

# Prof. Dr. Susanne Crewell | Publications

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My publication record spans a wide range of topics

- with more than 100 peer-reviewed publications as of 01 July 2021  
Publons O-1640-2013: 139 publications, 3347 citations, h-index=32  
Scopus: 146 Publications, 2698 citations, h-index = 33  
[Google](#): 5551 citations, h-index = 43
- and book contributions/review reports related to observational techniques and the future development of measurement strategies.

Below also invited talks and specific reports of interest are given. The full list of my publications including conference contributions, talks and posters can be found at [https://atmos.meteo.uni-koeln.de/ag\\_crewell/doku.php?id=publications:publications](https://atmos.meteo.uni-koeln.de/ag_crewell/doku.php?id=publications:publications)

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## Accepted peer-reviewed publications

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Stevens, B, C.Acquistapace, S.Crewell, M.Jacob, M.Mech, S.Schnitt, et al.: Elucidating the role of clouds–circulation coupling in climate: datasets from the 2020 (EUREC4A) field campaign , Earth Syst. Sci. Data Discuss. [pre-print], <https://doi.org/10.5194/essd-2021-18>

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2. Böhm, C., J. H. Schween, M. Meyers, B. Maier, U. Löhnert, S. Crewell: Towards a climatology of fog frequency in the Atacama Desert via multi-spectral satellite data and machine learning techniques, Journal of Applied Meteorology and Climatology, <https://doi.org/10.1175/JAMC-D-20-0208.1>
3. Jentzsch, K., A. Schulz, N. Pirk, T. Foken, S. Crewell, J. Boike, 2021: High levels of CO<sub>2</sub> exchange during synoptic-scale events introduce large uncertainty into the Arctic carbon budget, Geophysical Research Letters Geophysical Research Letters, 18(9), <https://doi.org/10.1029/2020GL092256>
4. Schoger, S. Y., D. Moisseev, A. von Lerber, S. Crewell, and K. Ebell, 2021: Snowfall rate retrieval for K- and W-band radar measurements designed in Hyytiälä, Finland, and tested at Ny-Ålesund, Svalbard, Journal of Applied Meteorology and Climatology, 60(3), 273-289, <https://doi.org/10.1175/JAMC-D-20-0095.1>
5. Böhm, C., M. Meyers, J.-H. Schween, and S. Crewell, 2020: Water vapor variability in the Atacama Desert during the 20th century, Global and Planetary Change, 190, 103192, <https://doi.org/10.1016/j.gloplacha.2020.103192>
6. Cantalloube, F. j. Milli, C. Böhm, S. Crewell, J. Navarrete, K. Rehfeld, M. Sarazin, and A. Sommani, 2020: The impact of climate change on astronomical observations, Nature Astronomy, 4, 826-829, <https://doi.org/10.1038/s41550-020-1203-3>
7. Carbajal Henken, C., L. Dirks, S. Steinke, H. Diedrich, T. August, and S. Crewell, 2020: Assessment of Sampling Effects of Various Satellite-derived Integrated Water Vapor Datasets Using GPS Measurements in Germany as Reference, Remote Sensing, 12(7), 1170, <https://doi.org/10.3390/rs12071170>
8. Costa-Surós, M., O. Sourdeval, C. Acquistapace, H. Baars, C. Carbajal Henken, C. Genz, J. Hesemann, C. Jimenez, M. König, J. Kretzschmar, N. Madenach, C. I. Meyer, R. Schrödner, P. Seifert, F. Senf, M. Brueck, G. Cioni, J. F. Engels, K. Fieg, K. Gorges, R. Heinze, P.K. Siligam, U. Burkhardt, S. Crewell, C. Hoose, A. Seifert, I. Tegen, and J. Quaas, 2020: Detection and attribution of aerosol-cloud interactions in large-do-

- main large-eddy simulations with ICON, *Atmospheric Chemistry and Physics*, 20(9), 5657-5678, <https://doi.org/10.5194/acp-20-5657-2020>
9. Jacob, M., P. Kollias, F. Ament, V. Schemann, and S. Crewell, 2020: Multi-layer Cloud Conditions in Trade Wind Shallow Cumulus – Confronting Models with Airborne Observations, *Geoscientific Model Development*, 13, 5757–5777, <https://doi.org/10.5194/gmd-13-5757-2020>
  10. Mech, M., M. Maahn, S. Kneifel, D. Ori, E. Orlandi, P. Kollias, V. Schemann, and S. Crewell, 2020: PAMTRA 1.0: A Passive and Active Microwave radiative TRANSfer tool for simulating radiometer and radar measurements of the cloudy atmosphere, *Geoscientific Model Development*, 13, 4229-4251, <https://doi.org/10.5194/gmd-13-4229-2020>
  11. Neher, I., S. Crewell, S. Meilinger, U. Pfeifroth, and J. Trentmann, 2020: Long-term variability of solar irradiance and its complications for photovoltaic power in West Africa, *Atmospheric Chemistry and Physics*, 20, 12871-12888, <https://doi.org/10.5194/acp-20-12871-2020>
  12. Reyers, M., C. Böhm, L. Knarr, Y. Shao, and S. Crewell, 2020: Synoptic-to-regional scale analysis of rainfall in the Atacama Desert (18°S–26°S) using a long-term simulation with WRF, *Monthly Weather Review*, 148 (8), 1-51, <https://doi.org/10.1175/MWR-D-20-0038.1>
  13. Ruiz-Donoso, E., A. Ehrlich, M. Schäfer, E. Jäkel, V. Schemann, S. Crewell, M. Mech, B.S. Kulla, L.-L. Kliesch, R. Neuber, and M. Wendisch, 2020: Small-scale structure of thermodynamic phase in Arctic mixed-phase clouds observed by airborne remote sensing during a cold air outbreak and a warm air advection event, *Atmospheric Measurement Technology*, 20, 5487–5511, <https://doi.org/10.5194/acp-20-5487-2020>
  14. Frank, C. W., B. Pospichal, S. Wahl, J. D. Keller, A. Hense, and S. Crewell, 2020a: The added value of high resolution regional reanalyses for wind power applications, *Renewable Energy*, 148, 1094-1109, <https://doi.org/10.1016/j.renene.2019.09.138>.
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  16. Henken, C., L. Dirks, S. Steinke, H. Diedrich, T. August, and S. Crewell, 2020: Assessment of Sampling Effects of Various Satellite-derived Integrated Water Vapor Datasets Using GPS Measurements in Germany as Reference, *Remote Sensing*, 12, 1170, <https://doi.org/10.3390/rd12071170>.
  17. Marke, T., Löhnert, U., Schemann, V., Schween, J. H., and S. Crewell, 2020: Detection of land-surface-induced atmospheric water vapor patterns, *Atmospheric Chemistry and Physics*, 20, 1723–1736, <https://doi.org/10.5194/acp-20-1723-2020>.
  18. Stevens, B., C. Acquistapace, M. Costa-Surós, S. Crewell, M. Jacob, U. Löhnert, S. Schnitt, et al., 2020: Large-eddy and Storm Resolving Models for Climate Prediction - The Added Value for Clouds and Precipitation, *Journal of the Meteorological Society of Japan*, 98(2), 395-435, <https://doi.org/10.2151/jmsj.2020-021>
  19. Konow, H., M. Jacob, F. Ament, S. Crewell, F. Ewald, M. Hagen, L. Hirsch, F. Jansen, M. Mech, B. Stevens, 2019: A unified data set of airborne cloud remote sensing using the HALO Microwave Package (HAMP), *Earth System Science Data*, 11, 921-934, <https://doi.org/10.5194/essd-2018-116>.
  20. Lammert, A., A. Hansen, F. Ament, S. Crewell, G. Dick, V. Grützun, H. Klein-Baltink, V. Lehmann, A. Macke, B. Pospichal, W. Schubotz, P. Seifert, E. Stamnas, and B. Stevens, 2019: A Standardized Atmospheric Measurement Data (SAMD) Archive for distributed cloud and precipitation process-oriented observations in Central Europe, *Bulletin of the American Meteorological Society*, 100(7), 1299-1314, <https://doi.org/10.1175/BAMS-D-18-0174.1> 12, 3237-3254.
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  25. Radovan A., S. Crewell, E.M. Knudsen and A. Rinke, 2019: Environmental conditions for polar low formation and development over the Nordic Seas: study of January cases based on the Arctic System Reanalysis, *Tellus A: Dynamic Meteorology & Oceanography*, 71, 1-16, <https://doi.org/10.1080/16000870.2019.1618131>.
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## Book contributions

- 2019 Crewell, S., M. Wendisch, and U. Loehnert, 2019: Passive Solar and Microwave Spectral Radiometers, in *Springer Handbook of Atmospheric Measurements*, Ed. T. Foken, accepted.
- Crewell, S., M. Mech, and C. Prigent, *Microwave Radiometry*, in *Springer Handbook of Atmospheric Measurements*, Ed. T. Foken, accepted.
- 2015 Saunders, R., S. Crewell, R. Gelaro, P.J. Minnett, V-H. Peuch, J. Schmetz, D. Turner, and C. Velden, 2015: Observations for global to convective scale models, In: *World Meteorological Organization, Seamless Prediction of the Earth System: from Minutes to Months*, (G Brunet, S Jones, PM Ruti Eds.), (WMO-No. 1156), (ISBN 978-92-63-11156-2), Geneva.
- 2012 Wendisch, M., P. Pilewskie, B. Bohn, A. Bucholtz, S. Crewell, C. Harlow, E. Jäkel, K. S. Schmidt, R. Shetter, J. Taylor, D. D. Turner, and M. Zöger, 2012: Atmospheric Radiation Measurements, In: *Airborne Measurements for Environmental Research – Methods and Instruments –*, Ed. Manfred Wendisch and Jean-Louis Brenguier, Wiley.
- 2010 Pospichal, B. and S. Crewell, 2010: Observations of the Lower Atmosphere Over West Africa Using Ground-Based Remote Sensing Instruments. In “*Integrated Ground-Based Observing Systems-Applications for Climate, Meteorology, and Civil Protection*”, Chapter II.8, pp. 281-295, Eds. D.Cimini, F. S. Marzano and G. Visconti, Springer SBN 978-3-642-12967-4.
- 2006 Battaglia, A., C. Simmer, S. Crewell, H. Czekala, C. Emde, F. Marzano, M. Mishchenko, J. Pardo, and C. Prigent, 2006: Emission and scattering by clouds and precipitation. In: *Thermal Microwave Radiation: Applications for Remote Sensing*, Chapter 3, pp. 101–242, Edited by C. Maetzler, The Institution

of Engineering and Technology, ISBN 0 86341 573 3.

2005 Crewell, S., 2005: Hydrological applications of remote sensing: Atmospheric states and fluxes: Water vapor and clouds (passive/active techniques). Chapter 65, pp. 981-996, Encyclopedia of Hydrological Sciences, Wiley & Sons, Edited by M G Anderson John Wiley and Sons, Ltd., ISBN: 0-471-49103-9.

Drusch, M. and S. Crewell, 2005: Hydrological applications of remote sensing: Basic Principles and Sensors: Radiative Transfer. Chapter 46, pp.659-672, in Encyclopedia of Hydrological Sciences, Edited by M G Anderson John Wiley and Sons, Ltd., ISBN: 0-471-49103-9.

## Miscellaneous

- 2020 Guerova, G., G. Möller, E. Pottiaux, H. Brenot, R. Van Malderen, H. Haralambous, F. Tymvios, J. Douša, M. Kačmařík, K. Eben, H. Vedel, K. Rannat, R. Kivi, A.-M. Harri, O. Bock, J.F. Mahfouf, J. Wickert, G. Dick, R. Pothast, S. Crewell, C. Pikridas, N. Zinas, A. Ganas, R. Szabolcs, M. Mile, S. Thorsteinsson, B.G. Ófeigsson, Y. Reuveni, S. Krichak, R. Pacione, G. Bianco, R. Biondi, G. Stankunavicius, F.N. Teferle, J. Bosy, J. Kaplon, K. Szafranek, R. Fernandes, P. Viterbo, A. Sá, J. Hefty, M.H. Igonova, E. Priego, G. Elgered, M. Lindskog, M. Ridal, U. Willén, T. Ning, E. Brockmann, K. Wilgan, A. Geiger, C. Mekik, J. Jones, Z. Liu, B. Chen, C. Wang, S. Masoumi, M. Moore, S. MacPherson, Advanced GNSS Tropospheric Products for Monitoring Severe Weather Events and Climate, 403-481, Springer
- 2019 Mattioli, V., C. Accadia, C. Prigent, S. Crewell, A. Geer, P. Eriksson, S. Fox, J. R. Pardo, E. Mlawer, M. Cadet, M. Bremer, C. D. Breuck, A. Smette, D. Cimini, E. Turner, M. Mech, F. S. Marzano, P. Brunel, J. Vidot, R. Bennartz, T. Wehr, S. D. Michele, and V. John, 2019: Atmospheric gas absorption knowledge in the sub-millimeter: Modeling, field measurements, and uncertainty quantification, Bulletin of the American Meteorological Society, 100, ES291–ES295, <https://doi.org/10.1175/BAMS-D-19-0074.1>.
- MWI-ICI Science Advisory Group, W. Bell, S. Bühler, S. Crewell, P. Eriksson, A. Geer, J.-F. Mahfouf, F. S. Marzano, C. Prigent, R. Tonboe, 2019: Microwave Imager (MWI) - Ice Cloud Imager (ICI) Science Plan
- 2018 Ebell, K., S. Crewell, 2018: Bodengebundene Strahlungsschließung als Qualitätsmaß für Fernerkundungsmethoden, in PROMET: Strahlungsbilanzen, Heft 100, 75-83.
- Ghate, V. P., P. Kollias, S. Crewell, A. M. Fridlind, T. Heus, U. Löhnert, M. Maahn, G. M. McFarquhar, D. Moiseev, M. Oue, M. Wendisch, C. Williams, 2018: The Second ARM Training and Science Application Event: Training the Next Generation of Atmospheric Scientists, Bulletin of the American Meteorological Society, <https://doi.org/10.1175/BAMS-D-18-0242.1>
- 2017 Schröder, M., Lockhoff, M., Shi, L., August, T., Bennartz, R., Borbas, E., Brogniez, H., Calbet, X., Crewell, S., Eikenberg, S., Fell, F., Forsythe, J., Gambacorta, A., Graw, K., Ho, S.-P., Höschel, H., Kinzel, J., Kursinski, E.R., Reale, A., Roman, J., Scott, N., Steinke, S., Sun, B., Trent, T., Walther, A., Willen, U., Yang, Q., 2017: GEWEX water vapor assessment (G-VAP). WCRP Report 16/2017; World Climate Research Programme (WCRP): Geneva, Switzerland; 216 pp.
- Wendisch, M., M. Brückner, J. P. Burrows, S. Crewell, K. Dethloff, K. Ebell, Ch. Lüpkes, A. Macke, J. Notholt, J. Quaas, A. Rinke, and I. Tegen, 2017: Understanding causes and effects of rapid warming in the Arctic. Eos, 98, page 22-26 <https://doi.org/10.1029/2017EO064803>. Published on 17 January 2017.
- 2016 Banks, R. F., S. Crewell, S. Henkel, and J. M. Baldasano, 2016: Training network for young atmospheric researchers, Eos, 97, <https://doi.org/10.1029/2016EO045899>. Published on 16 February 2016.
- 2005 Westwater, E.R., S. Crewell, C. Maetzler: Surface-based microwave and millimeter wave radiometric remote sensing of the troposphere: A tutorial, IEEE Geoscience and Remote Sensing Society Newsletter 134, 16-33.
- Westwater, E.R., S. Crewell, C. Maetzler, D. Cimini: Principles of surface-based microwave and millimeter wave radiometric remote sensing of the troposphere, Quad. Soc. Ital. Elettromagnetismo 1 (3), 50-90.
- 2004 Westwater, E.R., S. Crewell, C. Maetzler: A review of surface-based microwave and millimeter-wave

radiometric remote sensing of the troposphere, *URSI Radio Science Bulletin* 2004 (310), 59-80.

### Invited Talks (last 5 years)

- 
- 2020      Crewell, S., K. Ebell, A. von Lerber, A. Radovan, B. Kulla, L.-L. Kliesch, M. Mech, A. Rinke, V. Schemann, M. Wendisch: Arctic Amplification – what can we learn from microwave measurements? Institute seminar, Institut für Physik der Atmosphäre, ETH Zürich, 27 April 2020
- Crewell, S., K. Ebell, A. von Lerber, A. Radovan, B. Kulla, L.-L. Kliesch, M. Mech, A. Rinke, V. Schemann, M. Wendisch: Arctic Amplification – what can we learn from microwave measurements? Institute seminar, Institut für Physik der Atmosphäre, DLR Oberpfaffenhofen, 8 Januar 2020
- 2019      Cloud observations in 2030, Understanding Clouds and Precipitation ([UCP2019](#)), Berlin, Germany, 25 February - 1 March 2019
- Arctic clouds - Insights from the ALOUD campaign around Svalbard, Seminar Talk, University Centre in Svalbard/, Longyearbyen, Svalbard, 28 March 2019
- 2018      Arctic clouds - first insights from the ALOUD campaign around Svalbard, Colloquium, University of Bremen, 12 January 2018
- The Role of Mixed-Phase Clouds in the Arctic, Seminar Talk, Colorado State University, Fort Collins, 20 April 2018
- Crewell, S., Warum erwärmt sich die Arktis am stärksten – und was haben die Wolken damit zu tun? STUMETA, University of Bonn, 10 May 2018
- Microwave radiometry for atmospheric application: a journey across the world from ground, via aircraft to satellites, Seminar talk, LERMA, Paris, 5 June 2018
- Microwave radiometry - an important component of the global observing system, ARM Summer workshop, Norman, Oklahoma, 20 July 2018
- 2017      Future Campaigns. HD(CP)2 Annual Meeting, Schneefernerhaus, 15 February 2017
- Narval Next-generation aircraft remote-sensing for validation studies, HALO Symposium, Oberpfaffenhofen, 14 March 2017
- Microwave Radiometry and Sensor Synergy, Winter school on the observation and modeling of high-latitude and Arctic clouds, Hyytiälä, Finland, March 19-25, 2017
- Planned HALO/HAMP campaigns + Polar 5/MiRAC, ISMAR Workshop, Eumetsat, Darmstadt, 10 May 2017
- Wasser und Wolkenbildung – Atmosphäre und mögliche Vorhersagen. Wissenschaft im Rathaus, Köln, 9 October 2017
- The AC3 project: why is the Arctic warming faster than the mid latitudes? Svalbard Science Conference, Oslo, 6-9 November 2017
- 2016      What can we learn from atmospheric profiling stations to better understand climate processes? Challenges of Atmospheric Research, DLR Conference on Climate Change, Cologne, 5 - 7 April 2016
- Atmospheric Remote Sensing: Challenges and Applications, 1st ECARS Summer School, Romania, 2 June 2016
- Assessment of sampling effects on precipitable water climatology, GEWEX Water Vapor Assessment

(GVAP) Workshop, Eumetsat, Darmstadt, 22 September 2016

Crewell, S.: Was ist gute Betreuung? Promovierendentag, Universität zu Köln, 2 November 2016

Arctic Amplification: Climate Relevant Atmospheric and Surface Processes, and Feedback Mechanisms (AC3) with a focus on clouds. MISU, University of Stockholm, Seminar talk, 29 November 2016

**DIE MATHEMATISCH-NATURWISSENSCHAFTLICHE FAKULTÄT  
DER  
RHEINISCHEN FRIEDRICH-WILHELMS-UNIVERSITÄT BONN**

**stellt unter dem Rektorat des**  
Professors für Städtebau und Siedlungswesen  
*Dr.-Ing. Klaus Borchard*

**und unter dem Dekanat des**  
Professors für Mathematik  
*Dr. rer. nat. Ingo Lieb*

die Lehrbefähigung von

**Frau Dr. rer. nat. Susanne Crewell**  
geboren am 1. Januar 1964  
in Hagen

für das Lehrgebiet

**Meteorologie**

fest, nachdem sie im ordnungsgemäßen Habilitationsverfahren durch die bisher von ihr  
veröffentlichten Schriften, durch die Habilitationsschrift

**„Bodengebundene Fernerkundung der bewölkten Atmosphäre und deren Nutzung zur  
Evaluierung dynamischer Atmosphärenmodelle“**

durch das Habilitationskolloquium und die wissenschaftliche Aussprache die Fähigkeit  
nachgewiesen hat, das Fach in Forschung und Lehre selbständig zu vertreten.

Bonn, den 26. Juni 2002



*Ingo Lieb*  
Prof. Dr. Ingo Lieb  
Dekan

Universität Bremen

P R O M O T I O N S U R K U N D E

Der Fachbereich 1 (Physik/Elektrotechnik) verleiht

Susanne Crewell

geboren am 1. Januar 1964

in Hagen

den Grad einer

**Doktorin der Naturwissenschaften (Dr. rer. nat.)**

aufgrund des Kolloquiums am 10. Mai 1993 und der Dissertation mit dem Titel:

Submillimeter-Radiometrie mit einem flugzeuggetragenen Empfänger zur  
Messung atmosphärischer Spurenstoffe

Die Promotion wurde mit dem Prädikat **magna cum laude** bewertet.

Bremen, den 13. Mai 1993

Der Rektor



(Prof. Dr. Jürgen Timm)



Der Fachbereichssprecher



(Prof. Dr. Stefan von Aufschnaiter)

CHRISTIAN-ALBRECHTS-UNIVERSITÄT KIEL  
MATHEMATISCH-NATURWISSENSCHAFTLICHE FAKULTÄT

DIPLOM

Frau \_\_\_\_\_ Susanne Crewell \_\_\_\_\_  
geboren am 01.01.1964 in Hagen (Kr. Cuxhaven) \_\_\_\_\_  
hat am 29.01.1990 die Diplom-Hauptprüfung für Meteorologie gemäß der Prüfungsordnung  
vom 1. Oktober 1970 mit dem Gesamturteil

- sehr gut -

an der Universität Kiel bestanden.

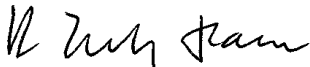
Auf Grund dieser Prüfung wird ihr hiermit der akademische Grad

DIPLOM-METEOROLOGIN


verliehen.

Kiel, den 29. Januar 1990 \_\_\_\_\_

DER VORSITZER DES PRÜFUNGS-AUSSCHUSSES  
FÜR DIE DIPLOM-HAUPTPRÜFUNG  
FÜR STUDIERENDE DER METEOROLOGIE

  
(Prof. Dr. L. Hasse)

DER DEKAN  
DER MATHEMATISCH-NATURWISSENSCHAFTLICHEN FAKULTÄT  
DER CHRISTIAN-ALBRECHTS-UNIVERSITÄT KIEL

  
(Prof. Dr. D. Adelung)



# CHRISTIAN-ALBRECHTS-UNIVERSITÄT KIEL

Diplom-Hauptprüfung für Studierende der Meteorologie

## PRÜFUNGSZEUGNIS

Die Studierende der Meteorologie Susanne Crewell  
geboren am 01.01.1964 in Hagen (Kr. Cuxhaven)  
hat sich vom 01.11.1988 bis 29.01.1990 gemäß der Prüfungsordnung vom 1. Oktober 1970  
der Diplom-Hauptprüfung für Studierende der Meteorologie an der Christian-Albrechts-Universität unterzogen und die  
Prüfung mit

- sehr gut -

bestanden.

Das Thema der Diplom-Arbeit lautet:

„ Fluß latenter Wärme über dem Nordatlantik ”

Die Bewertungen der Diplom-Arbeit und der Leistungen in der mündlichen Prüfung sind untenstehend aufgeführt.

Kiel, den 29.01.1990

Der Vorsitz des Prüfungsausschusses  
für Studierende der Meteorologie



(Prof. Dr. L. Hasse)

Der Dekan  
der Mathematisch-Naturwissenschaftlichen Fakultät  
der Christian-Albrechts-Universität zu Kiel



(Prof. Dr. D. Adelung)

Prüfungsgebiete:

Bewertungen:

Prüfer:

1. Allgemeine Meteorologie	<u>sehr gut</u>	<u>Prof. Dr. L. Hasse</u>
2. Theoretische Meteorologie	<u>gut</u>	<u>Prof. Dr. E. Ruprecht</u>
3. Angewandte- <del>Experimentelle</del> <del>Theoretische</del> Physik	<u>sehr gut</u>	<u>Prof. Dr. U.-P. Hansen</u>
4. Wahlfach Geophysik	<u>gut</u>	<u>Prof. Dr. J. Zschau</u>
5. Diplom-Arbeit	<u>sehr gut</u>	<u>Prof. Dr. L. Hasse/ Prof. Dr. E. Ruprecht</u>
6. Zusatzfach	<u>                    </u>	<u>                    </u>

Gesamturteil<sup>2)</sup>

- sehr gut -

1) Nichtzutreffendes streichen.  
2) Zusatzfach nicht berücksichtigt.