1 **10 years with planet Earth essence in the primary school children drawings**

3 Giuliana D'Addezio

4 INGV – Istituto Nazionale di Geofisica e Vulcanologia, Rome Italy

5 giuliana.daddezio@ingv.it

7 **Abstract**

8 "10 years with Planet Earth" is the title of the 2016 INGV calendar for primary schools resulting from

9 the review of a project conceived to support and complement 15 years of INGV dissemination

10 activities with schools. We made 10 calendars together with and for primary schools, every year with

11 a different subject related to a world in constant evolution. We have launched competitions asking

12 children to send drawings on the themes chosen, to stimulate learning about Earth Sciences and Planet

13 Earth dynamics. We intended to raise awareness on water resources availability, prevention of natural

14 disasters and planet sustainability. For each competition, we chose the most significant drawings to

15 be included in the yearly calendar about the Earth. The authors of drawings were awarded by

16 scientists, journalists, artists and science communicators and even by a minister. Beyond the

17 competitions, the drawings reflect impressions and thoughts, providing an opportunity to illustrate

18 the children's point of view. From drawings arise a great sensitivity, consideration, responsiveness

19 and respect for the Planet and positive feeling for Science. The project was made possible thanks to

20 the teachers and to the wonderful students of more than 200 schools. We received about 10,000

21 drawings that have intrigued, touched, enchanted, and surprised us. We are grateful for all they have

22 chosen to share with us.

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24   **1. Introduction**

25 The INGV is one of the most important international research Institution in the field of geophysics

26 and, as part of the National Civil Protection Service, provides important support for seismic and

27 volcanic risk mitigation programs on a global scale and for emergency management. INGV is

28 entrusted with the surveillance of the seismicity of the national territory, the activity of Italian

29 volcanoes and the early warning for tsunami in Mediterranean area, through technologically advanced

30 instrumentation networks. Particular attention is devoted to the dissemination of scientific culture and

31 the development of a culture of risks and prevention. INGV manages museums dedicated to

32 Geophysics and Volcanology: the Geophysical Museum of Rocca di Papa, the Vesuvian Observatory,

33 the Aeolian Information Centres and collaborates in the scientific management of the Laboratory-

34 Museum of Earth Sciences of Ustica and the Volcanological Museum of Nicolosi. In these museums,

we conceived and collaborated in the creation of permanent and temporary scientific exhibitions and installations (Pagliuca et al., 2007; Avvisati et al., 2015; D'Addezio et al., 2015). Furthermore, on the occasion of national and international events and festivals, INGV researchers and technicians take action to offer outreach initiatives on Earth Sciences (D'Addezio et al., 2014).

We organize every year educational and outreach activities for schools. The goal is to responds to the needs and the request of the community for more information on issues regarding our planet and to engage society in a correct, straightforward and efficient communication on scientific research and technological innovations. In a world that request citizens to be more informed, aware and able to make crucial decisions about their own health and safety, the knowledge is crucial to handle doubts and to know how to choose with consciousness. Activities are designed to help raise awareness about Earth sciences and research activities, as well as intrigue, interest, and stimulate on scientific culture.

2. The calendar projects

Among the most successful INGV initiatives, is the creation of the school calendars, designed for the school and realized based on competitions devoted to children of primary school. The intent is to provide a pleasant stimulus for discussion among scientists, teachers and students. The initiative achieved great participation and appreciation, and schools join in with enthusiasm by sending drawings made by children on a specified theme, different each year, chosen among geophysics and Earth Science arguments. Earthquakes, volcanic eruptions, tsunami, magnetic storms and other phenomena are manifestations of the complexity and dynamicity of our planet, which began more than four billion years ago and never halted. Since the Earth originated from the first presence of water, life and oxygen, we assisted to the Cambrian explosion of species, the domain of dinosaurs, the great extinctions and glaciations. The surface of our planet still experiences continents collisions, mountains and oceans formation and life forms emerging and disappearing. In the past decades, the problem of global warming was added to Earth dynamisms and will impact profoundly on future generation, who are already called now to face the crises of climate change.

Involve children of primary school in this project give us the chance to both bring science and school closer and to investigate the children's point of view about Earth, Science, Environment and Sustainable Behaviour. In fact, the content of children's drawings may provide insight into their feelings and thoughts about the world and how does it work. Drawing is important for children as increases their imagination and it is an amazing way of displaying emotion. Children's drawings can tell you so much about their fears, joys, dreams, hopes and nightmares. The drawings of young children have attracted and interested many ~~professional~~ in the field of education (Farokhi and Hashemi, 2011; Cherney et al., 2007). In our project children's drawings represent useful tools in

69 providing valuable information for the assessment of children's environmental perceptions and their

70 major expectations and concerns for the future.

71 With the exception of the first calendar, a launch call for the initiatives were prepared with

72 information on the chosen theme, motivations and starting points for discussion. The collected

73 drawings were then selected based on relevance to the theme, originality, pleasantness of the general

74 composition and, last but not least, the inherent message. For some collection, also texts have been

75 chosen among those sent by the kids, together with the drawing. The graphic design of the calendars

76 were studied and realized by the INGV Laboratorio Grafica e Immagini (Riposati et al., submitted).

77 Each graphic project was inspired by the theme of competition and has particularly taken care of the

78 mediation among the drawings, realized with different techniques, different colors and subjects,

79 always maintaining the centrality of the children's work. In addition to copies of the calendars,

80 educational materials produced by INGV were sent to the participating schools.

81 Events were organized for the awarding of the winning children. The winners were hosted in the

82 INGV venue in Rome, with their classmates whenever possible, and with teachers and often with

83 relatives. They received certificates and medals, games and scientific experiments and T-shirts with

84 the logo of the competition (Fig. 1). For the award ceremonies we invited scientists, journalists, artists

85 and science communicators, generally experts on calendar themes. A remarkable event was when the

86 Italian Minister of Public Education decided to demonstrate her appreciation and support for the

87 initiative towards schools with her presence, rewarding personally the winners.

88

89 **Fig. 1.** Award ceremonies. On the right distribution of the T-shirts made for the 2009 calendar; on the left the
90 winner's awarding of the 2010 edition (Photos by Luigi Innocenzi).

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3. The 2016 calendar

In the 2016 calendar we have collected the drawings chosen as the cover for each of the past years calendar dedicated to the Earth (Fig. 2). This initiative gave us an opportunity to reflect and evaluate what the 10 years long project can tell to the scientific community on the relationship between children and the planet Earth.

Fig. 2. The cover page of the 2016 calendar made with a collage of all calendar covers (edited by INGV Laboratorio Didattica e Divulgazione Scientifica and INGV Laboratorio Grafica e Immagini).

*2004 – 2005 Calendar **"A natural phenomenon called earthquake"***

The first calendar was inspired by the project "When the Earth has a stomach ache" (Burrato et al., 2004). In 2000 a small size earthquake hit a town near Rome. This event was strongly felt by teachers and students of the local primary schools, and sprang the idea of a project focused on earthquakes. Children, who have been taught about earthquakes, can be engaged to use their knowledge within the context of their own art, illustrating it to others through drawings (Izadkhah and Gibbs, 2015). The aim of the project was to gain knowledge of what causes earthquakes and to familiarize with a phenomenon considered random and unforeseeable. Moreover, an important part of the project was to train students and teachers to behave properly during the occurrence of an earthquake. At the end of the project we realized a calendar that tell about earthquakes using the kid's original drawings and

texts, describing their own impressions of Earth, earthquake, its effects and simple behaviours that can help reduce the damage.

Calendar 2005 – 2006 **"Once upon a time there was a Volcano"**

Drawings of this calendar were chosen among 853 works dedicated to volcanoes. From the drawings emerge the fascination and the fear that the "mountains of fire" arouse in children. Month after month, children tell us the legends of the past regarding volcanoes. Hephaestus, the god of fire in the Greek mythology, that had his nether forge in the inner of Etna, working alongside the Cyclopes, giants having a single eye. Many drawings represented the volcano as an island recalling the homonymous island in the Eolian archipelago, the dwelling of the god of fire for the ancient roman people, Volcano. It's from Volcano Island itself that, at the end of the Middle-age, the mountains of fire were given the name volcanoes. Children represent also volcanoes in activity, illustrating damage of eruptions with fire and flames, housing in danger and frightened people but also the role of volcanoes for the life of the planet with emissions of flowers and fish from craters and the slopes of the volcano covered with vegetation.

Calendar 2006 – 2007 **"Telling the Story of the Earth"**

In this calendar, children drew the Earth's History and the many different living beings that have dwelled on it, showing Mother Earth's diversity and grandeur. We received 2200 drawings, illustrating the children's point of view on the history of the planet, from the origin of the Universe and of the solar system, the first forms of life, the differentiation of species in waters and then on land, dinosaurs, volcanoes, mammals and humans. Through the children's drawings you will recognize the story of an extraordinary adventure, a Universe full of energy, seas and oceans crowed of life forms, unmissable giant dinosaurs grappling with smoking volcanoes and luxuriant vegetation, the beginning of the human race, with human ancestors and other hominids engaged in hunting, and finally the incoming of civilization.

Calendar 2007 – 2008 **"Living with a Star"**

In occasion of the International Heliophysical year (IHY) we dedicated the to the Sun the 2007 competition (Fig. 3). By partnering with COST269 project, to this competition participated school from 8 European countries (Czech Republic, Cyprus, Finland, France, Italy, Poland, Spain and United Kingdom). Drawings have been chosen among about 1300 works. Realized in all the languages of participating countries, this calendar has collected images of many suggestions that "our star" evokes in children. Fantastic images of the Sun in the space with other celestial bodies, with rockets and

satellites observing and studying. Drawings that recall life on Earth, the sun with rainbow rays and the warm ones in the summer beaches. Images related primarily to the idea of energy and life that the Sun brings with it, but also the phenomena related to the interaction with the Earth at different latitudes: eclipses, auroras, the Sun in summer and non-Sun in winter.

Fig. 3. The back page of the 2007-2008 calendar dedicated the to the Sun and realized, by partnering with European countries of COST269 project, in 8 languages (edited by INGV Settore Formazione e Divulgazione Scientifica and INGV Laboratorio Grafica e Immagini).

2009 Calendar **"The Earth of tomorrow is today in my hands"**

For the UNESCO International Year of Planet Earth we focused on the issue of human responsibility on the sustainability of the planet, trying to stimulate attention in young, but active citizens of tomorrow. Children's relationships with nature for environmental education are already explored using draw and write methodology (Kalvaitis and Monhardt, 2012). Climate change will have

multiple effects on human health and is the defining young human development challenge of the 21st century. We suggested topics on climate, oceans and seas and continental water to sensitize younger generation about the Earth beauty and the natural resources, as well as natural hazards and the relation between human's and Earth's health. Children responded by sending drawings of rainbow waterfalls, volcanoes and flower fields but also with images against the environmental degradation and the indiscriminate use of the planet's resources, disrespectful behaviours fought sometimes with contribution of "Superheroes" or protectors. Moreover, drawings telling natural environments and everyday life highlight virtuous and environmentally friendly behaviour, respect for environment and the importance of taking care (Fig. 4).

Fig. 4. The back page of the 2009 calendar dedicated the to the Earth and to the today responsibility to protect the environment (edited by INGV Laboratorio Didattica e Divulgazione Scientifica and INGV Laboratorio Grafica e Immagini).

*2010 calendar **"Precious Earth"***

The 2010 calendar still focused children's attention on planet Earth and the effect of human activity on the Earth. We asked children to use creativity and sensitivity to design a message, an image to promote planet Earth. The title, Precious Earth, was chosen to underline that our existence completely

depends on the planet Earth, where we have been evolved. We are part of it and will continue to be so if we manage to maintain a dynamic balance between a sustainable life and the Earth ecosystem. The alteration of the planet natural climate cycle requires responsible and efficient use for the future and in parallel the promotion and development of alternative energy sources that our planet is potentially rich in. From the drawings and the texts we have collected emerge a great sensitivity for the issue, respect for the planet, the consciousness of its beauty and uniqueness and the sadness for activities perceived as wrong. Also from the texts the same sensitivity emerges, i.e.: *Va bene cercare un altro mondo ma se ti trattiamo bene sarà sempre bello chiamarti casa* It's okay to look for another world but if we treat you well it will always be nice to call you home. *Chiudo gli occhi e sogno un mondo pulito e nessuno alza un dito. Sogno le persone rispettose dell'ambiente e la natura tornare vincente* I close my eyes and dream of a clean world and nobody raises a finger. I dream of people who respect the environment and nature become winning again.

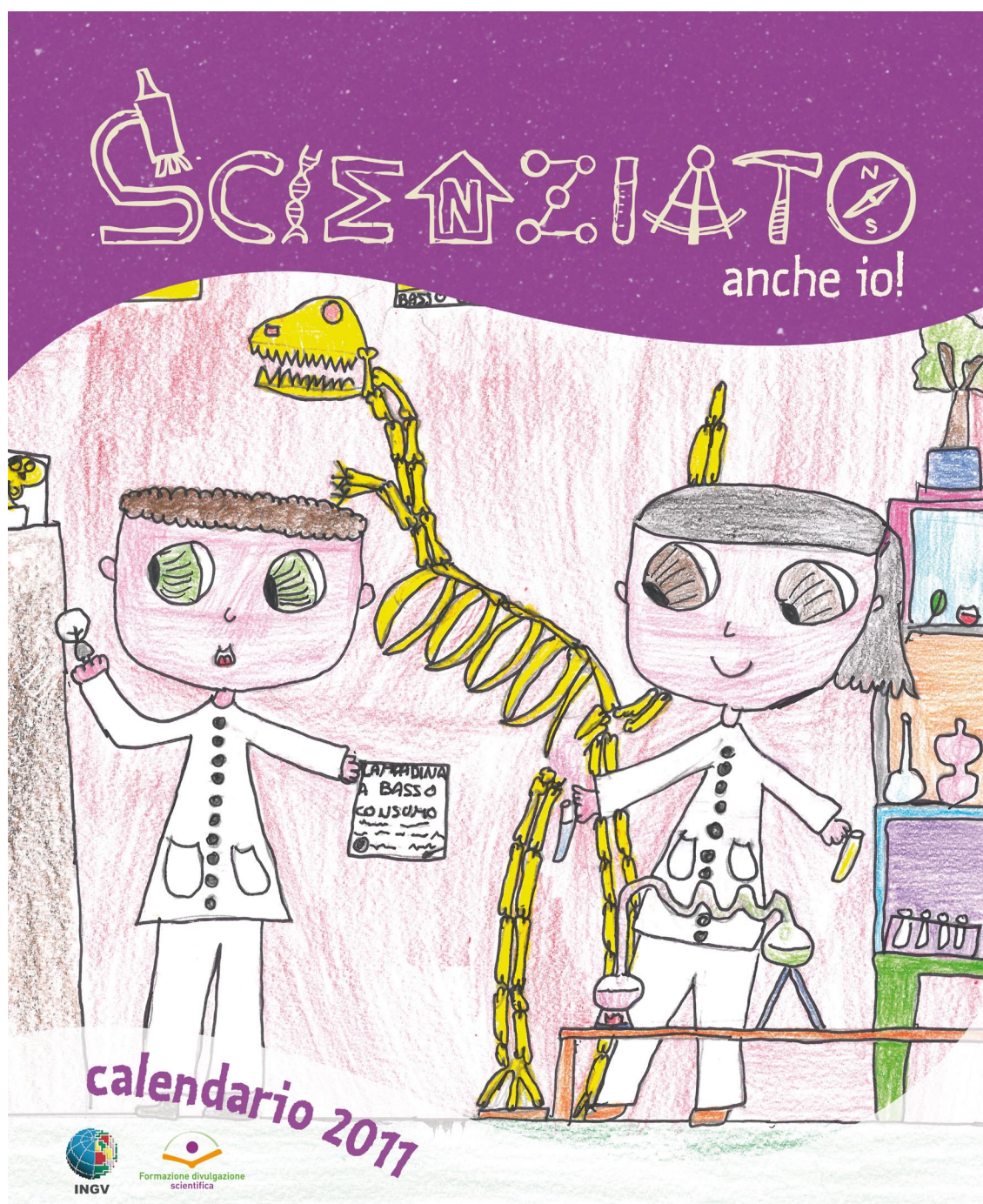
*2011 Calendar **"I'm a Scientist too! Science and scientists from the children point of view"***

In the International Year of Youth, established by the United Nations General Assembly, the theme was selected with the purpose of giving shape to the image children have of the world of science, its potential and its future perspective, as well as the image they have of scientists and research. Children were asked to create a drawing from three suggestions: (1) How do you imagine a scientist? How do you imagine the daily activities of a researcher? (2) What is the invention you consider the most important among all those you know? (3) What would you invent?

During the competition, 986 drawing were collected. What we got is a colorful and busy world, full of young scientists confident in the power of science and technology, engaged in inventing devices to make you happy, to travel in space and time, and to solve the problems of the Earth (Fig. 5).

A sample of 200 drawings have been analyzed in order to test and tune a classification scheme and to infer some considerations of the perceived image of science, scientists and inventions from the child's point of view (Rubbia et al., 2015). The analysis reveals a persistent gender stereotype related to scientists, since 70% of the depicted persons were male and 45% of girls draw male scientists. The image of a 'mad scientist', mainly related to male scientists, is still present (15%). Female scientists are drawn by girls; they are represented as young, not crazy and are usually good-looking. Scientists of both genders are young, and this is a positive image, in that scientists may be perceived as closer to everyday life (Rubbia et al., 2015).

*2012 Calendar **"Mission Possible: let's save the world"***

The theme was inspired by the International Year of Sustainable Energy for All, designated by the United Nations General Assembly to promote research of new green technologies and to focus on environmental problems and the future of the Earth. Our planet provides all those resources that have allowed life to flourish. Many of these resources depend on delicate balances and are not unlimited. We consume more resources than the Earth can generate. Almost all of the energy and raw materials we use to produce or build what surrounds us and are needed to live comes from the Earth. A land that feeds, warms and offer us beauty.

223 **Fig. 5.** The design chosen for the 2011 calendar cover, summarizes the main themes present in the drawings
224 sent by the children. Smiling scientists, confident of the potential of science, engaged in enthusiastic
225 discoveries to improve planet life (edited by INGV Laboratorio Didattica e Divulgazione Scientifica and INGV
226 Laboratorio Grafica e Immagini).
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229 The suggested priority for the possible mission were:

230 1) to counteract the pollution of air, water and soil;

231 2) stop global warming and the destruction of ecosystems;

232 3) develop new green technologies.

233 The children's fantasy enhanced us to the images of a planet with rainbows, trees, clean rivers and

234 lakes, the desire to be useful creating pedals school buses, eco-volcanoes, machines that convert waste

235 into flowers. In fact, the real children's challenge was inventions. Green ideas and technologies based

236 on solar energy for high-speed train or pizza ovens, obtaining the energy from destroying weapons

237 or harnessing volcanoes (Fig. 6). In other words, Sustainable Development that is able to meet the

238 needs of now without compromising those of future generations.

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Fig. 6. One of the drawing selected for the 2012 calendar. In the drawing a very complex project of a eco-volcano, with very detailed instructions and precise statements on the low cost of the project and on the absence of pollution (edited by INGV Laboratorio Didattica e Divulgazione Scientifica and INGV Laboratorio Grafica e Immagini).

*2013 Calendar **"In the heart of the Earth"***

What students of primary schools imagine there is inside the Earth? Scientists agree for a representation of the interior of the Earth, but to date no one has yet gone to check. Inside the Earth, temperature and pressure increase progressively until reaching very high values, capable of challenge any technology known to date. We went to the moon, but we have not been able to go for more than a few kilometres inside the Earth. From the 1034 drawings we have received, the interior of the Earth is definitely very colourful and sometimes animated by turtles, butterflies and fire-breathing dragons. In some cases consists of candy, cream and chocolate, through precious stones and fire of volcanoes. Some drawings were inspired by legends and myths alluding to the existence of underground, hidden and mysterious worlds, inhabited also by peoples and fantastic creatures.

*2014 Calendar **"The Magic of Water"***

Water is an essential part of the Earth and contributes to make unique our planet. Precious and indispensable to life, is a wealth we are claimed to protect. Consciousness helps us to increase awareness avoiding water wasting or pollution.

We received 1195 children's drawings, were water is represented in its plentiful manifestations, in the atmosphere and on Earth's surface (Fig. 7). Placid waters of lakes and lagoons, pouring waterfalls where the sun is reflected, along with more troubling water that gives rise to glaciers and ice figures and polluting boats. There are also suggestive images that remind extreme events such as floods and very powerful rain phenomena. A sign of awareness where understanding water multiple and sometimes powerful manifestations in the atmosphere and on the Earth surface, enhance correct use of territory and a behaviours of respect and attention towards the natural environment.
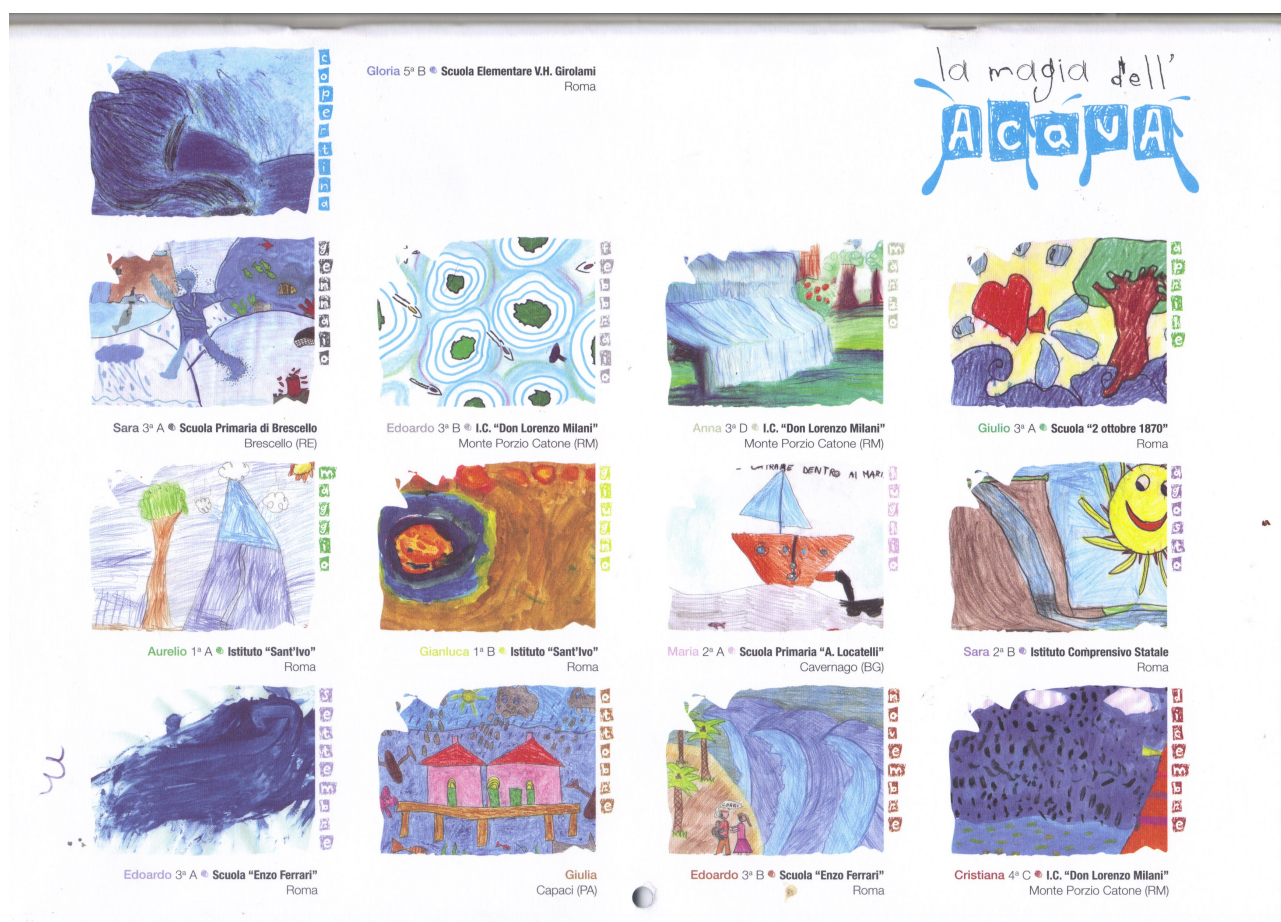
Fig. 7. The back page of the 2014 calendar dedicated the to the water (edited by INGV Laboratorio Didattica e Divulgazione Scientifica and INGV Laboratorio Grafica e Immagini).

4. Final ~~Considerations~~

The organization of training and outreach activities implies the analysis of cognitive and emotional outcomes by intercepting the experience of the beneficiaries. Projects with schools and with public have been analysed in order to catch the effects of training activities and motivations for participation. These studied provided information over the years on the liking and effectiveness of training proposal in various contexts (D'Addezio, 2019; D'Addezio *et al.*, 2014; Lanza *et al.*, 2013; Musacchio *et al.*, 2015a; Musacchio *et al.*, 2015b). Moreover, we can built a more general analysis of how the scientific message is received, how efficient scientists are in transferring concepts, ideas, information in a correct but also captivating way.

Besides the competitions, the drawings we received in ten years of continuous dialogue with schools depict children impressions and reflections, providing an opportunity to illustrate the children's point of view. A critical analysis of the drawings should take in consideration the relation to both the Earth Sciences and the images that surround children today. The information children have about an environmental issue will be crucial for mental representation. Children's drawings can thus provide

291 valuable information on the development of children's ~~environmental~~ perceptions (Farokhi and
292 Hashemi, 2011). But how young people cope with global problems, such as climate change,
293 potentially worrying and destressing? Generally, children use less problem-focused coping and more
294 distancing to cope with worry and place trust in researchers and technological development to a higher
295 degree (Ojala, 2012). Our analysis shows the same attitude in the children perception. In fact, a great
296 consideration, a deep environmental concern and respect for the planet arise from the drawings and
297 texts we have collected. As in other works, children demonstrated a positive relationship with nature
298 (Kalvaitis and Monhardt, 2012). A similar positive relation emerges from our drawings between
299 children and science and scientists. Science and technology are perceived as powerful tools, capable
300 to handed the continuous challenges humanity is facing. Moreover, children represent themselves as
301 users of these tools to solve problems and improve the world. In this light, the outcome we have catch
302 from the calendar project, raise hopes that similar initiatives can contribute to increase the knowledge
303 of the Earth and of the fragile human ecosystem in the hearts and minds of future active citizens.
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306 The author declare that she has no conflict of interest. Figures are from INGV publications.
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