

*Application for the 2017 EMS Outreach
and Communication Award*

Le Train du Climat & ses Messagers



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Context

Back to mid-2014, about a year and a half before the 21st climate conference (COP21¹) held in Paris in Dec. 2015. Plethoric initiatives from diverse origins (national and local public institutions, private companies, non-governmental organizations, schools, etc.) were popping out in France to prepare and participate, directly or indirectly, to one of the most crucial rendez-vous in the international negotiation process about climate change. In such a boiling creative context, COP21 was a great and unique opportunity for the French climate research community at large to think about its role in the ongoing debate and to imagine means and actions to convey climate science into society.

Climate change issues are definitely not a sole question of fundamental science and thermometer to make it short; those encompass research areas in humanities and social science at the core of the imagination and emergence of new sustainable futures for the societies and for the planet. The IPCC² reports, and particularly the 5th, which served as base frame for the Paris negotiations, include a large part of the diversity in the fields of climate science (from pure geophysics to economy and impacts on society and ecosystems). It is the compilation of these results that led to the COP15 international accord to keep global warming below +2°C. This ambition reaffirmed and reinforced with the Paris Agreement implies considerable effort and change from society while questioning roadmaps for future development.

To help contribute to the success of COP21 at the civil society level, the French climate research community identifies its responsibility and legitimacy in the public debate to (i) reaffirm the science facts on which the terms of the Paris Agreement are built, (ii) explain the entire science process and practice that lead climate researchers to ring the alarm bell, and also (iii) provide objective and comprehensive information about research in solutions and possible choices to limit future climate change (societal implications, technological constraints, ethical issues etc.). Within such a context, a group of three climate researchers in geophysics together with a specialist of outreach and communication in science, have imagined a nomadic exhibition about climate change to be installed in a train travelling all over France at the eve of COP21. The target of the exhibition was to cover every facet of science in climate and to embark scientists of diverse expertise (paleo-climatologist, glaciologist, oceanographer, weather experts, economists, sociologists, etc.) to bring comprehensive knowledge about climate change through direct discussion and exchange with all types of public. Education in matter of climate change, from geophysical to societal approaches, is one of the most important issues and challenges for the climate science community, as it is the basement for any democratic evolution that is desirable for our evolving society in response to climate threat and vulnerability.

The “Train du Climat” with its “*Messagers du Climat*” (name for the scientists on board) is born. 19 stops are scheduled all over France from the 6th of October to the 25th, 2015, based on a one-day/one city format (Fig. 1). It was the only event of national importance outside Paris to receive the official “COP 21 event” label.

¹ COP21 = 21st yearly session of the Conference of the Parties to the 1992 United Nations Framework Convention on Climate Change.

² IPCC = Intergovernmental Panel on Climate Change

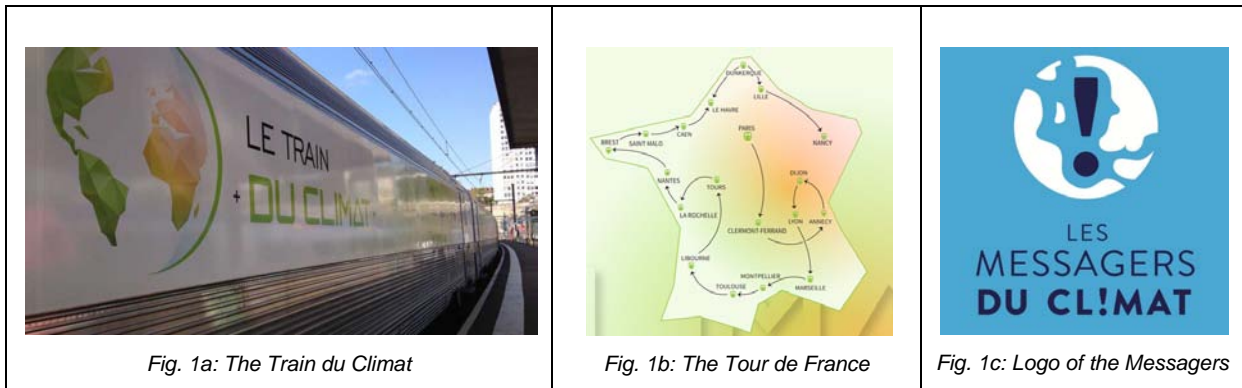


Fig. 1a: The Train du Climat

Fig. 1b: The Tour de France

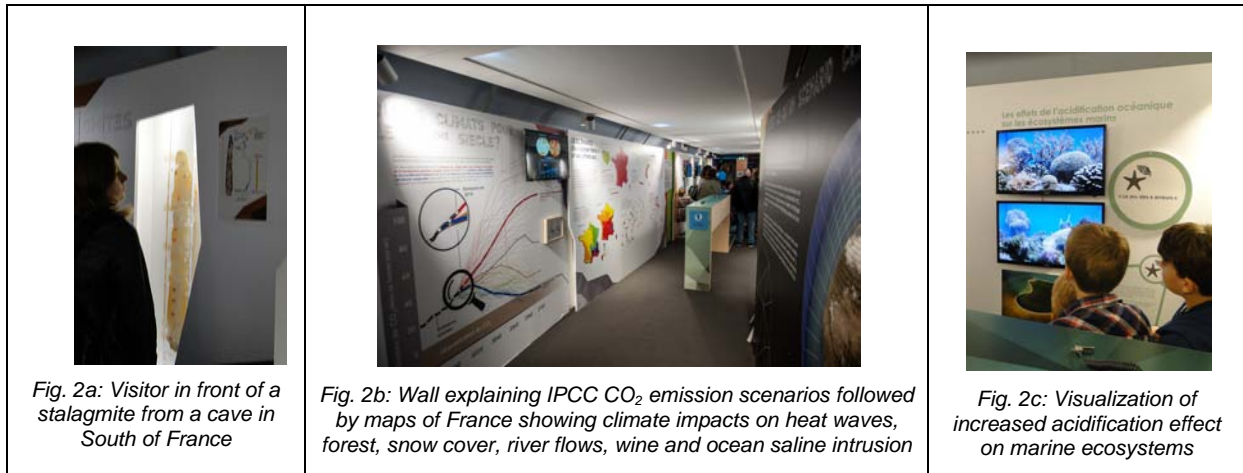
Fig. 1c: Logo of the Messengers

The exhibition on board of the Train du Climat

Imagining an exhibition inside a train is a real challenge, as it must account for all the intrinsic constraints of a railway carriage, in particular the one-way movement of the visitors, the limited space and absolute necessity to avoid jams at any point of the visit. Beyond practical issues, scientific contents must cover all the main facets of climate science to benefit at best from the transdisciplinary expertise of the scientific *Messengers* on board. Said differently, because a *Messenger* is expected to guide visitors, or group of visitors, there is a need for materials and “stations” in the course of the exhibition, in which he/she could fully exploit his/her own expertise as a co-building process of the main messages to deliver about climate change. Linearity and comprehensiveness appear as the two main requirements for the exhibition content in addition to the absolute necessity for a story-telling type of framework to excite “perception and emotion” in visitors. Awareness rising, which leads potentially to decision and action, is a combination of growing knowledge (cognitive system) and incarnation (emotional system) and the exhibition must target both.

Three train carriages were available and the exhibition was built accordingly into three distinctive parts to capitalize on the real physical experience of the visitors to leave/enter into a new space. Understand/Experience/Anticipate was the sequential logics we adopted following a chronological backbone. In the first carriage, climate archives were presented to document the climates of the past (back to ~1 billion of years) and explain the different sources of natural variability at the origin of the observed glacial/interglacial alternation. At the end of the carriage, a special emphasis was devoted to the last millennium and to the instruments available for climate monitoring since the early 1800s. Objects (one sediment core, one stalagmite –Figure 2a-, an old thermometer from ~1870, one XBT oceanographic probe, etc.) and videos on screen were displayed to support written explanations (on wall) and oral exchanges with a messenger. A virtual visit of the first carriage is available at ftp://ftp.cerfacs.fr/pub/globc/exchanges/cassou/EMS/Train/virtual_visit_car1.mp4.

The second carriage started with a description of the industrial epoch and associated constant-rising emission of greenhouse gases due to human activities. The evolution of the CO₂ concentration over the last 150 years or so was contrasted to the past records obtained from ice cores as described in the 1st carriage. Physical processes involved in greenhouse effect and carbon cycle were presented with a special focus on the orders of magnitude and timescales of the observed changes. Emphasis is laid on current climate (interannual variability, extreme events, etc.). Climate modeling was then detailed as well as the different IPCC scenarios of evolution for CO₂ emission. The end of the carriage was devoted to the impacts expected at the end of the century in the business-as-usual (BAU) scenario at both local (France) and planetary scale (global ocean acidification, Figure 2c).



Before entering the last carriage, discussions about the choices for future society were initiated with the public through two symbolic doors, one leading to a dead-end wall and corresponding to the just-described Business-as-usual scenario, and an alternative one opening to the so-called sober scenario to be discussed in Paris and aiming at limiting the global warming at +2°C. Inventories of historical and ongoing CO₂ emissions through different approaches and perspectives (per country, per habitant, per sector etc.) were then provided to set the discussion on facts and raise awareness about the complexity of (i) the climate issues at the core of the negotiations in the COPs and (ii) the solutions, which are all but easy and universal. The third carriage was designed as a space for discussion and debate with the public. Detachable disks, on which a given subject of discussion is stated, were available for the visitors who were expected to choose and grab one and to symbolically bring it to a messenger for debate and exchange (Figure 3). Disks were clustered by domains such as energy, transport, etc. but also ethics and justice issues. The exhibition ended with some philosophical thoughts about humankind.



Importantly, all the above-listed climate facts and knowledge were embedded within a linear narrative thread, which concretely and perceptively tells the story of the human evolution, and consequently the story of the visitor who becomes part of the ongoing scene. As earlier mentioned, it is essential to stimulate emotion and feeling in the public as a necessary and efficient process for assimilation of new and complex concepts. Whenever possible, at several key sectors of the exhibition, examples are thus given about interaction between climate and human development/society. We talk about the colonization of the North American continent through Bering Strait then emerged during the last glaciation, the landscape in France at that period based on cave-painting drawing, the importance of recurrent climate events in triggering the French Revolution in 1789 as detailed in a video starring an historian, the industrial booming in the XIXth century which is materialized through old postcards and pictures and explained through the thoughts of a sociologist and science and technology historian, and lastly, we finish with the concept of anthropocene and climate migrations/refugees. In the second carriage devoted to the impacts of climate change, illustrative examples have been chosen to

resonate in public consciousness, such as change in viticulture and forest, both being deeply anchored in the French cultural heritage.

Within such a framework, the visitor progressively evolved through the cars from being a passive reader or listener passive position of his/her own story (carriages 1 and 2) to becoming an actor of his/her own future or the one of the next generation (carriage 3). He was guided to *understand* the past climate variability, to *experience* ongoing climate change and to get background knowledge to realize what *adaptation* to near-term climate change and *mitigation* measures to reduce CO₂ emissions, objectively mean.

To create such an exhibit and cover all the transdisciplinary fields related to climate issues, social scientists and interdisciplinary scientists³ join the initial 4-people core team specialized in geophysics and mediation in science popularization. Experts in design and technical conception of exhibitions (The Carte-Blanche company) help frame the scenography and were in charge of the practical realization.

Le tour de France of the Train du Climat

The French ministers of Ecology&Environment (Segolène Royale) and Research (Thierry Mandon) who financially support the initiative together with SNCF⁴, the French Railway company, Train-Expos, its subsidiary for public events, and The French Meteorological Society (Météo&Climat-SMF, member of EMS), blew the whistle at the Gare de Lyon in Paris on October 6, 2015 (Figure 4a) and the Train du Climat started its 3-week tour with 42 scientific *Messengers* on board (14 per week) and 7000km/19 stops ahead (Figure 1). In total, the Train du Climat welcomed about 23.000 people who spent on average 90 minutes per visit. Among them, 3500 schoolchildren from elementary to high schools and 1200 elected representatives and decisions makers; they both were the two communities *a priori* targeted. A strong partnership with the Ministry of Education and its regional antenna had been organized accordingly to prepare the visits of students and initiate tutorial projects at classroom level. In parallel, stops in cities had been prepared in advance with the local decisional institutions (local deputies, local representative assemblies, mayors, etc.) as well as local organizations promoting science, to trigger initiatives for the arrival of the train and to ensure relay in communication. In total, 30 TV and 80 radio programs (from news coverage and reports to dedicated shows, Figure 4b) and 620 articles in national and local press have been tracked.



Fig. 4a: Inauguration of the Train du Climat by the ministers of Ecology and Research



Fig. 4b: Interview of a messenger by BFM TV



Fig. 4c: Article in local newspaper

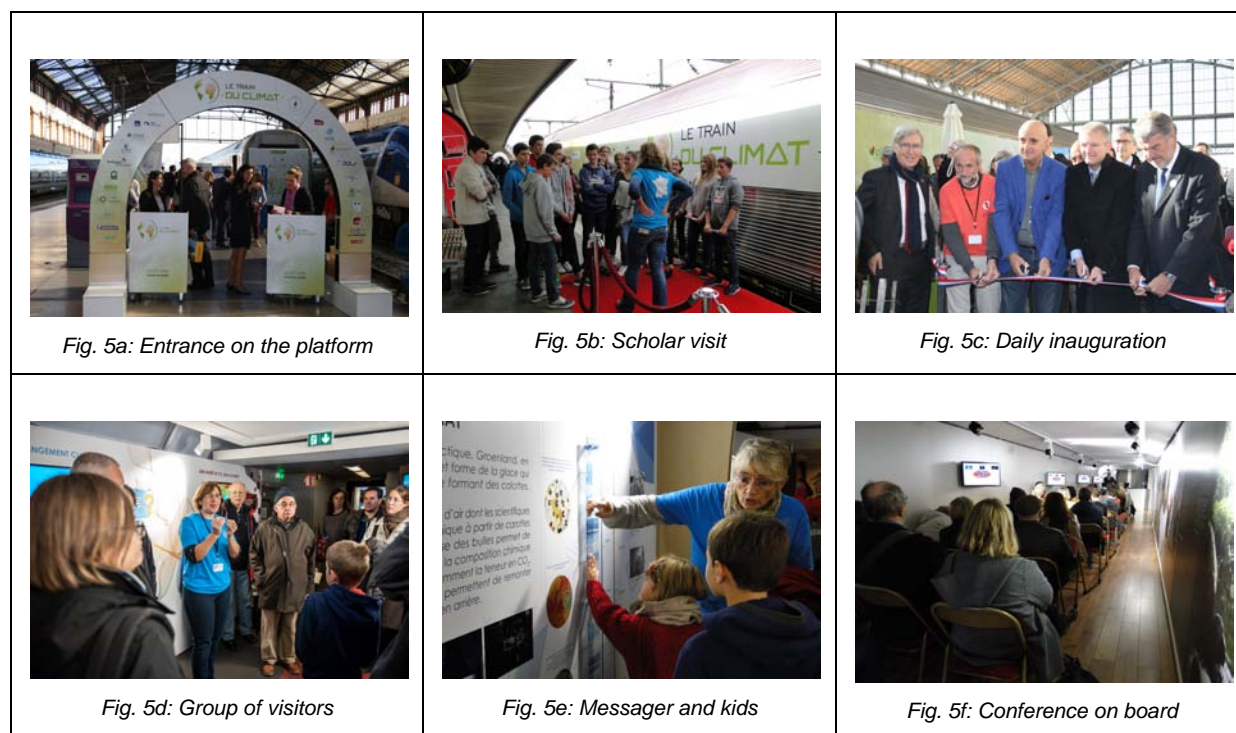
Open from 10.00am to 7.00pm (Figure 5a), a typical and routine day for the Train du Climat included:

- Scholar visits (Figure 5b). Groups of about 15 students were formed at the entrance of the Train and then guided by two *Messengers* "in duty", one for the early part of the exhibition (mostly geophysics) and one for the discussion/debate about solutions and future worlds at the end.

³ Céline Guivarch, Thomas Gasser and Beatrice Coince from CIRED.

⁴ SNCF = Société Nationale des Chemins de Fer

- Dedicated and private visit from 11.00am-12.00 for the elected representatives and the delegations (~50 people on average, Figure 5b).
- Visit of individuals of any ages (Figure 5cde). Series of ~30mn talks given by local researchers from the stopover town were also proposed in a dedicated conference carriage. Topics were adapted to the local issues whenever possible, to increase visitors' interest and perceptions (e.g. talks on sea-level rise in coastal cities, glacier melting in Alpine cities etc.)



The messenger-in-duo format to guide any type of visitors became the standard organization proven to be the most efficient and adequate after several tests and inevitable real-time adaptation. Nevertheless, success was beyond expectation and traffic jams became the worst nightmare of the *Messengers!* Conferences on the platforms as well as all sorts of “games” with the help of local artists were ad hoc designed as buffer to regulate the flow of visitors and school classes (Figure 6).



In addition, a so-called “village” as a showcase for local communities and research involved in environmental issues was organized in most of the cities, especially those of medium size for which the arrival of the Train was a catalyst for initiatives (e.g. Annecy, La Rochelle, Brest, etc., Figure 7). The Train du Climat was labeled as the highlight of the annual science week organized nationwide by the Ministry of Education and Research and which happened this year 2015 to occur during the tour. Altogether, the Train du Climat became the biggest side-event in France, outside Paris, at the eve of COP21.



Fig. 7a: Animation in front of the train station and stands of the "village du climat"

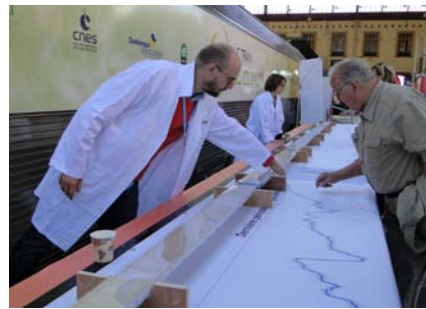


Fig. 7b: Stand of local researcher on platform to promote local universities

Closed to public from 7.00pm, another day started for the *Messagers*: debriefing, experience and best practice sharing, discussions about public reactions and engagements, personal frustrations and rewards etc. before good food, rest, relax time and recovery sleeps on board, while the Train was heading overnight to the next city. A 52-mn film-documentary has been directed and produced by the VideoScopie company and relates the story of the Train and its *Messagers* and visitors (<https://vimeo.com/172668014/9d741ef3b7>).

Seeds for novelty and success

The main goals of the Train du Climat were to advance climate literacy and contribute to science-based policy making and individual actions. At the eve of COP21 negotiations, ambition was therefore for the climate science community at large, to raise public awareness and nationwide citizen mobilization about climate change issues. The goal was to provide objective information and tools as ground for enlightened opinions and choices at individual and collective levels. Success was beyond expectation. It was elegantly summarized by Nicolas Hulot, who became the French minister for ecology&environment in 2017, during his 2015 visit in Saint Malo: *"This train does not work as a particle accelerator but as an accelerator of consciousness and obviously knowledge. It is the best educational outreach tool because scientists make the effort and devote time to meet people directly and provide readily information and facts, which are complex and deterring at first glance"*⁵. Such an accomplishment is due to several factors, as retrospectively analyzed:

- **The "reverse dynamics effect"**: Outreach and communication by scientists are often done through conferences, invited speeches in schools and universities, in fairs, festivals, through articles, TV programs, etc. "Honored guest" is the traditional hat for scientists put on a pedestal that seems out of reach for the general public. A reverse process is acting with the Train, as the scientist becomes the host and the public is the guest. Symbolically, Science is brought "at home", at least in a familiar place in people's daily life that is a train station, whose social meaning is also deeply present in the French culture. There is no intermediary in discussions and unconscious hierarchy is thus minimized. Exchange/open communication founded on trust and co-listening is easier because scientists, as *Messagers* in the Train, are receptive to the perspectives and concerns of the general public. They are adapting in real-time to their audience, rather than simply "teaching" scientific facts and knowledge and "dismissing" the misconceptions. As a consequence of the reversed dynamics effect, people from all social categories and educational levels visited the Train. This is opposed to usual and more traditional public attending conferences for instance, who is often aware enough for enlightened thoughts and actions about climate. "You are just like everyone else and accessible" was one of the most common thankful and rewarding feedbacks from visitors at the end of their visit.

⁵ « Ce train fonctionne non pas comme un accélérateur de particules mais comme un accélérateur de conscience et visiblement de connaissance. C'est le meilleur outil pédagogique qui soit parce que les scientifiques font l'effort d'aller vers les citoyens et de rendre accessible des connaissances ou des points de vue qui peuvent parfois être un peu complexes et rebutants. » Nicolas Hulot.

- **The “community effect”:** effective communication about climate change requires transdisciplinary knowledge to account for the true complexity of climate science and related issues. Accordingly, the *Messengers’* shifts on board were carefully planned to benefit from all specialities (from geochemist, climate modelers to economist, etc.) at the same time, in order to cover at best the different aspects of climate science. Such an organization, in line with the narrative thread of the exhibition, demonstrated to the public that groups of different expertise and motivation could come together behind a worthy cause. Although being strongly supported by their own research institute or laboratory (13 in total), all the *Messengers* appeared as a single entity in the Train and this team-building perception reinforces the meaning of the initiative. Not only does this considerably help to talk about the consensus of the scientific community on climate change, but it also contrasts with the dominant mainstream way of communication in media, based on the promotion of individual’s work/finding, which can artificially nurture climatesceptics.
- **The “tunnel effect”:** Like an “initiation rite”, the visitor had to pass through all the stages of the exhibition with no way to escape or go back once entered inside the Train. This constraint was particularly interesting during the visit of the elected representatives and decision makers who are usually in rush and not self-committed. During an hour or so, they were trapped and forced to listen about science facts but also, as importantly, about the process of doing science. Highlighting the scientific methods, logics and rigor in our communication effort is a challenge and the tunnel effect helps convey the iterative process in building knowledge and understanding in science.
- **The “regional effect”:** France is a very centralized country with many more initiatives held in Paris than outside. The Train du Climat was perceived as a declination of an international event, here COP21, at regional scale, ensuring both legitimacy and great opportunity for local communities to get involved and mobilized. This was particularly striking in medium-sized cities where side-events organized on the day of the train stop (“village du climat”, public debates, etc.) got a lot of attendance and success. Anecdotically, presence of social activists at almost all stopovers illustrated the window of opportunity provided by the Train to shed light on claims and local concerns through the nationwide and regional media coverage.

Beyond success with the general public, the Train du Climat also created a great enthusiasm and group dynamics among the *Messengers* on board. Sharing expertise, views and experience as well as reciprocal curiosity, were very formative at individual level because of the intrinsic interdisciplinarity of the group. Analogy can be made with oceanographic cruise for which a team of scientists of different specialties is embarked on a common vessel and works on the same general theme but through the prism of their individual expertise and interest. The Train du Climat thus was a rail cruise sharing many perceptions and daily life constraints with an oceanographic campaign: a moving vessel, an organization based on shifts, a co-building and co-learning spirit, a disconnection with the outside world during the few days of duty, etc. It turns out that the co-building and “caring” spirit between the *Messengers*, as a **bottom-up** process of creation, has been retrospectively analyzed as a tremendous plus for the success in exchange and communication with the visitors. As a side, it is also interesting to really experience the fact that a same story with a same support (here the exhibition) can be told quite differently depending on the sensibility/background of the *Messengers*. This shed light on philosophical and psychological questions about outreach in science and in particular, the role of scientists, as individuals, in communication to general public.

Seeds for new initiatives

Train du Climat in Morocco

Inspired by the success of the French experience, ONCF⁶, the Moroccan National Railway Company, decided to organize a Train du Climat at the eve of COP22 held in Marrakech in late 2016. A dedicated work has been done by the team of specialists in science communication who worked on the French train, including a French scientific journalist, together with the Moroccan scientific community to adapt the exhibition to the most relevant climate issues for the country (drought, water

⁶ OCNF : Office National des Chemins de Fer au Maroc

resources, solar energy development, etc.). Texts have been translated in Arabic and examples for impacts induced by climate change have been chosen to match the collective and cultural heritage of the Moroccan visitors. The last part of the exhibition devoted to adaptation and mitigation strategies has been revisited to fit to the Moroccan society whereas most of the geophysical contents has been kept and only translated. The tour included 12 stopover cities all over Morocco and the train stayed in Marrakech train station during the entire COP to welcome international delegations (Figure 8).



Fig. 8a: Train du climat at Marrakech



Fig. 8b: The tour of Morocco

56 Moroccan *Messengers* (14 per week) were present on board to welcome and guide the general public, the scholars and the decision-makers/elected-representatives. Unlike the French *Messengers*, most of them were either master or PhD students working on climate-related fields and few researchers/teachers from universities and institutes supervised them. A short training in outreach & communication was organized before the tour by the French science communication team (VideoScopie production) to get familiar with the exhibition and to improve communication skills. Three French *Messengers* participated to the Moroccan tour of the Train. Success was huge with around 30.000 visitors. Jams were very common inside and outside the Train, which got victim of its own success (Figure 9). Provided cultural differences, the huge interest and craze about the train as well as the feedbacks from the public were kind of similar to the French edition. This proves the pertinence and adequacy of the concept for a nomadic exhibition in a train and very importantly, for the presence of scientists to readily explain its content and to convey objective messages.



Fig. 9a: Visit in the train du climat in Morocco



Fig. 9b: Same as 9a



Fig. 9c: Waiting line on platform in Morocco.

Train du Climat “Science, Solutions et Territoires”

A new train built on the outcome and expectation of the first edition in 2015 has been created and inaugurated last March in Paris (Figure 10). The “time of alert” and recognition for human influence on climate is over and a new area towards actionable initiatives and transitions is on its way. The evolving maturity of the train follows such a trend and, although the general concept is kept, greater emphasis is laid on solutions (adaptation/mitigation strategies). The exhibition has been accordingly revisited with a more extensive focus on how research can contribute to emerging thoughts, concepts and implementation for transitions as well as new societal models. In addition, an app named “Les

"Gardiens du Climat" has been created for children so that they can follow adapted contents of the exhibition in the course of their visit (flash code available at different stages).



Fig. 10a: The new Train du Climat "Science, Solutions et Territoires"



Fig. 10b: Inauguration day with the Minister of Research and General Secretary of SNCF



Fig. 10c: "Les gardiens du Climat" App for 5 to 12 year old children to be activated on board.

Even if the new train is a nationwide initiative through renewed partnership with the Ministry of Education/Research, the Ministry of Ecology and SNCF, a territorial approach is imagined with a succession of regional tours to eventually cover the entire country between late-2017 and early 2019. Stopovers of 2-3 days with priority to small-to-medium size cities will be the standard format and the actual tour is on progress. Side events will be organized in construction with local actors in order to shed light on regional initiatives. Strong implication of local elected representatives and decision makers is expected and the train is expected to foster exchanges and debates between researchers, general public, NGO etc.

Of course, scientific *Messengers* will be present on board preserving the originality and novelty of the Train concept. The diversity of expertise will be promoted again and because the project is much more ambitious than its 1st edition, PhD students and post-doctors will be encouraged to enroll. Training session on communication will be organized as part of their academic cursus to value their experience on the Train.

May the Train du Climat have a long journey to go!