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The Changing-Atmosphere Infra-Red Tomography Explorer CAIRT – a proposal for an innovative whole-atmosphere infra-red limb imaging satellite instrument

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To improve our knowledge of the coupling of atmospheric circulation, composition and regional climate change, and to provide the urgently needed observations of the on-going changes and processes involved, we have recently proposed the Changing-Atmosphere Infra-Red Tomography Explorer (CAIRT) to ESA as Earth Explorer 11 candidate. CAIRT will be the first limb-sounder with imaging Fourier-transform infrared technology in space. By observing simultaneously the atmosphere from the troposphere to the lower thermosphere (about 5 to 115 km altitude), CAIRT will provide global observations of temperature, ozone, water vapour, as well as key halogen and nitrogen compounds. The latter will help to better constrain coupling with the upper atmosphere, solar variability and space weather. Observation of long-lived tracers (such as N₂O, CH₄, SF₆, CF₄) will provide information on transport, mixing and circulation changes. CAIRT will deliver essentially a complete budget of stratospheric sulfur (by observations of OCS, SO₂, and H₂SO₄-aerosols), as well as observations of ammonia and ammonium nitrate aerosols. Biomass burning and other pollution plumes, and their impact on ozone chemistry in the UTLS region, will be detected from observations of HCN, CO and a further wealth of volatile organic compounds. The potential to measure water vapour isotopologues will help to constrain water vapour and cloud processes and interactions at the Earth's surface. The high-resolution measurements of temperature will provide the momentum flux, phase speed and direction of atmospheric gravity waves. CAIRT thus will

provide comprehensive information on the driving of the large-scale circulation by different types of waves. Tomographic retrievals will provide temperature and trace gas profiles at a much higher horizontal resolution and coverage than achieved from space so far. Flying in formation with the Second Generation Meteorological Operational Satellite (MetOp-SG) will enable combined retrievals with observations by the New Generation Infrared Atmospheric Sounding Interferometer (IASI-NG) and Sentinel-5, resulting in consistent atmospheric profile information from the surface up to the lower thermosphere. Our presentation will give an overview of the proposed CAIRT mission, its objectives and synergies with other sensors.