Illustrations to Better Understand Ionospheric Sciences

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Abstract

Science is undergoing very rapid changes due to the larger number of people having the opportunity to do science and also with the development of new and revolutionary techniques (e.g. machine learning). The new concepts discovered to end up not gaining the deserved prominence and are quickly discarded. We live in a world where great discoveries have already been made and small new ideas need to be cultivated and developed to rise to their deserved significance. An interesting image can be a start point to attract scientists to know more about some subject, but they are considered a time-consuming effort and difficult to be done. The worries with the creation of the images are not limited to beauty, but accurate drawing is fundamental to science. Illustrated scientific posters made by dedicated design are attractive but are often connected to companies and associated with the sale of a product. Although the idea presented in simple posters can lead to the imagination of new structures or relationships, one image of this idea could more easily explain the concept and attract people, encouraging a scientific debate. A list of commercial programs can be cited as Linkscape, Adobe packages (CorelDRAW, illustrator, etc.), Microsoft packages (Paint, PowerPoint, etc.) or even Matlab functions and this work will present images produced for a better understanding of ionospheric sciences. It is common knowledge that human memory is mostly visual. The digital images can not only be used in paper posters but also in digital posters, projections, websites, etc. The idea is to motivate ionospheric scientists to draw their discoveries. The images, and the scientific work itself, begin in a simple way and gain complexity with the advancement of the scientific discoveries and could be used for the author as a personal way to instigate a continuation of the study. Complex systems studies like the ionospheric sciences are often composed of multidisciplinary groups and are important to quickly explain the meaning of some concept. To investigate the perception of the scientist about the importance of images in explaining scientific concepts a questionnaire was done to collect information about the importance of scientific images in different fields of investigation.

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PRESENTED AT:

INTRODUCTION

The production of scientific images by the own scientists can be improved using simple strategies in common software's and they can be of great value to the scientific society. This work is a motivation for scientists to draw more their discoveries and make scientific knowledge easier to be understood.

This work focuses on the ionosphere and its impact on the Global Navigation Satellite System (GNSS) high accuracy based applications.

The images are available here (https://docs.google.com/forms/d/e/1FAIpQLSc4O8063JMsR07pKC5fxyAK7K0-USeshzgKo9pKvr7fSLs9mA/viewform?usp=sf_link)

as a gift for completing the form and they are already being used by the scientific community:

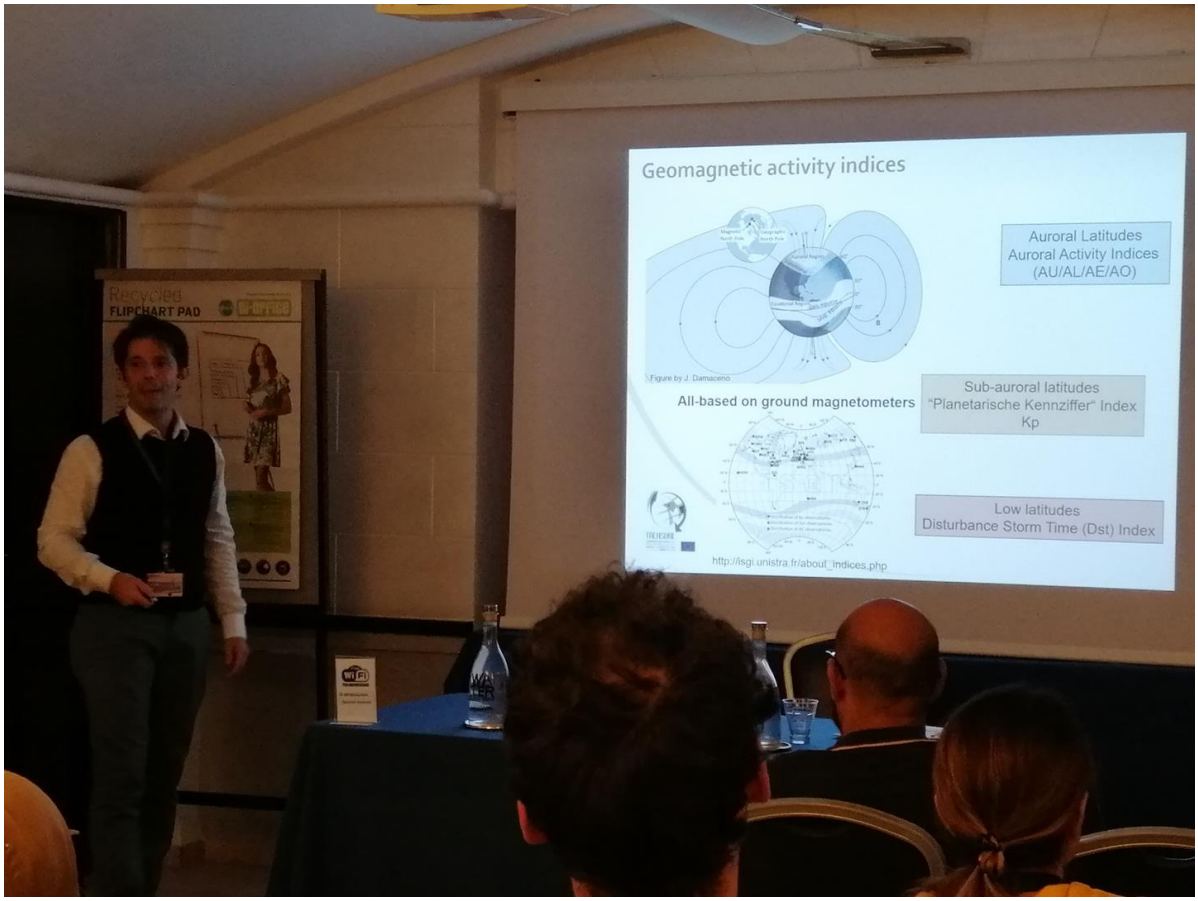


Image presented by Dr. Luca Spogli (INGV) during the 'third TREASURE school (http://www.treasure-gnss.eu/third_treasure_school/)', Turin, Italy, 4 – 8 November 2019, with the title: “State of the art EGNSS high accuracy positioning: what can Galileo bring to the table?”

PART 1: BASICS CONCEPTS OF THE IONOSPHERE

In case you are not familiar with the ionospheric sciences, I invite you to watch the introduction 'Welcome to the ionosphere', from NASA's Goddard Space Flight Center:

[VIDEO] https://www.youtube.com/embed/kDCz5jBfJoc?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0
The images developed in this work were created in PowerPoint and the legends are available in the audio format:

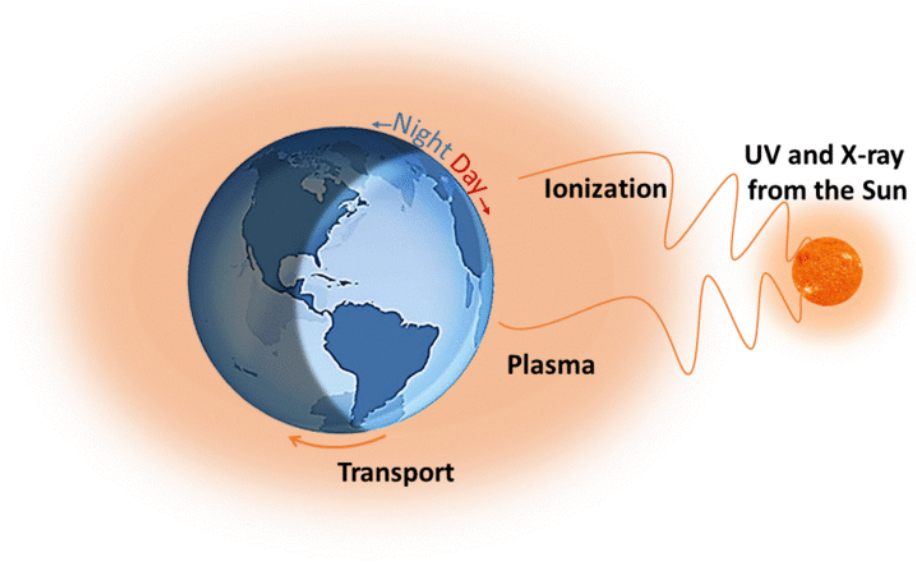


Figure 1: Audio legend

0:00 / 0:

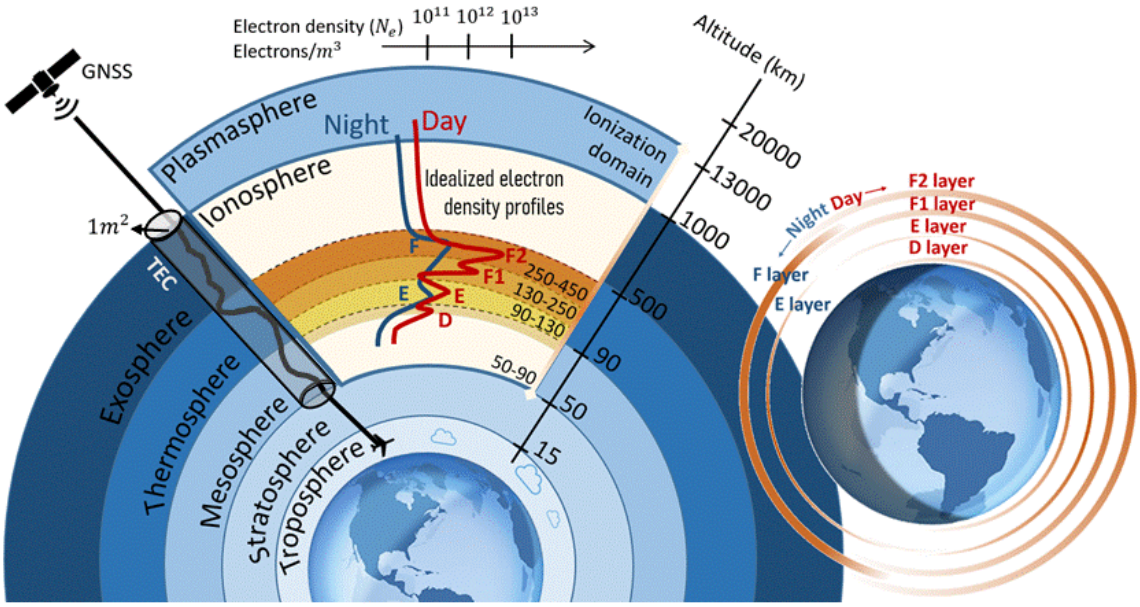


Figure 2. Audio legend.

0:00 / 1:

Figure 3. Audio legend.

0:00 / 1:

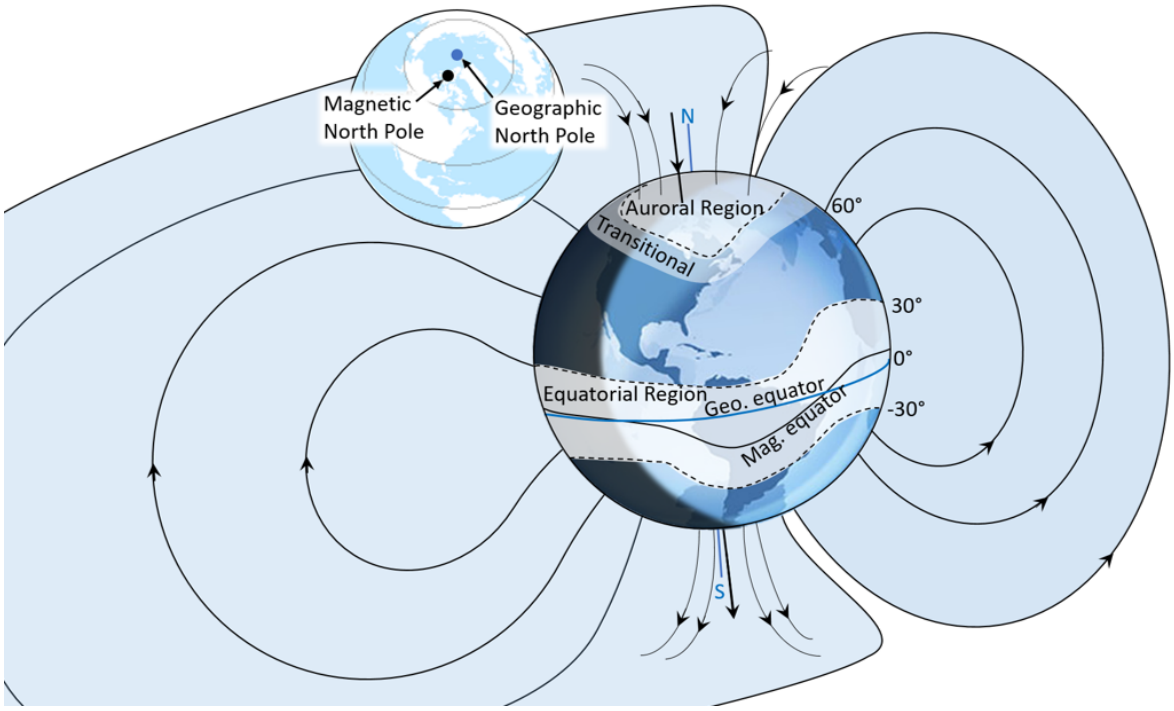


Figure 4. Audio legend.

0:00 / 0:

PART 2: MOTIVATE IONOSPHERIC SCIENTISTS TO DRAW THEIR WORK

Generally, the studies and the images proceed in parallel, both beginning in a basic/simple way. Then they gain complexity and new elements arise based on the advancement of scientific discoveries. In case you are not familiar with the ionospheric sciences, I invite you to watch 'The Equatorial Fountain', from NASA's Scientific Visualization Studio video :

[VIDEO] https://www.youtube.com/embed/zrDUN4HVq7o?feature=oembed&fs=1&modestbranding=1&rel=0&showinfo=0

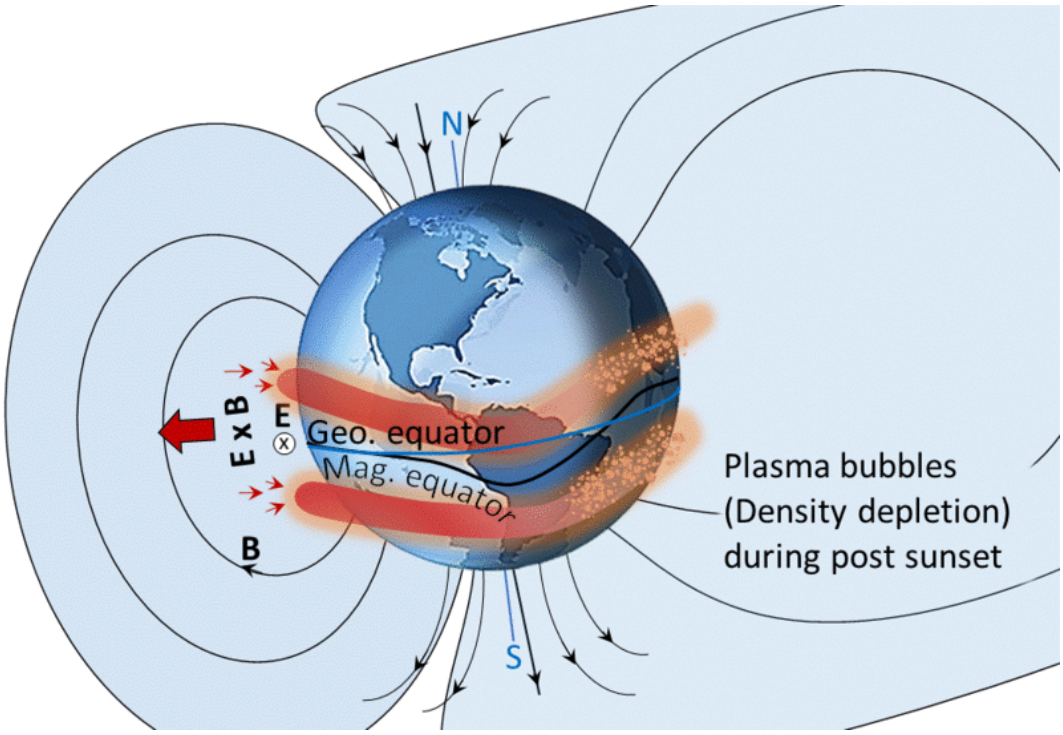


Figure 5. Audio legend.

0:00 / 1:

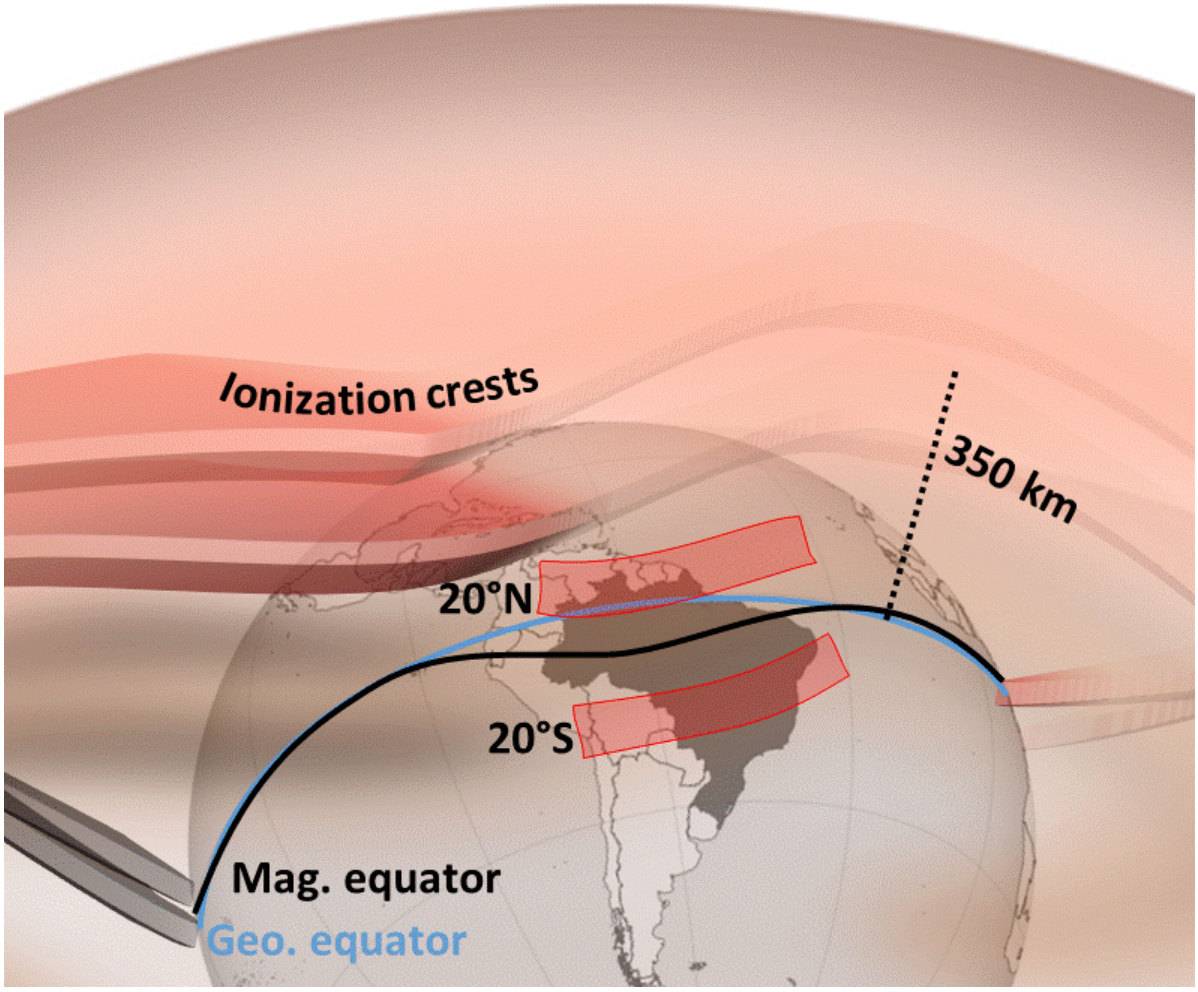


Figure 6. Audio legend.

0:00 / 1:

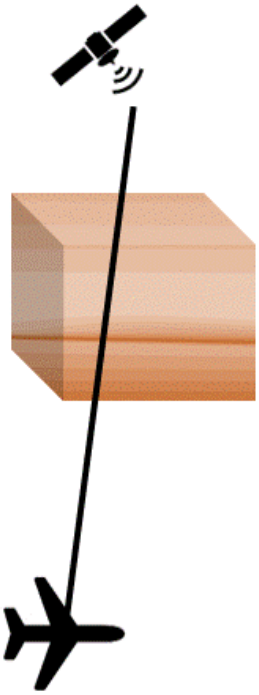
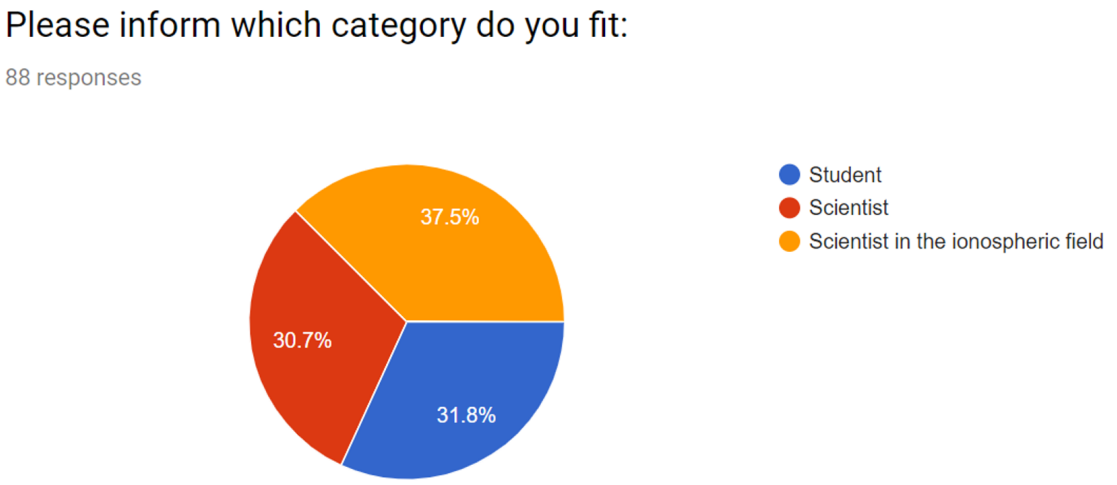


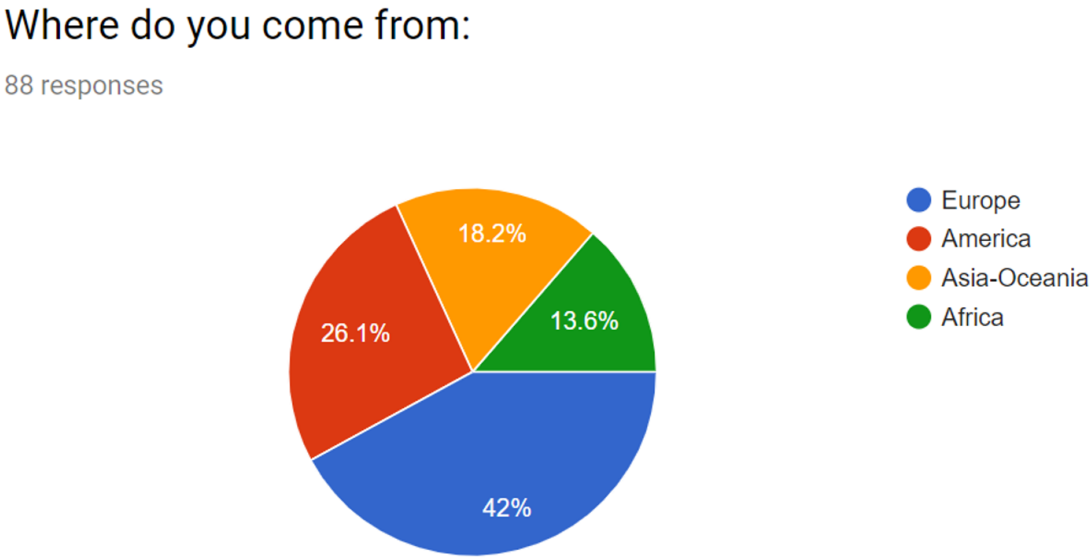
Figure 7. Audio legend.

0:00 / 0:

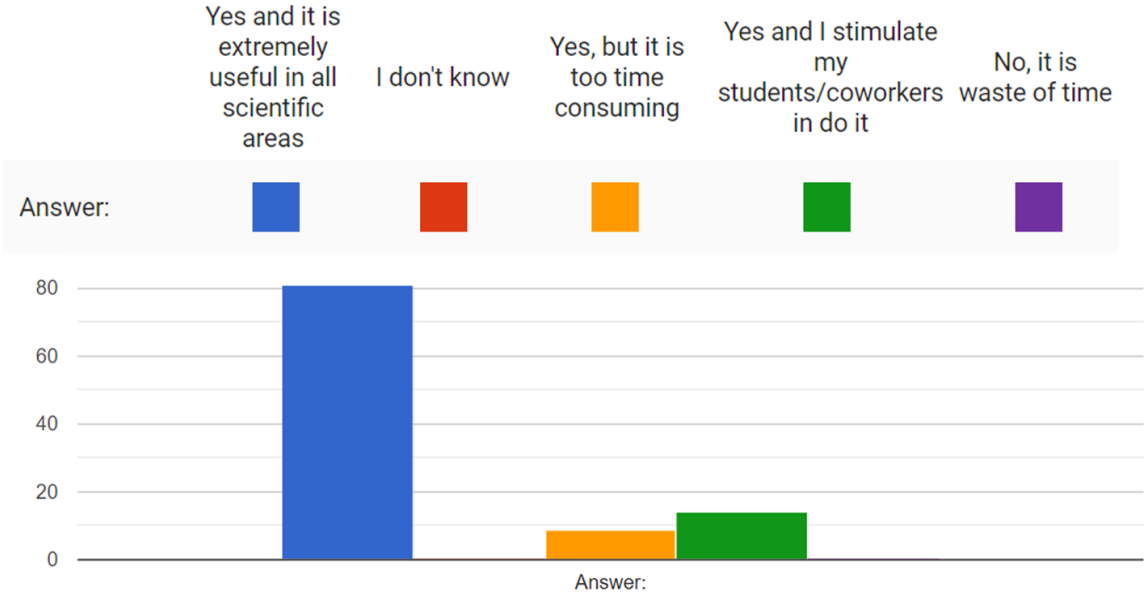
ONLINE SURVEY NUMBERS

Submitted: 29/10/2019, the results presented here are from 12/11/2019, 14 days collecting data, 88 people filled the form:

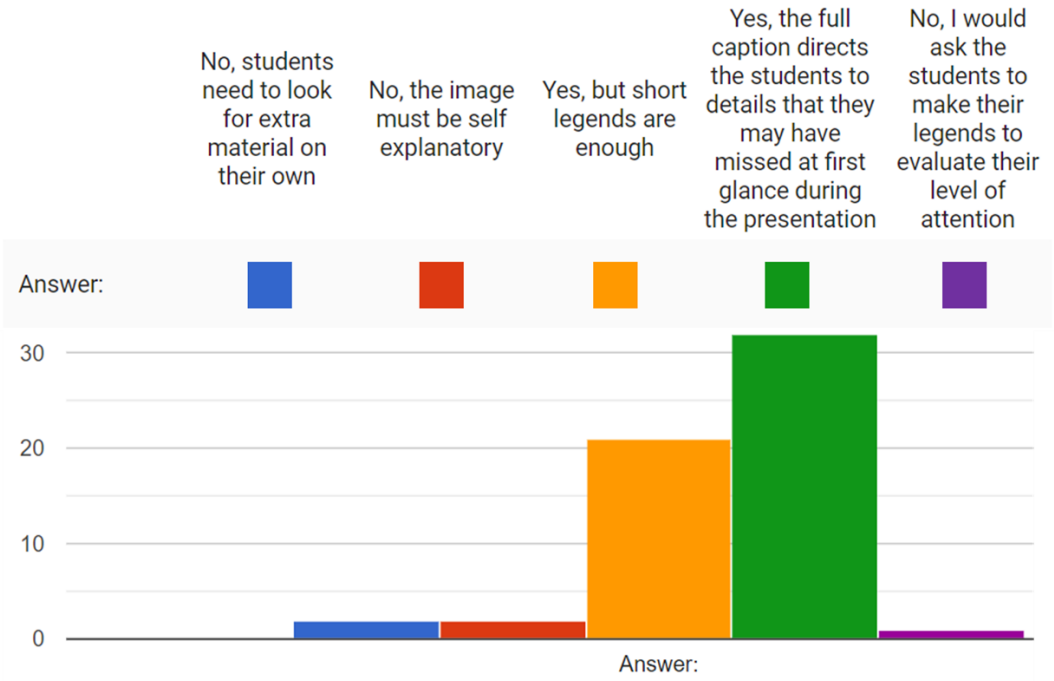




Question 1. Illustrations in science are mainly associated with, e.g., biology and medicine, but in some disciplines, like geophysics, it is not always possible to take a photo of the phenomena involved. Is it worth spending time producing proper scientific illustrations?



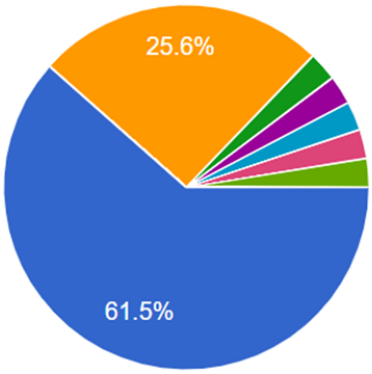
Question 2a (Only for educators). Based on studies for educational purposes, legends facilitate students learning more than the use of images alone. Would you consider to use full legends in the material you will distribute before/after your lecture?



Question 2b (Only for students). In your experience, material with full legends in images facilitate your comprehension more than the use of images alone?

- Yes
- No, I need to look for more information on the subject by myself
- Sometime, it is better to receive very short legend in order to be stimulated to search for further details
- Other:

39 responses



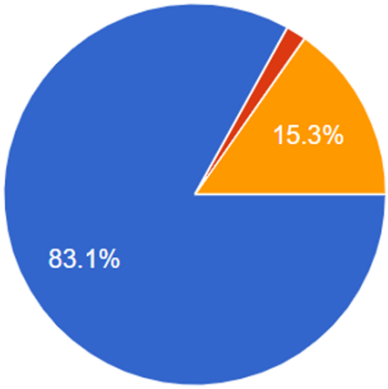
Question 3 (Only for educators). The use of animated gif is a strategy to catch the attention of the student. Do you agree?

Yes

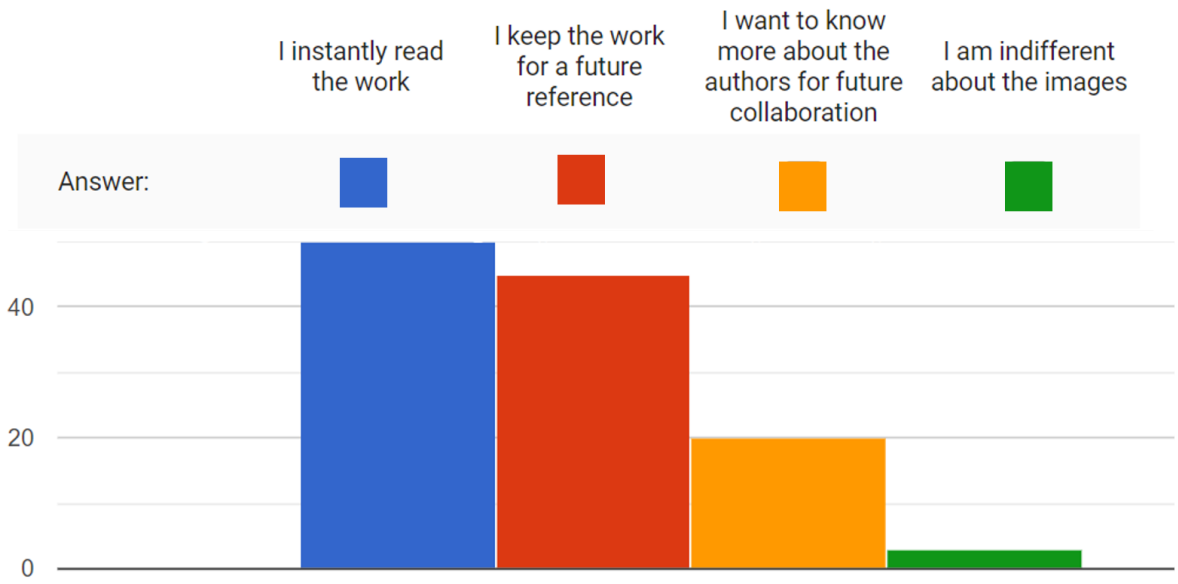
No

Sometimes, gifs can also distract students

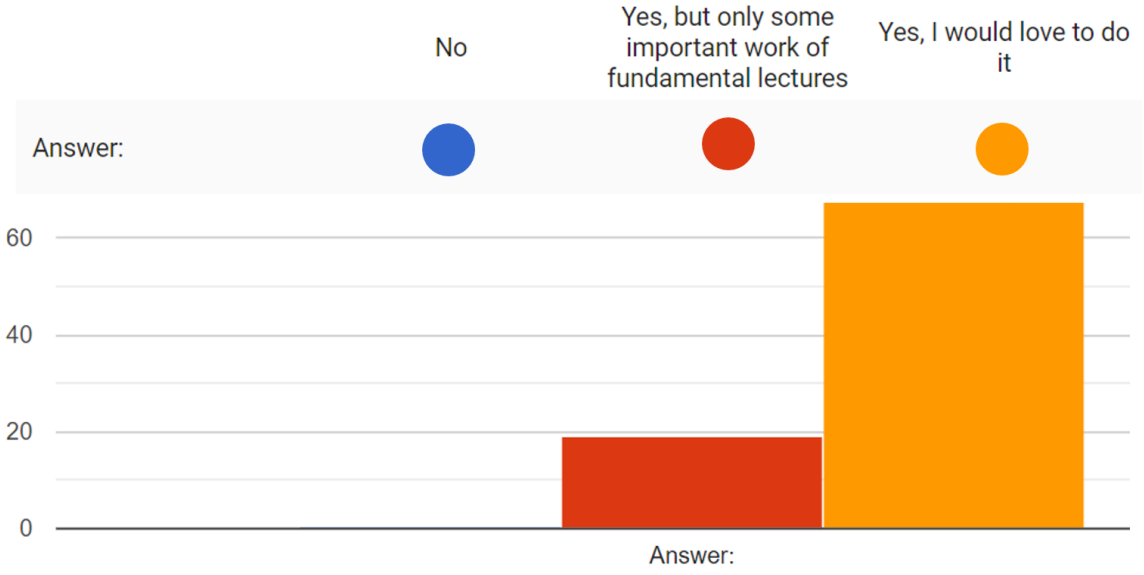
59 responses



Question 4. What do you do when you find works about your field of interest including effective illustrations?



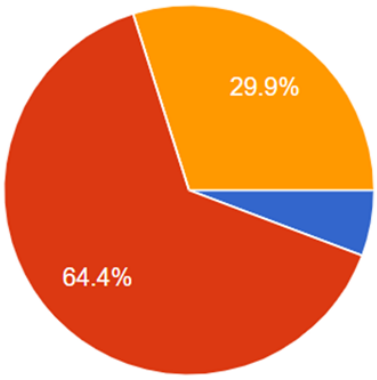
Question 5. Would you try to show visually your work if you were able to do it?



Question 6. Let’s suppose that you start to develop an illustration based on your first results, and with the progress of the work you improve the image, but you see that something is missing to make the illustration scientifically valuable. Are you stimulated to find the missing puzzle pieces to improve your image?

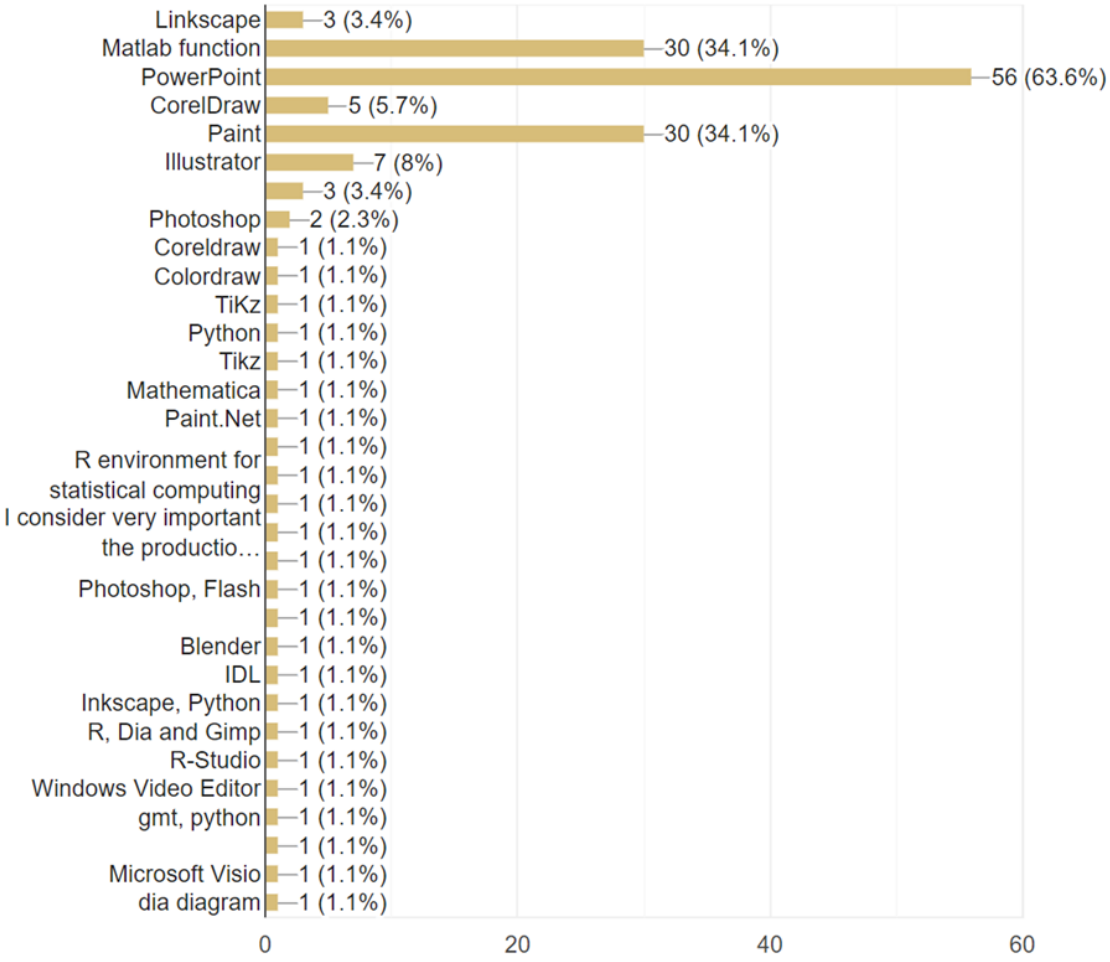
- No, I don't think about it since my work is too abstract and I don't have illustrations
- Yes, I will consider to start making better images from now
- Maybe, but I would not dedicate too much time for this

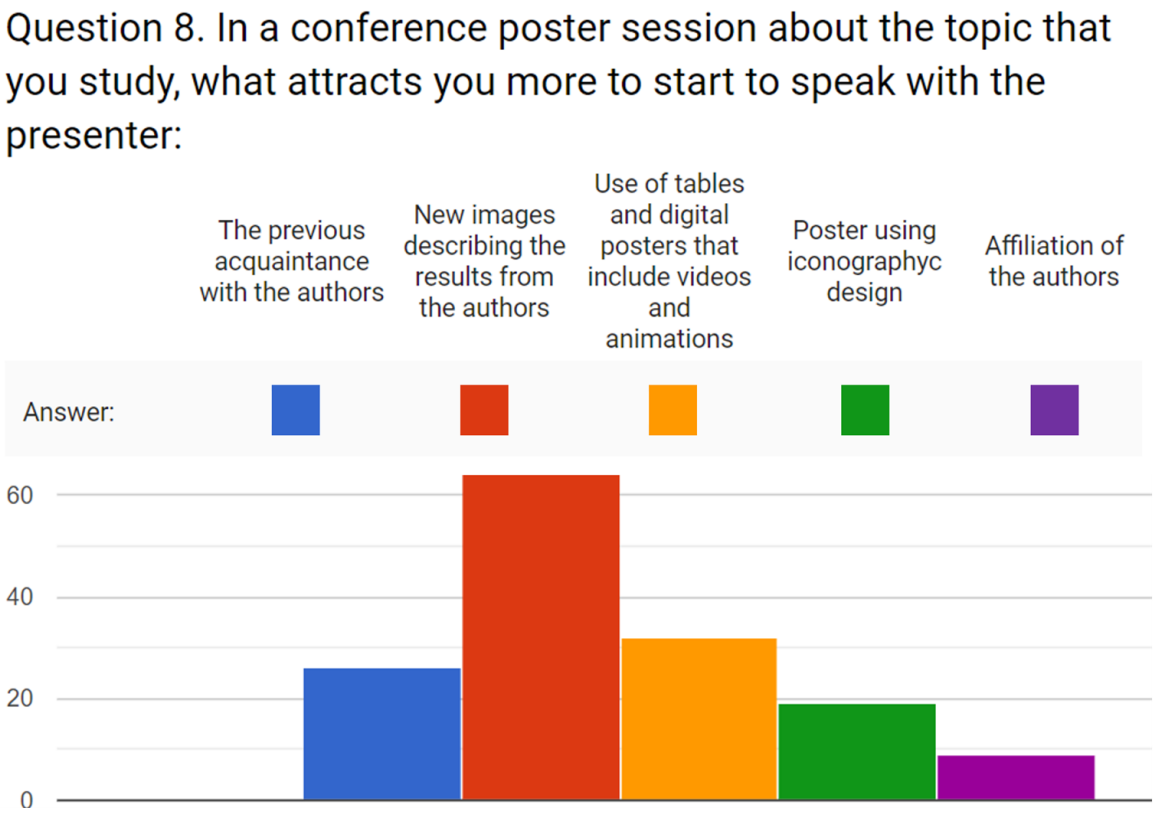
87 responses



Question 7. In this form, PowerPoint software was used to develop the images. You do not need to be a graphic designer with the knowledge of sophisticated programs to develop your own images. What program do you usually use to develop your own images?

88 responses





The update results from 29/10/2019 to today can be find clicking Results (https://docs.google.com/forms/d/1yy1IyepnzAgyAObfi5yPxxhHuNzbs-3qZQha9VP8aeQ/viewanalytics)

Sorry but time is up!

DISCLOSURES

To access the form: https://docs.google.com/forms/d/e/1FAIpQLSc4O8063JMsR07pKC5fxyAK7K0-USeshzgKo9pKvr7fSLs9mA/viewform?usp=sf_link (https://docs.google.com/forms/d/e/1FAIpQLSc4O8063JMsR07pKC5fxyAK7K0-USeshzgKo9pKvr7fSLs9mA/viewform?usp=sf_link)

Results of the form: https://docs.google.com/forms/d/1yy1IyepnzAgyAObfi5yPxxhHuNzbs-3qZQha9VP8aeQ/viewanalytics (https://docs.google.com/forms/d/1yy1IyepnzAgyAObfi5yPxxhHuNzbs-3qZQha9VP8aeQ/viewanalytics)

The author wishes to thank the TREASURE project (http://www.treasure-gnss.eu/ (http://www.treasure-gnss.eu/)), funded by the European Union's Horizon 2020 Research and Innovation Programme under the Marie SkłodowskaCurie Actions grant agreement No. 722023. The author would like to also thank the support of Istituto Nazionale di Geofisica e Vulcanologia (INGV) and Unisalento

CV

Juliana Garrido Damaceno is a PhD Student in 'TEC forecasting model' at the University of Salento, UNISALENTO and Istituto Nazionale di Geofisica e Vulcanologia, INGV, Italy.

Supervisor: Giorgiana de Franceschi - INGV Co-Supervisor: Claudio Cesaroni – INGV. Academic supervisor: Massimo Cafaro – UNISALENTO.

Grantee of: TREASURE project, funded by the European Union's Horizon 2020 research and innovation programme under the Marie SkłodowskaCurie Actions grant agreement No 722023 http://treasure-gnss.eu. Exclusive dedication. The major results expected are a review of the state of art on TEC and scintillation forecasting; the improvement of a short term forecasting model; the validation of the model against actual data under different helio-geophysical environment.

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ABSTRACT

Science is undergoing very rapid changes due to the larger number of people having the opportunity to do science and also with the development of new and revolutionary techniques (e.g. machine learning). The new concepts discovered to end up not gaining the deserved prominence and are quickly discarded. We live in a world where great discoveries have already been made and small new ideas need to be cultivated and developed to rise to their deserved significance.
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SWITCH TEMPLATE