Big Data Era in Sky and Earth Observation (*)

COST Action TD 1403

http://bigskyearth.eu

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Workshop MAESTRO – MADICS Days

Marseille - June 23rd, 2017

(*) Courtesy of Dejan Vinkovic – BSE Coordinator (presentation at LSST@Europe)

The Action wants to set the ground for a long-term networking across the earth-space domain

Big-Sky-Earth is a H2020 funded COST network

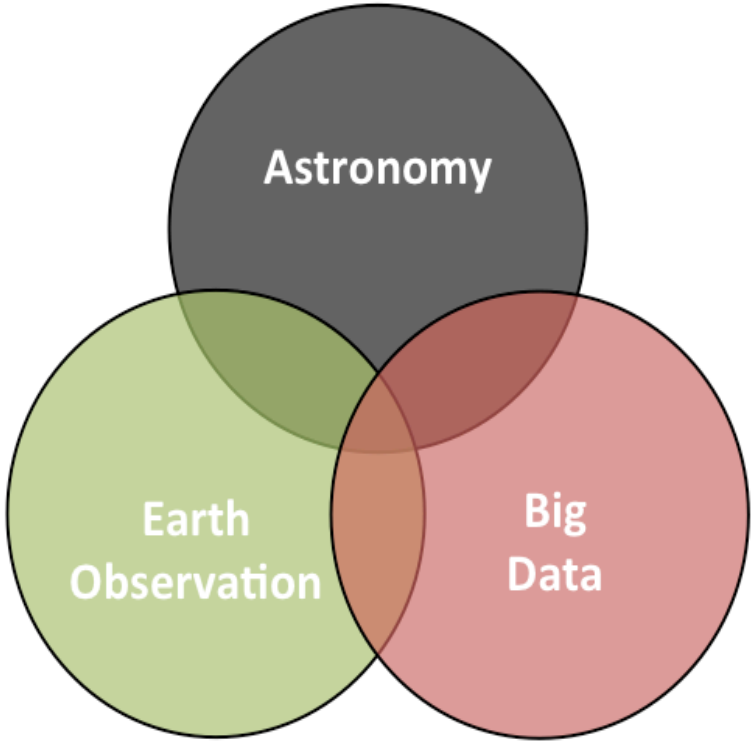
Motivation

- **Astronomy & earth observation** dependent on **"big data"**

BSE aims at boosting the communication within and between:

- Domain scientists in Astronomy AND in Earth observation
- And Data scientists in Computer science/ statistics/Data Analysts)

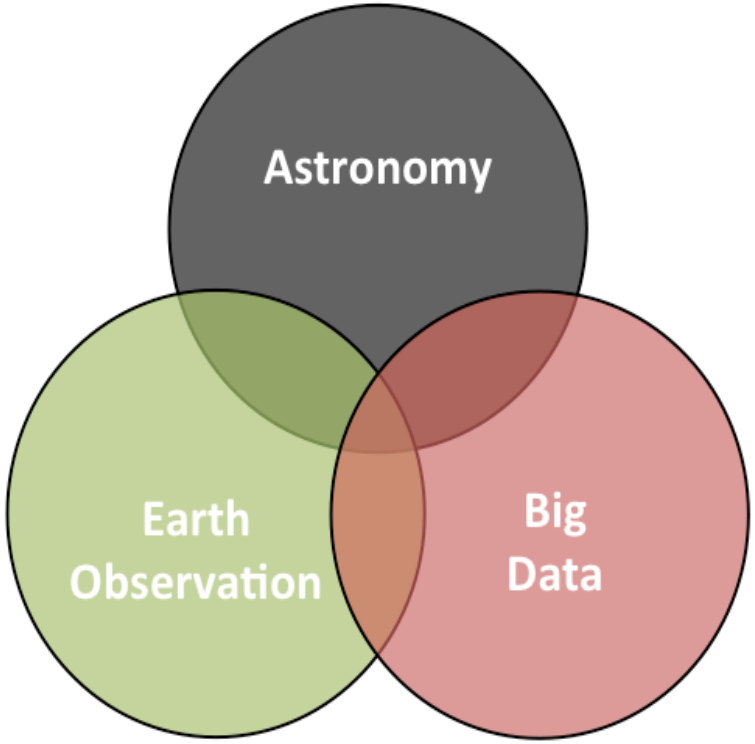
In order to identify common solutions to challenges faced in research and industry across them.



What Does Big-Sky-Earth Do?

- brings together experts from across the disciplines of astronomy, earth observation and big data …

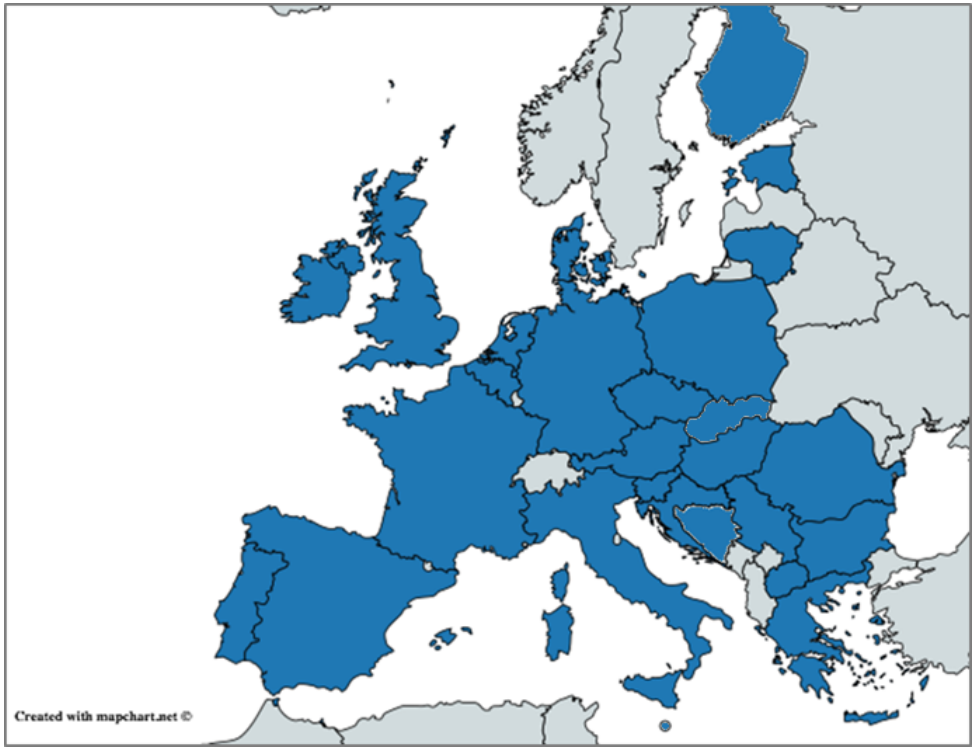
- … through conferences, short scientific projects, training schools, collaborative work, and preparation for larger projects



Who Is Involved In Big-Sky-Earth?

Researchers and experts from 28 countries (more to join):

Austria, Belgium, Bulgaria, Bosnia and Herzegovina, Croatia, Czech Republic, Denmark, Estonia, **France**, Finland, fYR Macedonia, Germany, Greece, Hungary, Ireland, Israel, Italy, Lithuania, Malta, Netherland, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, United Kingdom



+ institutions from:
Armenia (Byurakan Astrophysical Observatory)
South Africa (Trent University)
USA (University of Washington)
Canada (University of the Western Cape)

Participants from both public and private sector are welcome!

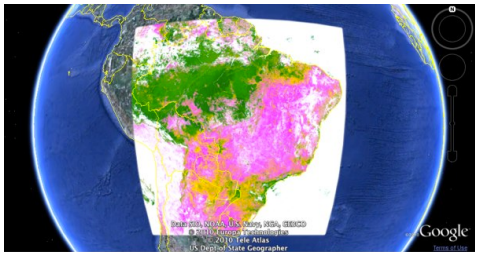
Shared challenges: data tsunami

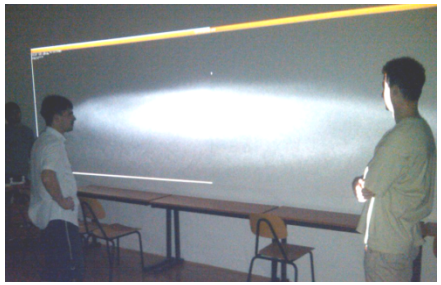
Digital curation and data access

- store, maintain & preserve huge amounts of data
- large **multidimensional & highly interrelated** datasets = paradigm change: **push the computing to the data**

Visualization

- visualizing large quantities of data with: low signal-to-noise ratio, high dynamic range, multidimensional parameter space, multi-layered time-dependent, ...





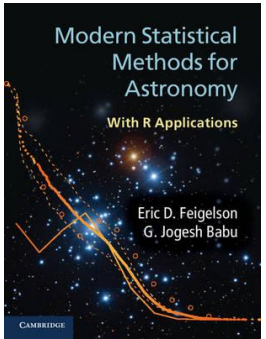
GPUs as numerical co-processors

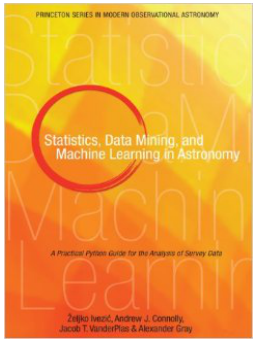
Adaptation to new high performance computing (HPC) technologies

- heterogeneous supercomputing environments
- new programming techniques for GPUs and cloud computing

Training of a new generation of scientists

- astroinformatics, geoinformatics, bioinformatics
- natural sciences + IT/CS = exploration with statistics





New books and online courses

Objectives

- OBJECTIVE 1: Framing the Joint Long-term Agenda
  - identify, compare and assess the common narrative, methods, techniques and tools used in astro-, geo- and computer sciences
- OBJECTIVE 2: Incubation of New Knowledge
  - through collaboration develop new solutions to challengies facing astro- and geoinformatics
- OBJECTIVE 3: Defragmentation of Existing Knowledge
  - identify a common set of asto- and geo-informatics tools that students and early stage researchers should learn to ease their crossing the disciplines
- OBJECTIVE 4: Dissemination
  - reaching a larger audience and spreading the acquired knowledge.

Organization & Governance

Organized in 4 Working Groups

WG1: Optimisation of database tools in astro- and geophysics contexts

WG2: Data mining and machine learning in the petabyte era as frontiers in astronomy and Earth observation

WG3: Education in knowledge extraction from massive Astro/Geo datasets

WG4: Visualization of high dimensional data

Management Committee (MC)

in charge of management and supervision of the Action

Participate to the MC Meetings and participate to the decisions

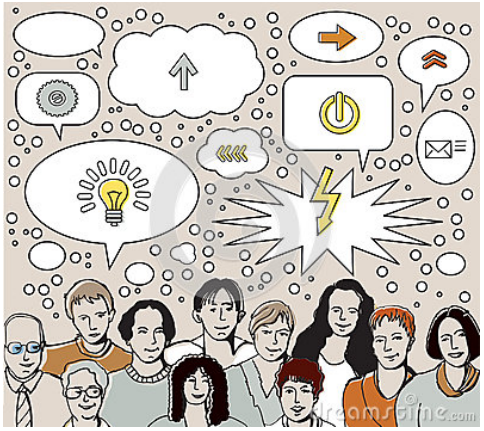
At least 2 meetings / year

France counts 2 MC members, and 2 substitutes

Actions

Meetings and Events

WG meetings – 1st WG1 meeting hold in Lyon on October 2015
Workshops – 1st in Brno (Czech Republic) on April 2016 ; the Next is joint to EWASS conference – Astroinformatics Symposium, in Prague on June 29-30, 2017
BSE Conference: at Sorrento (Italy) on October 24-25, 2016



Short Term Scientific Missions - STSM

Supports exchange visits aimed at supporting individual mobility
Researchers, PhD, Postdoc engaged in an official research program related to BSE topics can apply

Training School (TS)

1st TS held @DLR at Oberpfaffenhofen on April 2016
Last TSon on “Visualization for large scale analytics” @ Central Lancashire, UK on April 2017

Upcoming events/activities

Meetings:

- Working Groups meetings:
  in 2017: end of June (Prague), October (Bulgaria)
- Action Workshop in Novi Sad (Serbia), February 2018
  (previous workshops in Brno, 2016, and Sopron, 2017)
- BSE conference in the end of 2018

Broad project initiatives emerged:

- proposals for the European Training Network (H2020) and Research and Innovation Staff Exchange (RISE)
- Big Data astro-geo-physics of meteor plasma
- hyperspectral remote sensing in forestry (and possibly agriculture) using drones and other aerial remote sensing platforms
- a cross-domain (Earth Observation + Sky Surveys + Planetary Observations) project on fast, flexible, scalable engine for data-intensive computations on spatio-temporal datacubes
- a science case for a stratospheric airship platform (at about 20km altitude)

Upcoming events/activities (cont.)

Books and outreach initiatives:

- Preparation of a research book covering BSE topics (knowledge discovery in Big Data in Earth and Sky observations) that includes theory, programming, algorithms, learning, etc.
- Work on a training/teaching material repository that would combine theory and code examples relevant for Astronomy and Earth Observation (eventually transformed into a textbook)
- Outreach project combining attractive visualizations in astronomy and Earth Observations; include sociologists and psychologists who can provide a valuable feedback on the targeted audiences and what type of outreach produces the best outcomes.

Training School in astro- and geo-informatics (20-30 participants)

- 3rd Training School (San Sebastian, Spain) in March, 2018
- Previous schools: 2016 (DLR, Munich), 2017 (Univ. Central Lancashire)

Short-Term Scientific Missions:

small grants (up to 2000EUR) for exchange of experts between countries

Program of the next workshop in Prague

Friday, June 30, 2017:

This day is devoted to talks about the advancement in Big Data astronomy, especially in the context of time-domain astronomy opened by big sky surveys. This day is shared with the Astroinformatics Symposium at the EWASS conference and the list of presentations is available HERE (click on S14 panels).

Saturday, July 1, 2017:

1. Discussions within BigSkyEarth converged toward several immediate goals that will be discussed at this meeting.
    - Joint project proposals, including setting up a collaboration for Research and Innovation Staff Exchange (RISE)
    - A possible collaboration between Astronomy and Earth Observation on low- and high-altitude research platform (see also the ESA's call for work on High Altitude Pseudo Satellites)
    - Work on a research book covering BigSkyEarth topics (knowledge discovery in Big Data in Earth and Sky observations) that includes theory, programming, algorithms, learning, etc.
    - Work on a training/teaching material repository that would combine theory and code examples relevant for Astronomy and Earth Observation. Python would be the main language used in the repository, but not exclusively. The repository can be published on www.zenodo.org to get a DOI number for each submitted contribution, with additional links to code examples on Github.

Join us – simply register at http://bigskyearth.eu

For more information contact us at:

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