**EarthCARE: Cloudy with a chance of Aerosols**

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| Image | Text |
| **10:00:00:00*** **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA (9shots)**
 | **VO: After years of development and a rigorous testing programme EarthCARE is now ready to be shipped from the German Airbus cleanroom to the US for launch.**  |
| **10:00:11:17*** **EarthCARE Mission animations, EarthCARE over Japan – July 2022 ©ESA/ATG Medialab**
 | **TITLE: EarthCARE** |
| **10:00:16:00*** **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA (2shots)**
 | **EarthCARE is a new Earth Explorer with a focus on clouds and aerosols and has been developed by ESA and the Japanese Space Agency JAXA.**  |
| **10:00:25:01*** **Soundbites: Simonetta Cheli, Director of Earth Observation Programmes, ESA - 01 Februari 2024 - Frankfurt, Germany ©ESA**
 | **Simonetta Cheli, Director of Earth Observation Programmes, ESA:**EarthCARE is an Earth Explorer mission, the sixth of the series, and it's a mission that it's devoted to Earth science,to a topic very important currently in the climate change context is the Earth's radiation budget measurement.// It will do that through very strong international collaboration, as we have Jaxa, the Japanese space agency, that it's one of the partners of this mission |
| **10:00:47:10*** **EarthCARE Mission animations, ESA’s cloud and Aerosol mission – July 2022 ©ESA/ATG Medialab**
* **EarthCARE Mission animations, EarthCARE measuring clouds and Aerosols – July 2022 ©ESA/ATG Medialab**
 | **VO: From space, EarthCARE will shed new light on the role that clouds and aerosols play in regulating the Earth’s climate.**  |
| **10:00:55:16*** **Soundbites: Thorsten Fehr, EarthCARE Mission Scientist, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA**
 | **Thorsten Fehr, EarthCARE Mission Scientist, ESA:**Clouds are fundamental for understanding our climate. If you look at the cloud system, it is basically still one of the biggest unknown that we have to in the prediction of the climate and how the complete climate system is working.[00:00:30][12.4] |
| **10:01:07:21*** **rays-of-the-sun-make-their-way-through-the-branches-SBV-336482750-4K ©Storyblocks**
* **EarthCARE Mission animations, Earth radiation budget – July 2022 ©ESA/ATG Medialab (2shots)**
* **cloudy-sky-becomes-sunny-clear-SBV-327484002-4K ©Storyblocks**
* **EarthCARE Mission animations, Earth radiation budget – July 2022 ©ESA/ATG Medialab (2shots)**
 | **VO: As energy from the sun reaches our planet some is absorbed, scattered and reflected inside the atmosphere before it reaches Earth’s surface. Clouds and aerosols play an important role in this process.****The Earth’s surface emits thermal radiation back to space, and again clouds and aerosols play a role in how much heat is trapped and how much heat escapes.** |
| **10:01:31:06*** **Soundbites: Thorsten Fehr, EarthCARE Mission Scientist, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA**
 | **Thorsten Fehr, EarthCARE Mission Scientist, ESA:**So clouds have both a cooling and a warming effect. So this is why we have to investigate them so closely.  |
| **10:01:37:03*** **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA (3shots)**
 | **VO: And EarthCARE’s suite of four instruments will work together to help us understand much how more about Earth’s energy balance.** |
| **10:01:44:22*** **Soundbites: Dirk Bernaerts, EarthCARE Project manager, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA**
* **EarthCARE Mission animations, inside earthcare – July 2022 ©ESA/ATG Medialab (3shots)**
* **Soundbites: Dirk Bernaerts, EarthCARE Projectmanager, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA (3shots)**
* **EarthCARE Mission animations, EarthCARE measuring clouds and Aerosols – July 2022 ©ESA/ATG Medialab (3shots)**
* **EarthCARE Mission animations, Earth radiation budget – July 2022 ©ESA/ATG Medialab**
* **Soundbites: Dirk Bernaerts, EarthCARE Projectmanager, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA (3shots)**
* **EarthCARE Mission animations, inside earthcare – July 2022 ©ESA/ATG Medialab**
* **EarthCARE Mission animations, EarthCARE measuring clouds and Aerosols – July 2022 ©ESA/ATG Medialab (2shots)**
 | **Dirk Bernaerts, EarthCARE Project manager, ESA:**We have four instruments. Each of them is complementary to the other parts. We have the cloud profiling radar, CPR from, Jaxa. And this is a radar that looks inside the cloud. It looks rain, ice, but inside a cloud. Then we have atlid, it's a lidar. It uses a laser instead of radio signals and it sees what would be the thin atmosphere. // There is a third instrument, which is, MSI multispectral imager It sees the bigger scene. //We process the data, // and we predict how much heat, energy, radiation is going back into space.. And this we compare with the fourth instrument, BBR, the broadband radiometer. // And then by comparing it and seeing what we have to modify, we can improve the models. |
| **10:02:38:00*** **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA (2shots)**
 | **VO: EarthCARE is the largest and most complex Earth Explorer mission to date and a testament to international cooperation.**  |
| **10:02:45:15*** **Soundbites: Eiichi Tomita, EarthCARE/CPR Project Scientist, JAXA – november 2023 – Frascati, Italy ©ESA**
 | **Eiichi Tomita, EarthCARE/CPR Project Scientist, JAXA:**ESA and Jaxa have built a good cooperative relationship, including both industries. With this good cooperative relationship, we will proceed, launch and initiative operation campaign shortly and we achieved mission success. |
| **10:02:55:09*** **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA (3shots)**
* **EarthCARE Mission animations, EarthCARE measuring clouds and Aerosols – July 2022 ©ESA/ATG Medialab (2shots)**
 | **VO: Soon it will launch and the data will prove to be vital for climate research, improving the accuracy of climate models and will even support numerical weather prediction. It is a state-of-the-art mission, filling gaps in Earth system science while demonstrating new space technologies.**  |
| **10:03:13:23** | **ESA OUTRO** |
| **10:03:28:12** | **END** |
| **Soundbites: Simonetta Cheli, Director of Earth Observation Programmes, ESA - 01 Februari 2024 - Frankfurt, Germany ©ESA** | **2024.001\_ESA\_EARTHCARE\_BR001\_Interview Simonetta Cheli\_EN****Simonetta Cheli:**[00:00:05]Simonetta Cheli, director of Earth observation Programs of the European Space Agency. [00:00:08][3.8]**Simonetta Cheli:**[00:00:12]EarthCARE is an Earth Explorer mission, the sixth of the series, and it's a mission that it's devoted to Earth science, to a topic very important currently in the climate change context is the Earth's radiation budget measurement. It will do that through very strong international collaboration, as we have Jaxa, the Japanese space agency, that it's one of the partners of this mission, with the contribution in kind of a cloud profiling radar, one of the four instruments onboard the mission. We also have a collaboration among many European countries for the program, which is future EO, where all the 22 countries of ESA contribute and participate. On top of that, the collaboration is the one with industry because Airbus, Airbus germany is the prime contractor on this mission in the development and has been working the last 15 years to develop this mission with over 75 industrial contributions at European level. Last but not least, the collaboration will be immense and major on the exploitation of the data from the science community worldwide in terms of using those data free and open to support all what is needed in terms of information for supporting climate change challenges, but also in terms of uses worldwide that we want to use those data for any of those benefits. [00:01:30][77.8]**Simonetta Cheli:**[00:01:34]Yeah, Earth explores like EarthCARE are missions which are developed in the context of the Earth science missions, the missions which have a primary scientific objective, which is based on user requirement coming from the scientific community. They're also validated through a long process of selection, which includes the advisorship of a committee, a science one in ESA and decision by relevant member states. So it's explorers are missions that in fact are one off in principle, but with a strong potential to become in the future operational missions. Earth care, in particular, was conceived by the science community to respond to challenges associated with the monitoring and mitigation of Earth's radiation budget, which is today, after 15 years of development. Very timely in terms of contribution to what we need to do. Sea temperatures, land temperatures are rising and we need to understand better the interaction between clouds, aerosols and precipitation. And that's exactly what EarthCARE will do. [00:01:34][0.0][81.6] |
| **Soundbites: Dirk Bernaerts, EarthCARE Projectmanager, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA** | **2024.001\_ESA\_EARTHCARE\_BR002\_Interview Dirk Bernaerts\_EN****Dirk Bernaerts:**[00:00:05]I'm Dirk Bernaerts. I'm the EarthCARE project manager at the European Space Agency ESA. [00:00:09][4.0]**Dirk Bernaerts:**[00:00:13]The uniqueness of EarthCARE is that it has indeed four, different instruments that each give valuable information. But the real strength is that it's the combination of these measurements at the same location at the same time. We are observing clouds and clouds are changing continuously. And they're very locally, very local. So when you do measurements, it's important to be at the same location at the same time, because then you know that each instrument is measuring at the same time. We have four instruments. Each of them has a function. Each of them is complementary to the other parts. We have the cloud profile, profiling radar, CPR from, Jaxa. And this is a radar that looks inside the cloud. It looks rain, ice, but inside a cloud. Then we have atlid, it's a lidar. It uses a laser instead of radiosignals and it sees what would be the thin atmosphere. It's the, the top of the clouds, but also the very haze and, fog of particles. Clouds of particles outside the clouds. There is a third instrument, which is, MSI multispectral imager different from the the previous two instruments. It sees the bigger scene. If we use, the data from MSI, we can extrapolate from the other images. The other instruments are producing. We can make it bigger and look over a bigger, skill. And it's, it takes basically images in the visual and the infrared part of the light. The results of those three instruments we put into the processing, data. We process the data, we put it into the models of mathematical models, and we predict how much heat, energy, radiation is going back into space that we would expect goes back into space from this point. And this we compared with the fourth instrument, BBR, the broadband radiometer, that we can compare the measurements with, with this. And then by comparing it and seeing what we have to modify, we can improve the models, our understanding of what is happening, in the atmosphere, but also that we can improve the models, which then will be beneficial for, the weather and the climate predictions, later on. [00:02:33][140.1][00:02:37]So the launch campaign is important, to prepare the spacecraft while it is here in Airbus to, the, the actual moment of launch. And what does it mean? First, the spacecraft will be packed inside these, storage containers. It will be transported, prepared, transported, and then on the launch site itself, the spacecraft will, it will be first unpacked. But we have to clean it. We have to, check that everything is still functioning, that everything is ready for launch. We have to remove all the items that, should not be launched. The spacecraft has to be fuelled, so the propellant has to be loaded inside the spacecraft. In atlid, for instance, there are certain elements that need to be pressurised. And all that we do as close as possible to the launch. So we prepare the spacecraft. Then the spacecraft is mounted on top of the adaptor and, the upper part of the launch vehicle. The fairing is closed. Is encapsulated, we call it. The whole upper stage is then transported and integrated with, the rocket. And then this one moves to the launch pad and, straightened up and launched. [00:03:49][72.8]**Dirk Bernaerts:**[00:03:53]So I'm obviously very excited about just the launch itself, because it's the the culmination of years of years of work. And when this is successful and we are confident it will be, the it it means that we have done our job in the previous years. Correct. But I'm also very excited to see the results of EarthCARE. The results of EarthCARE, the measurements, they will be going first to teams that will verify and see how good and bad, and what we have to tune on the instrument to, to deliver good data. But then that this data, once it's good, goes to the scientific, community and that they can, learn how our climate works, can learn how clouds impact and, the clouds and aerosols, the dust can impact our thermal budget, our how warm it is on the Earth, and that we can contribute to understanding, but also seeing how we can move forward, with respect to the climate change. I think this is a very exciting, topic and is very exciting to work for, for that. [00:05:02][68.9]**Dirk Bernaerts:**[00:05:05]EarthCARE is white because it flies quite low. It flies below 400km. And, if you are at that altitude, that is still remaining part of, the atmosphere present, and not in the state that we know it here, but in the form of atomic oxygen, which is very reactive. It basically, would attack the external thermal isolation of the spacecraft. So you need special materials to be resistant against that. And it turns out that a material that is very good, in doing that, is white. And that's the one that we use, on EarthCARE. But you can see that in a lot of spacecraft, including, for example, the International Space Station, if you look a lot of it is white and a lot of spacecraft that are flying higher, they are more the, the copper gold colour of MLA or black, but it's related to the height. [00:05:05][0.0][285.8] |
| **Soundbites: Thorsten Fehr, EarthCARE Mission Scientist, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA** | **2024.001\_ESA\_EARTHCARE\_BR003\_Interview Thorsten Fehr\_EN****Thorsten Fehr:**[00:00:05]My name is Thorsten Fehr, and I'm the EarthCARE mission scientist. So my role is basically to translate between the engineers and the scientists that will then use the data. [00:00:14][9.3]**Thorsten Fehr:**[00:00:17]Clouds are fundamental for understanding our climate. If you look at the cloud system, it is basically still one of the biggest unknown that we have to in the prediction of the climate and how the complete climate system is working. So why we know that, for example, the greenhouse gases have a certain effect. We know the physics of them quite, quite good already. On clouds it's quite different. So here the uncertainties are still quite high on what we know. And this of course, is important for us to also project into the future. How will the climate change, how will the clouds with climate change change? [00:00:48][30.8]**Thorsten Fehr:**[00:00:52]So clouds have both a cooling and a warming effect. So this is why we have to investigate them so closely. So it's not that we look at one kind of clouds, and then we know that the clouds in general do cool or heat, it's quite the difference. So some clouds are heating and some clouds are cooling. More clouds, bright clouds reflecting a lot of sun back into into space and are cooling while other high ice clouds, for example, they are trapping the heat between the surface and the cloud itself. And they're warming. And it's this interplay between those different kind of clouds that we are trying to further investigate. And then with gained knowledge, also improve our climate predictions. [00:01:31][38.7]**Thorsten Fehr:**[00:01:35]So scientists are talking about the age of convection, in the sense that now our understanding of the climate, our understanding of the models in particular, are now at this place where we can, for example, in models, directly resolve these clouds. So far, the models had a horizontal resolution. So that's basically the grid on which all of those sort of calculations are being done. We're relatively widely spaced apart, so they were much wider than what we would consider a typical cloud. So now the models, even the global models, are the stage where they can resolve all of those clouds. And this is why we're talking about the age of convection. Convective clouds are smaller scale. And now we can basically use directly the data coming from EarthCARE without manipulating it too much. So we can directly use basically EarthCARE as it is, we don't have to interpolate. And that is really making a big difference because it reduces uncertainties. So this is why we're talking about the age of convection. We try to better understand the role of convection in the climate system. Also using tools or satellites like EarthCARE. [00:01:35][0.0][78.8] |
| **Soundbites: Interview Björn Frommknecht, EarthCARE Mission Manager, ESA -01 Februari 2024 - Frankfurt, Germany ©ESA** | **2024.001\_ESA\_EARTHCARE\_BR004\_Interview Björn Frommknecht\_EN****Bjorn Frommknecht:**[00:00:05]My name is Bjorn Frommknecht and I'm theEarthCARE mission manager. [00:00:08][2.9]**Bjorn Frommknecht:**[00:00:11]So, what is really special and unique about EarthCARE is that it will be the first mission to observe cloud and aerosol profiles at the same time, at the same location, together with complementary information from the multispectral imager and the broadband radiometer. So actually, what it will allow us to do is to, measuring the cloud inertial profiles, and then we can simulate which radiation should arrive at the position of the satellite, if our models were right. And then we can compare to the direct measurements and then, learn the errors we have intrinsic in our models and can improve them. [00:00:52][41.2]**Bjorn Frommknecht:**[00:00:56]So, actually, a first of its kind is definitely, the CPR Doppler measurement, which allows us to see not only a cloud profile, but vertical motion inside the cloud. So if it's raining, upwelling and so vertical motion of, of water droplets and also ice particles. [00:00:56][0.0][44.2] |
| **GV’s EarthCARE in cleanroom - Airbus Defense & Space, Frankfurt, Germany 1 -Februari 2024 ©ESA** | **2024.001\_ESA\_EARTHCARE\_BR005\_EarthCARE cleanroom footage** |