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OBITUARY

Distinguished Air–Sea Interface Explorer Lutz Hasse (1930–2016)

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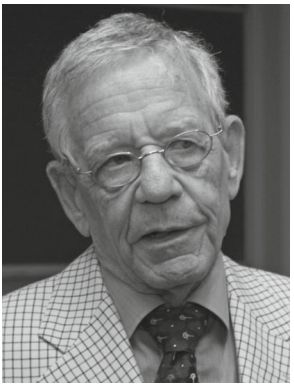

Photo by Andreas Villwock, GEOMAR

Lutz Hasse passed away on 1 March 2016. Throughout his long scientific career he critically contributed to the understanding of marine boundary-layer physics and its implications for weather and climate predictions. He was one of the "Mohicans" of marine meteorology whose expertise covered the discipline from end-to-end: from instrument design and field experiments, to theoretical analysis and climate applications. During the 1980s and 1990s, Lutz Hasse was a member of the Editorial Board of "Boundary-Layer Meteorology", and in which he published the majority of his seminal papers.

Lutz Hasse graduated from the University of Hamburg under the supervision of Prof. Karl Brocks, and his co-referent Hans Ulrich Roll. The late 1960s and 1970s were the "golden age" of boundary-layer physics when theoretical developments of the 1950s and early 1960s started to be used in conjunction with observations under natural conditions. Advances came

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thick and fast. During this period, Hasse joined a group of boundary-layer researchers who were to define this field for many years to come. Hasse's works, most of which were published as solo author papers, touched many of the critical areas of boundary-layer science and air–sea interaction.

In 1971, he was likely the first to construct a conceptual model of the marine skin layer and designed an elegant parametrization of temperature deviations across the cold skin. This parametrization, based on a simple relationship for the effective thermal diffusivity, is still used for computing turbulent sensible and latent fluxes. Hasse was one of the organizers of the 1969 ATEX (Atlantic Trade Wind Experiment) experiment, one of the first international experiments on air–sea interaction that spawned a series of measurement campaigns throughout the proceeding decades, including JASIN, HEXOS and COARE among many others. Working on board RV "Meteor", he designed in 1973–1974 one of the first parametrizations of the surface drag coefficient that was later extended to the heat and moisture transfer coefficients. Simultaneously he directly confronted the question on the relation between the surface and geostrophic winds and the so-called geostrophic drag, first posed by Prandtl in the 1920s. Further, in 1976, Hasse developed the full theory of the resistance law for the non-stationary, advective boundary layer in which he first argued that the processes in the surface layer are influenced by processes within the planetary boundary layer, and that the parametrization of surface fluxes should engage external parameters of the planetary boundary layer.

In the late 1970s, Lutz Hasse began work on the physics of gas exchange at the air–sea interface. Considering this problem in a holistic manner, he argued that this complex process involves turbulence, wave energy and bubbles. His approach, developed together with Peter Liss, was based upon a molecular plus eddy diffusivity concept, and went on to become a foundation for further advances in the parametrization of air–sea gas exchange. Additionally this led him to a new perspective on the role of sea spray in air–sea exchange and to the development of new models for particle exchange over the sea.

Not surprisingly, after more than a decade of extremely productive work on boundary layers, Lutz Hasse became the successor to Friedrich Defant at the Institute für Meereskunde, Kiel (now GEOMAR), where he became the head of the Department of Marine Meteorology in 1980. He brought to Kiel a unique culture focused on measurement precision related to processes at the sea–air interface—something without which boundary-layer physics cannot be studied. Here Hasse, with his vision of the ocean's role in climate and his premonition of the key role of air–sea fluxes in climate variability, started to look into the climatological implications of air–sea energy exchanges. The result was "The Bunker Climate Atlas of the North Atlantic Ocean" developed together with Hans-Jörg Isemer. The title reveals something of his personality: Lutz Hasse always hated "sexy" titles, arguing that a good scientist always should say and write "much less than he know". Nevertheless, this was a unique and first attempt to develop what we now call gridded climatology of surface fluxes and flux-related variables. "*The Bunker Atlas*…." provided for the first time a complete guidance on data preprocessing, development of parametrizations, mapping and became for many years a bible for those who developed global and regional climatologies of air–sea fluxes. Remarkably, Andrew Bunker—a prematurely deceased Woods Hole colleague who supplied Isemer and Hasse with original data (called now the Voluntary Observing Ship reports)—became the namesake. Paying tribute to Bunker was typical of Hasse: he was extremely fair and honest, honouring even small contributions of individuals to scientific results. Later, "*The Bunker Atlas*…." was used for the design of a surface-flux climatology guaranteeing the closure of the heat budget of the North Atlantic by constraining surface-flux computations with the transport estimates on oceanic cross-sections. This pioneering work (together with Hans-Jörg Isemer and Jürgen Willebrand) faced a competitive challenge from the just-launched World

Ocean Circulation Experiment and was later repeatedly used in several global climatologies of surface fluxes.

In the late 1980s, Hasse became deeply interested in long-term climate variability and the changes in surface meteorological variables. At that time, a question about the reliability of long-term trends in surface winds was widely discussed. In 1987 Hasse, together with Ernest Peterson, first hypothesized that uncertainties in the standard Beaufort equivalents impose unrealistic trends in wind climate records. Their paper "*Did the Beaufort Scale or the Wind Climate Change?*" (J. Phys. Oceanogr.) established a new paradigm for the analysis of long-term changes in surface meteorological variables over the global ocean. Moreover, in the 1990s it resulted in the development by Ralf Lindau of an improved equivalent Beaufort scale that has now become a standard for processing marine wind reports. It was typical of Hasse to analyze the science problem comprehensively, end-to-end. Once discovering the problems of suspicious wind trends, he later contributed significantly to the development of numerical schemes for a proper objective analysis of wind speed over the ocean (together with Karl Bumke) and analysis of alternative independent data, such as wind waves observed by merchant ships.

In 1995 Lutz Hasse retired, but even so he continued attending the Institute almost daily. In these years, he became fascinated with the idea of developing a new highly accurate precipitation instrument to be used at sea. Again, he was ahead of the community concern about ocean precipitation by almost a decade. With very limited technical and calibration resources, but great enthusiasm and fantastic ingenuity, he, together with colleagues, developed two new instruments: a ship rain gauge and an optical disdrometer, both designed for high wind speeds. Remarkably, both devices are now widely in use and not only at sea. Recently these instruments were used for the calibration of precipitation over land as revealed from the car-wiper data regimes.

Hasse's life remains an example for many young researchers, especially now in the epoch of "post-normal" science and strong funding agency pressure on scientists. Now, when so-called "efficiency indicators" frequently dominate over the scientific merit of the results, Hasse's oft-repeated phrase "*…it is extremely interesting, but I do not think we need to publish this…*" can rarely be heard. He will be dearly missed.

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