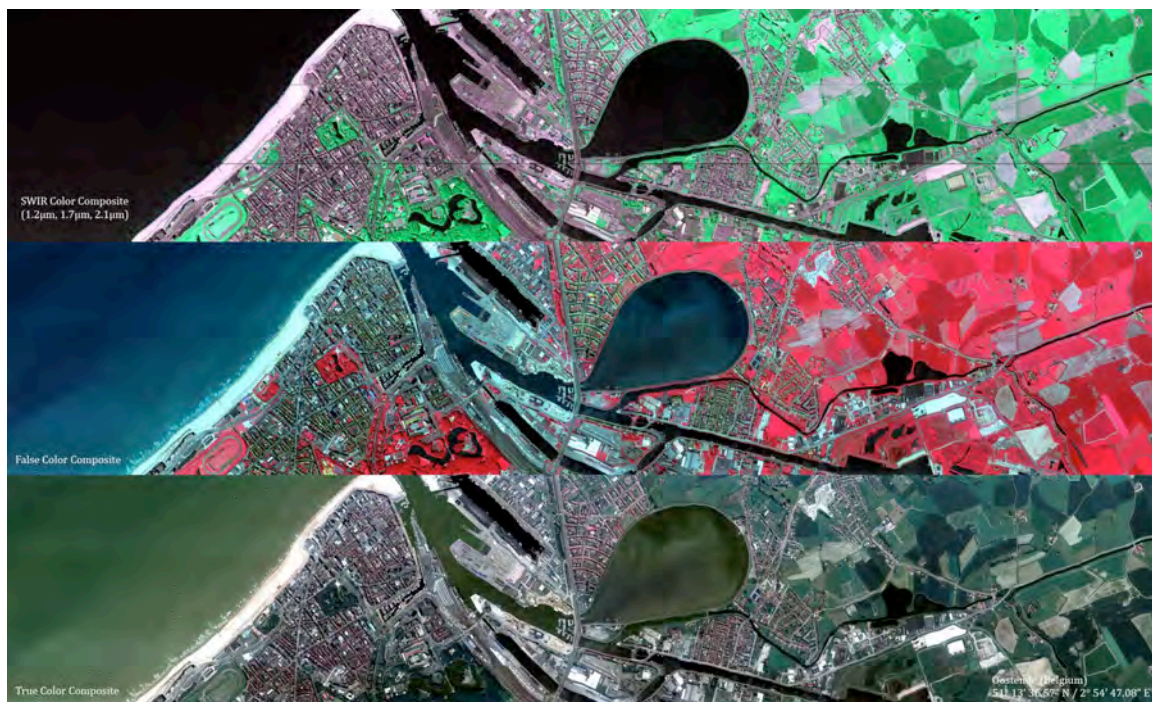
ftp://ftp.geo.uzh.ch/pub/schaep/APEX/Switzerland_APEX_QL.jpg

ftp://ftp.geo.uzh.ch/pub/schaep/APEX/Switzerland_APEX_TrueColor_OL.jpg

Quicklook 2 - Belgium

Oostende (Ostend, Ostende) ($51^{\circ} 13' 36.57''$ N / $2^{\circ} 54' 47.08''$ E) is a Belgian city located in the Flemish province of West Flanders with a population of 70'000. The APEX quicklook shows a transect from West (left) to East (right) comprising the North Sea, the city of Ostend south of the harbour, and the hinterland of Ostend. In the image center, a large recreational lake named 'Spuikom' can be seen.

APEX images are 1000 pixels across track and 4964 pixels along track. One pixel represents 2x2 m spatial resolution in this image and is recorded in more than 300 spectral bands. The three images represent three different color combinations: bottom is a true color combination with the visual appeal of our eye. Middle is a false color combination, having one spectral band in the near infrared region of the electromagnetic spectrum. Top represents a shortwave infrared (SWIR) color combination, with spectral bands centred at absorption lines of vegetation structure ($1.2\mu\text{m}$), hydrocarbons ($1.7\mu\text{m}$), and cellulose ($2.1\mu\text{m}$). The two black lines at one third of each image represent hair wires glued on the slit for calibration purposes. They will be removed prior to operational acquisitions. The images are stored in compressed JPEG format and do not represent physical measurements anymore.



ftp://ftp.geo.uzh.ch/pub/schaep/APEX/Belgium_APEX_QL.jpg

ftp://ftp.geo.uzh.ch/pub/schaep/APEX/Belgium_APEX_TrueColor_QL.jpg

Image 1 – German Aerospace Center (DLR) Research Aircraft Dornier DO-228 used for the airborne data acquisition (Photo: APEX Team).



Image 2 – APEX (Airborne Prism Experiment) installed in DLR's Dornier DO-228 research aircraft. The black cover comprises the spectrometer part of APEX, and the gray box to the right holds the climate control unit of APEX (Photo: APEX Team).



Image 3 - APEX (Airborne Prism Experiment) installed in DLR's Dornier DO-228 research aircraft pictured just before a data take (Photo: APEX Team).



Image 4 – Field calibration measurements performed during an APEX overflight on June 17, 2009 in Oensingen (CH) (Photo: APEX Team).



Image 5 – Water quality measurements performed for an APEX overflight on Lake Constance (Photo: APEX Team).

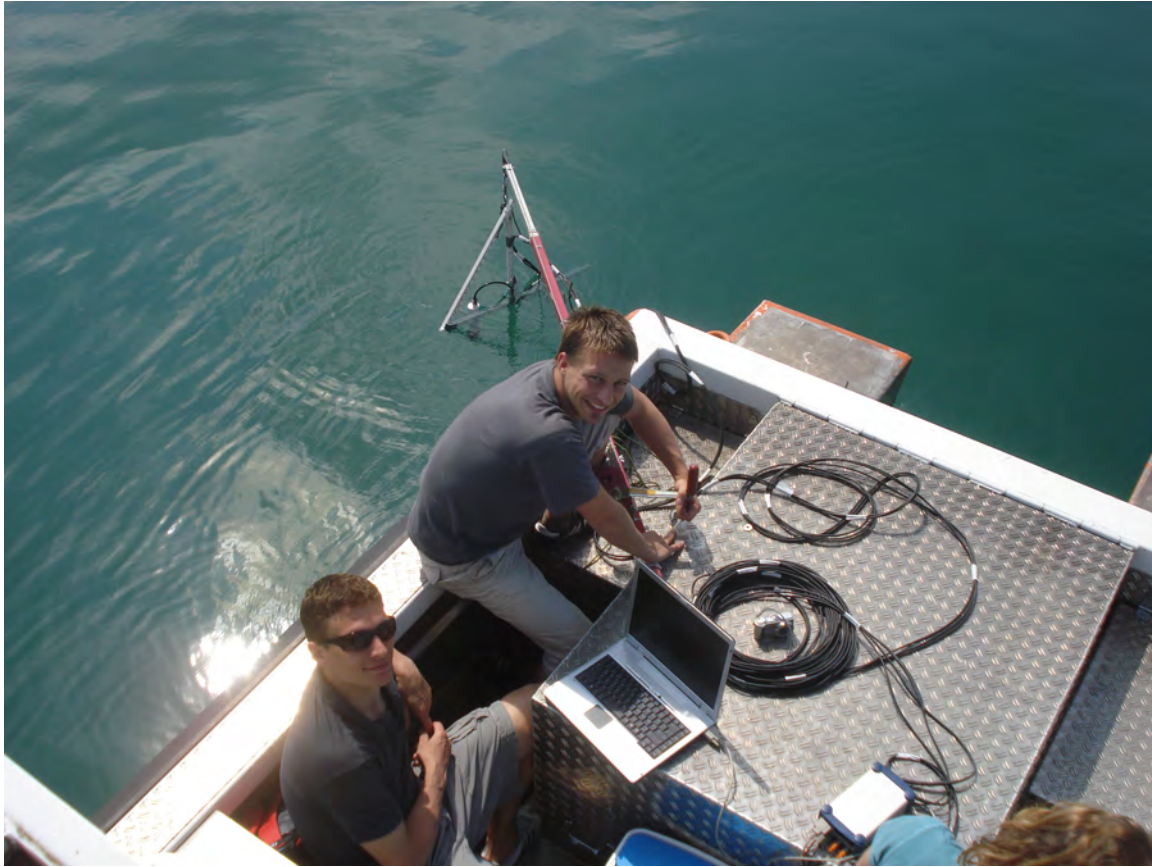


Image 6 – APEX operation during data acquisition. The operator (right) is equipped with an oxygen mask for high altitude flights. The rack in front of the operator is used to steer data acquisition (Photo: APEX Team).

