TRack Your ATmosphere: Open Learning Materials for Vocational Education and Training

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Photography encouraged

Introduction

Within the framework of the ERASMUS+ program Key Action "Cooperation for innovation and the exchange of good practices" with an Action Type "Strategic Partnerships for vocational education and training", our project TRack Your ATmosphere (TRYAT) was approved in august 2017 and is co-funded by the European Union. The projects total duration is 35 months and the participants are teachers, researchers and students from three vocational schools and Research/University Institutes in France, Germany and Italy.
The research objective of TRYAT is a combination of the processing and analysis of Global Navigation Satellite Systems (GNSS) data and monitoring of environmental parameters for Vocational Education and Training (VET).
Permanent high-precision GNSS stations currently operate for geodetic purposes, e.g. earthquake and volcano monitoring. We want to capitalize and highly disseminate the fact that they also offer a reliable tool for remote sensing of atmospheric water vapour.
Our project includes the acquisition of both meteorological and GNSS data so that students can participate in the scientific high precision measurement campaign. In parallel, they also build their own low cost GNSS receivers and evaluate and interpret the collected data. The project aims thus at building bridges from forefront research to practice-oriented learning and from scientific measurement and analysis to open knowledge citizen science. This may include developing research questions, designing methods, gathering and analysing data, and communicating results.
In this work, we will present the actual state of the project and the achievements in the previous year. We will show what has been done for each Intellectual Output (**O**) proposed within TRYAT project. In particular, we describe the installation and the preliminary data from the three GNSS stations on the roof of the Lycée Saint Cricq (Pau, France), Lise-Meitner-Schule (Berlin, Germany) and Istituto Leonardo da Vinci (Naples, Italy) buildings respectively. Moreover, we present the web-based Learning Platform (**O1**), Starter Kit (**O2**), Learning Material (**O3** and **O4**) and Educational Videos (**O5**).

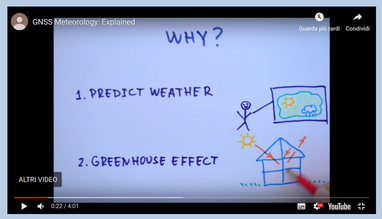
O1 - Learning Plattform – O5 Educational Video

Activity Leading Organisation:
Helmholtz Zentrum Postdam DeutschesgeoForschungsZentrum, GFZ

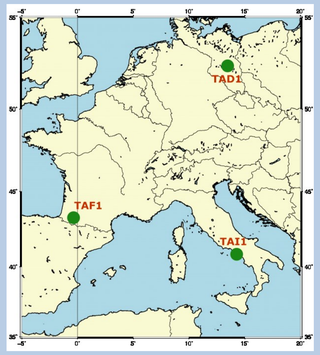
Start Date 01 – 11- 2017 End Date 31 – 08 - 2020
Start Date 01 – 18- 2018 End Date 31 – 08 - 2020
Languages: English, Italian, French, German

The Learning Web Platform is an interactive and versatile tool for our project goals. It helps learners, teachers, researchers and other involved personnel to crosslink, enhance intercultural teambuilding and work and learn together on the related technological and environmental issues.
The platform gives access to online real-time and archived data, online maps, evaluation and graphical visualization.

www.tryat.eu



Installing GNSS stations

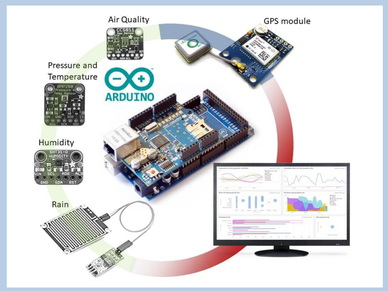


TAD1 GNSS station in Berlin, TAF1 GNSS station in Pau, TAI1 GNSS station in Naples.

O2 - Starter Kit and Installation Guide

Activity Leading Organisation
Istituto Nazionale di Geofisica e Vulcanologia

Start Date 01 – 03- 2018 End Date 30 – 06 - 2019 Languages: English, Italian



We propose a starter kit for the development of a system to acquire and manage data provided by a co-located GNSS & weather station. This approach gives the opportunity to test not only the technology, but also the concept in itself. Once we built the kit, we plan to jointly install the home-made tool with a geodetic professional GNSS station, which is routinely used for studying ground deformation. We are in process of creating the installation guide for the GNSS and weather stations.

O3 - OER Learning Material 'Physical and Technical Foundations'
O4 - Learning Material 'Informatics and Electrical Engeneering

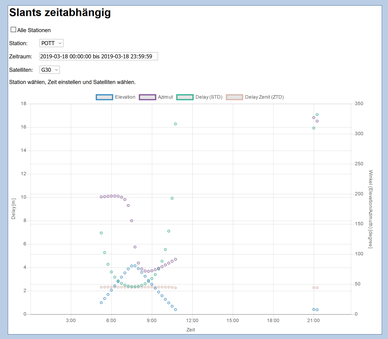
Activity Leading Organisation
Lise Meitner Schule
Lycée Saint Cricq

Start Date 01 – 10- 2017 End Date 30 – 06 - 2019
Start Date 01 – 10- 2017 End Date 31 – 12 - 2019
Languages: English, German, French, Italian

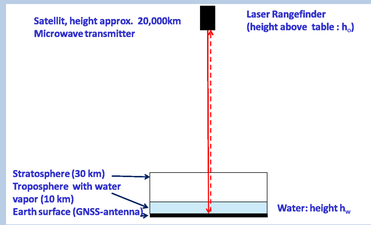
O3 is an interactive physics course where students learn the foundations of three relevant fields of the project: **1) satellite technology**, **2) propagation of waves** & **3) physics of the atmosphere**. The corresponding competences are elaborated for the use in different VET curricula. Students perform experiments with laser, microwaves and mechanical waves. They make measurements with their own Smartphone using the built-in sensors and camera for documentation. They evaluate und present their measured data. Students learn about the socio-economic dimension of the addressed fields and describe and assess the importance of international cooperation for sustainable development.

Structure of the interactive Physics course

1 Learning material "GNSS Meteorology"
2 Mechanical Vibration and sound
3 Mechanical waves
4 Refractive Index and Snell's Law
5 Experiments with Microwaves
6 Physics and Chemistry of the atmosphere
7 Visualizing the satellites trajectory with smartphone, diagram drawing, coordinates, calculus
8 Orbit calculation - The Kepler Problem for five examples of Earth satellites
9 Model Experiment for water vapor calculation
10 Water vapor calculation with real data.
11 Glossary



Model experiment for the determination of the content of water vapour in the Earth's atmosphere



The determination of the water vapour content from GNSS data is shown schematically. Model experiment (U. Sander for TRYAT, CC BY-SA 3.0)

Differences between GNSS measurements and the model experiment:

- GNSS measurements are carried out with microwaves,
- in GNSS measurements, the receiver is an antenna on the ground, the signal is not reflected,
- the data from several satellites generally not in zenith, are evaluated,
- the influence of water *vapour* in the earth's atmosphere on the optical path length is measured,
- the water vapour content can then be calculated using meteorological data (pressure, temperature and humidity)

Conclusions

Through the Open Educational Resources (OER) and especially the Learning Web Platform the outcomes of the project will be disseminated Europe-wide. This hopefully will lead to an intensive exchange and discussion within the communities of teachers, instructors and companies that provide professional training as well as implementation of the contents in the national curricula.

EGU – General Assembly 2019, Wien, 7 – 12 April.
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