Hands-on exhibits/experiments

To illustrate all the topics interactively, various hands-on activities and experiments will be developed. A few ideas are listed here:

a. **CO_2 heat capture**: to demonstrate that CO_2 traps heat, an infrared camera visualises temperatures of an object. Once CO_2 is applied between the object and the camera, the object disappears from the camera's view. (with Prof N. Gruber, D-USYS)

b. **Interactive carbon cycle**: cog wheels represent the connection between slow and fast components of the global carbon cycle. Slight turns on a large wheel (e.g., fossil fuel carbon in sedimentary rocks) can result in a full rotation of a smaller wheel (e.g., atmospheric CO_2), showing the sensitivity of the carbon cycle to anthropogenic perturbation. (with PI)

c. **Extreme climate event simulator**: based on chapter 11 in the 6th IPCC report and results from the MESMER-X project, a simulation shows how visitors' choices of CO_2 reduction/increase (e.g., reducing fossil fueled mobility) lead to more or less intense and frequent extreme climate events (e.g., heat waves, drought, and heavy rainfall). (with Co-applicant)

d. **Carbon calculator & priority evaluator**: based on a survey by the Swiss Mobility Panel, the exhibit raises awareness on the true costs and effects of visitors' actions in terms of money and CO_2 emissions. To do so, visitors submit their mobility choices and living situations to calculate their carbon footprints. They then explore how much CO_2 they can reduce by changing various life aspects and behaviours. (with Prof T. Bernauer, D-GESS)

e. **CO_2 energy fluxes & reservoirs**: fluxes of CO_2 and energy reservoirs are visualised in an animated diagram. Visitors 'play' with different fluxes and reservoirs by taking CO_2 reducing actions and immediately seeing how flows and storages change. (with Prof M. Saar, D-ERDW; Dr G. Giudati, Energy Science Center, ETH Zurich; Prof T. J. Schmidt, Paul-Scherrer-Institute)

f. **CO_2 in the city**: in a 3D model of Zurich submerged in a liquid, CO_2 emissions from different sources such as traffic, households and industry are visualised by infusion of ink to see spatially and temporally variable effects (e.g., daily rush hour, seasonal heating). (with Prof D. Brunner and Dr Christoph Hüglin, empa)

g. **Interactive table 'restoration potential'**: visitors interact with global restoration potential data using a multitouch screen and infrared-traced tokens. The aim is for visitors to see how nature was destroyed over the course of human settlement and which actions – conservation, sustainable management, restoration – allow us to store CO_2 in our natural environment. (with Prof T. Crowther, D-USYS; Restor; Prof J. Späth, Zurich University of the Arts (ZHdK))

h. **City Analogues**: Visitors match a city's future climate to another city's climate today. This results in city pairs (e.g., Zurich and Milano), where Zurich's climate in 2050 will resemble Milano's climate today. (with Prof T. Crowther, D-USYS)

i. **Forest simulator**: visitors shape a digital forest according to their ideas of what purpose a forest should fulfill. The simulation shows which tasks and utilisation requirements (e.g., carbon sequestration, ecological value, recreational benefit) exist, how they are interrelated, partly competing or interdependent. (with Prof A. Grêt-Regamey, D-BAUG; Waldlabor Zürich; Museum Burghalde, Lenzburg; Incolab)

j. **Forest virtual reality / CO_2 visualisation**: visitors take a stroll in a virtual forest where fluxes of CO_2 become visible and different processes that are important for CO_2 removal from or emission into the atmosphere (e.g., photosynthesis, one's own breathing) can be explored in detail. (with Prof V. Griess, D-USYS)

k. **Soil profiles**: display of several real soil profiles with relevance for understanding how soils act as a carbon sink and can thus help mitigate climate change with a particular focus on the soil landscapes of central Europe and Switzerland. (with Prof S. Dötterl, D-USYS)

l. **Mini solar refinery**: the solar refinery at ETH Zurich is rebuilt in small-scale. Visitors interact with the model using a button to trigger actions and to watch explanatory movie excerpts to trace step by step how synfuel is produced and eventually used to fuel flights. The exhibit showcases a truly sustainable, closed CO_2 cycle. (with Prof A. Steinfeld, D-MAVT)

m. **Earthquake simulator:** the already existing earthquake simulator is connected to the CO_2 exhibition by incorporating induced seismicity. This is related to the topic of underground CO_2 storage (risk of causing such earthquakes) as well as the Swiss Seismological Service's (SED) monitoring activity accompanying underground CO_2 storage research. (with SED)

n. **Underground CO_2 storage**: a basalt drill core is displayed with pores filled with the mineral that forms when CO_2, directly captured from the air and mixed with water, is pumped into the subsurface and reacts with the basalt. (with Climeworks)

o. **Rock permeability (underground CO_2 storage):** storing CO_2 underground requires rock with a high permeability. The exhibit illustrates how air (analogue for CO_2 containing fluid) flows through rock and allows visitors to explore the permeability and hence storage capacity of sandstone. (with Dr P. Pilz, GFZ Potsdam)

p. **CO_2-bearing concrete vs. conventional concrete:** CO_2 can also be stored in products. A new technology allows for it to be inserted into concrete (e.g., used for buildings). Visitors can compare the new and conventional concrete. (with Neustark)

q. **Climate mitigation strategies:** the installation allows visitors to explore (and try out) potential impacts of climate mitigation technologies (e.g., carbon capture). (with J. Sleigh, Department of Health Sciences and Technology)

r. **Visitor's opinion:** Visitors contribute to the exhibition and potentially to research questions by responding to survey questions regarding climate action. The answers are displayed for peer visitors to observe and discuss.

Activities during the exhibition

All the activities will be conducted by the museum staff, scientists from ETH Zurich and the ETH Domain, the University of Zurich (UZH) and other project partners. They will include:

A) A vernissage with press-coverage and talks.

B) Public guided tours for visitors of all ages including themed guided tours that address specific CO_2 and climate topics.

C) Workshops for visitors of all ages, for school classes, for teachers and within the Ferienplausch Zürich und Umgebung. One will be the game Sarnetz (originally designed as a board game by ETH Zurich in the framework of Zernez 2020, that will be run together with Lucerne University of Applied Sciences and Arts).

D) School materials with worksheets and activities, downloadable for free from the fT website.

E) Public science talk series including discussions to deepen specific CO_2- and climate related topics.

F) 'Geology in fairy tales': science and culture afternoons for kids and their families , including fairy tales, music as well as experiments on CO_2 and climate; in cooperation with the Swiss Fairy Tales Association.

G) 'Meet the Scientist': an activity for school classes (Sekundarstufe II), where pupils interact with scientists, visit their laboratories and experience a guided tour through the CO_2 exhibition.

H) Excursions, e.g., to the Waldlabor Zürich.

I) A program on CO_2 and climate including experiments at Zurich's Long Night of the Museums, Scientifica (Zurich Science Days of ETH Zurich and UZH) and the Zukunftstag ETH Zurich.

J) MSc / BSc thesis and student projects with scientists from ETH Zurich (Prof M. Stauffacher, D-USYS) and ZHdK (Prof J. Späth).

K) Training students in science communication and outreach activities.