

## NOTIFICATION OF PROPOSED RESEARCH CRUISE

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## GENERAL

Part A

01. Name of research ship: **M E T E O R** Cruise No. **M166 (GPF 18-1\_59)**
02. Dates of cruise from **09 September 2020** to **08 October 2020**
03. Operating Authority **Institut für Geologie / University of Hamburg**  
**Bundesstr. 55, D-20146 Hamburg, Germany**  
**Tel.: +49-40-42838-3640 - Fax: +49-40-42838-46 44**

04. Owner (if different from para 3) **Federal Ministry of Education and Research**

05. Particulars of ship:
- |                 |                        |
|-----------------|------------------------|
| Name            | <b>METEOR</b>          |
| Nationality     | <b>German</b>          |
| Overall length  | <b>97,5 metres</b>     |
| Maximum draught | <b>5,6 metres</b>      |
| Nett tonnage    | <b>1284.0 NT</b>       |
| Propulsion      | <b>Diesel Electric</b> |
| Call sign       | <b>D B B H</b>         |
06. Crew
- |                |                       |
|----------------|-----------------------|
| Name of master | Detlef Korte          |
| No. of crew    | <b><u>max. 33</u></b> |
07. Scientific personnel:
- |   |  |
|---|--|
| Name and address of scientist in charge | Dr. Ryan North<br>Bundesstr. 53; 20146 Hamburg             |
| Tel./Fax/                               | +49 (0) 40 42838 6631                                      |
| E-Mail                                  | Ryan.Peter.North@uni-hamburg.de                            |
| Name and address of scientist in charge | Dr. Hossein Mashayekh Poul<br>Bundesstr. 53; 20146 Hamburg |
| Tel./Fax/                               | +49 (0) 40 42838 4582                                      |
| E-Mail                                  | Hossein.Mashayekh.Poul@uni-hamburg.de                      |
| No. of scientists                       | <b><u>15</u></b>   |
08. Geographical areas in which ship will operate  
(with reference in latitude and longitude)

Denmark Strait, East Greenland shelf, Iceland-Faroe Ridge (Region: 62°N-68°N, 34°W-7°W)

09. Brief description of purpose of cruise

Dense water is formed in the Nordic Seas and spills over the Greenland-Scotland Ridge as overflow plumes. During their descent into the basins of the North Atlantic, these plumes entrain ambient waters, increasing the volume of dense water. The overflows thus contribute significantly to the formation of North Atlantic Deep Water and the lower limb of the Atlantic Meridional Overturning Circulation. The largest average volume flux in an overflow plume is observed in the Denmark Strait (DSO), which is modified by eddies on time scales of a few days. The ridge system between Iceland and the Faroes presumably supports several weak flows, which nevertheless add to the total Nordic Seas – Atlantic Ocean exchange.

The planned survey contributes to (1) ongoing monitoring (since 1996) of the overflow at the sill of the Denmark Strait using deep-sea moorings, (2) investigating minor overflow branches at the Iceland-Faroe Ridge, in particular in the Western Valley. The cruise will contribute to the DFG Collaborative Research Centre TRR 181 “Energy transfers in atmosphere and ocean” and the BMBF project "RACE- Synthese - Regional Atlantic Circulation and global Change”

10. Dates and names of intended ports of call

No ports of call in Iceland

11. Any special logistic requirements at ports of call

## DETAIL

Part B

01. Name of research ship **M E T E O R** Cruise No. **M166 (GPF 18-1\_59)**  
02. Dates of cruise from: **09 September 2020** to **08 October 2020**

Since the exact cruise plan will depend on the weather and the actual ice situation at the time of the cruise the chief scientist may shift some days in the detailed cruise plan, see below.

## Detailed Cruise Plan

14 September - 20 September working in Iceland EEZ, west of Iceland (referred to as the "Western Valley" in the Iceland-Faroe Ridge Research Area)

20 September - 23 September transit to Denmark Strait

23 September - 26 September working in Denmark Strait. Mainly in Iceland EEZ with a long CTD transect that crosses into Greenland EEZ (ice-cover dependent).

26 September - 29 September transit to Western Valley

29 September – 3 October working in Iceland EEZ, west of Iceland (Western Valley in the Iceland-Faroe Ridge Research Area)

03. Purpose of research and general operational methods

The physical properties of the water masses and their transformation will be studied by means of moored and ship borne equipment. The goal of the cruise is to quantify the dense water outflow from the Nordic Seas into the North Atlantic in the Denmark Strait and the Western Valley and to assess subsequent mixing as the dense water descends.

04. Attach chart showing (on an appropriate scale) the geographical area of the intended work, positions of intended stations, tracks of survey lines, positions of moored / seabed equipment.

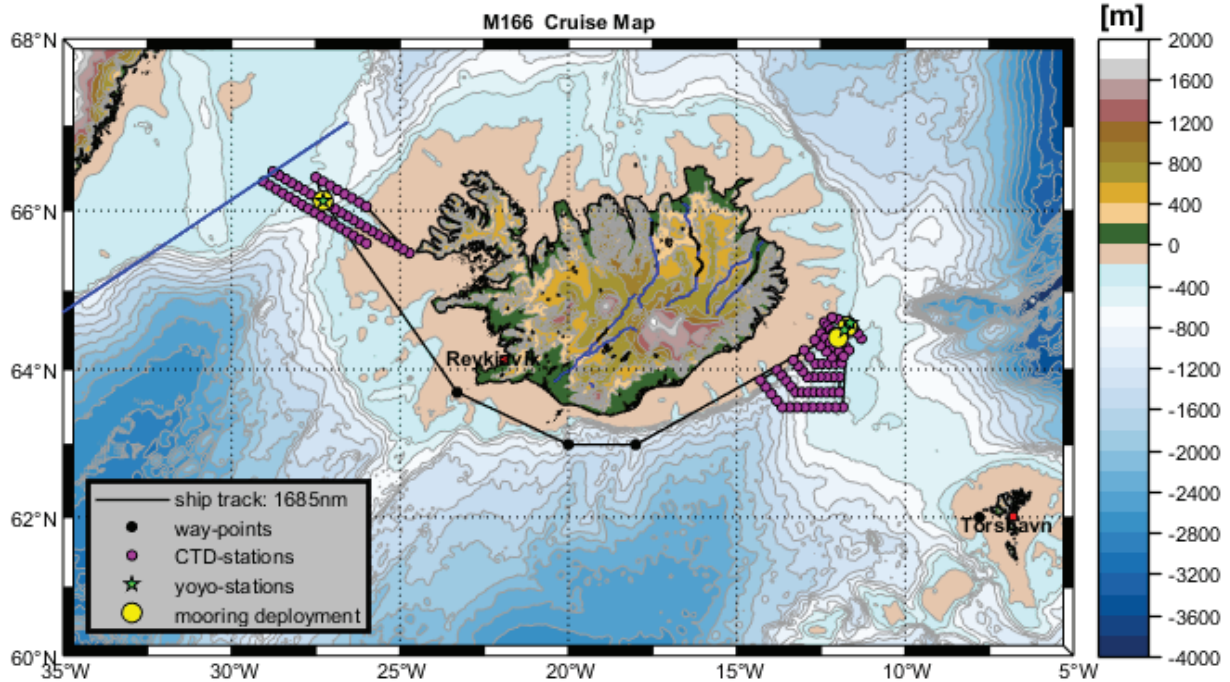


Chart showing the area of intended work, where the western research area is the Denmark Strait and the eastern research area is the Western Valley. The optimal position of the 2 short-term/long-term moorings in the Western Valley will be determined based on initial CTD sections.

05. Types of samples required, e.g. Geological / Water / Plankton / Fish / Radioactivity / Isotope

#### **Water column samples**

and methods by which samples will be obtained (including dredging / coring / drilling).

#### **CTD Rosette system**

06. Details of moored equipment:

Planned mooring recoveries:

name	deployment date	description	latitude	longitude	depth
DS2-19	09.2019	ADCP buoy	66°07.248' N	27°16.722' W	570 m

Planned long-term mooring deployments:

name	description	latitude	longitude	approx. depth
DS2-20	ADCP buoy	66°07.248' N	27°16.722' W	570 m
WV1-20-2	ADCP buoy	64° 33.0'N	11° 42.5'W	446.0 m
WV2-20-2		64° 24.6'N	11° 59.4'W	431.0 m

Area of potential ADCP buoy short-term moorings (deployment and recovery):

name	latitude	longitude	Approx. depths
WV1-20-1	64° 33.0'N	11° 42.5'W	446.0 m
WV2-20-1	64° 24.6'N	11° 59.4'W	431.0 m

The deployment positions are  $\pm 15$  nm and will be adjusted during the cruise, when data of the local water column are available. The optimal position of the 2 short-term/long-term moorings in the Western Valley will be determined based on initial CTD sections. The long-term mooring in the Western Valley will be deployed at the same location as the short-term moorings. Not all positions will be occupied. Recovery of the long-term moorings is planned for summer 2021.

07. Explosives: ***no explosives***

08. Detail and reference of

(a) Any relevant previous / future cruises

Poseidon P418, P437, MERIAN MSM21/1, Poseidon P471, P486, POS503, Pelagia PE426, MERIAN MSM76

(b) Any previous published research data relating to the proposed cruise.  
(Attach separate sheet if necessary.)

Moritz, M., K. Jochumsen, R.P. North, D. Quadfasel, and H. Valdimarsson: Mesoscale Eddies observed at the Denmark Strait sill, *Journal of Geophysical Research: Oceans*, accepted manuscript, doi: <http://dx.doi.org/10.1029/2019JC015273>

Hansen, B., K. M. H. Larsen, S. M. Olsen, D. Quadfasel, K. Jochumsen, & S. Osterhus (2018): Overflow of cold water across the Iceland–Faroe Ridge through the Western Valley. *Ocean Science*, 14(4), pp. 871–885. doi: <http://doi.org/10.5194/os-14-871-2018>

North, R., K. Jochumsen and M. Moritz (2018): Entrainment and Energy Transfer Variability Along the Descending Path of the Denmark Strait Overflow Plume, *Journal of Geophysical Research: Oceans*, 123, 4, pp. 2795-2807, doi: <https://doi.org/10.1002/2018JC013821>

Jochumsen, K., M. Moritz, N. Nunes, D. Quadfasel, K. M. Larsen, B. Hansen, H. Valdimarsson and S. Jonsson (2017): Revised transport estimates of the Denmark Strait Overflow, *Journal of Geophysical Research*, 122, pp. 3434– 3450, doi: <https://doi.org/10.1002/2017JC012803>.

Koszalka, I. M., T. W. N. Haine, & M.G. Magaldi (2013): Fates and Travel Times of Denmark Strait Overflow Water in the Irminger Basin. *Journal of Physical Oceanography*, 43(12), 2611–2628. doi: <http://doi.org/10.1175/jpo-d-13-023.1>

Jochumsen, K., S. M. Schnurr, and D. Quadfasel (2016): Bottom temperature and salinity distribution and its variability around Iceland, *Deep-Sea Research I*, 111, pp. 79–90, doi: <http://dx.doi.org/10.1016/j.dsr.2016.02.009>.

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Jochumsen, K., M. Köllner, D. Quadfasel, S. Dye, B. Rudels and H. Valdimarsson (2015): On the origin and propagation of Denmark Strait Overflow Water Anomalies in the Irminger Basin, *J. Geophys. Res.*, 120(3), pp. 1841–1855, doi:10.1002/2014JC010397.

Fischer, J., J. Karstensen, R. Zantopp, M. Visbeck, A. Biastoch, E. Behrens, C. Böning, D. Quadfasel, K. Jochumsen, H. Valdimarsson, S. Jónsson, S. Bacon, N. P. Holliday, S. Dye, M. Rhein, and C. Mertens (2015): Intra-seasonal variability of the Deep Western Boundary Current in the western subpolar North Atlantic. *Progress in Oceanography*, 132, pp. 233-249, doi:10.1016/j.pocean.2014.04.002.

Paka, V., V. Zhurbas, B. Rudels, D. Quadfasel, A. Korzh, and D. Delisi (2013): Microstructure measurements and estimates of entrainment in the Denmark Strait overflow plume. *Ocean Sci. Discuss.*, 10, 1067-1098, doi:10.5194/osd-10-1067-2013.

Jochumsen, K., D. Quadfasel, H. Valdimarsson and S. Jonsson (2012): Variability of the Denmark Strait Overflow: moored time series from 1996-2011, *J. Geophys. Res.*, 117, doi:10.1029/2012JC008244.

Serra, N., R. H. Käse, A. Köhl, D. Stammer, and D. Quadfasel, (2010): On the low-frequency phase relation between the Denmark Strait and the Faroe-Shetland Channel dense overflow. *Tellus*, 62, 530-550, doi: 10.1111/j.1600-0870.2010.00445.

Voet, G. and D. Quadfasel (2010): Entrainment in the Denmark Strait overflow plume by meso-scale eddies. *Ocean Sci.* 6, 301-310.

09. Names and addresses of scientists of the coastal state in whose waters the proposed cruise takes place with whom previous contact has been made.

Dr. Andreas Macrander, Marine Research Institute, Reykjavik,  
andreas.macrander@hafogvatn.is

10. State:

- (a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable.

**No port of call in Iceland. Due to worldwide travel restrictions we need to discuss whether a visit is really possible.**

- (b) Whether it will be acceptable to carry on board an observer from the coastal state for any part of the cruise and dates and ports of embarkation / disembarkation.

**Yes if Embarkation in Emden and participation in preceding quarantine camp, 05.09.2020 – 08.09.2020.**

**Embark: Emden, Germany, 08.09.2020 – Disembark Emden, Germany, 08.10.2020**

- (c) When research data from intended cruise is likely to be made available to the coastal state and if so by what means.

**- Cruise Report three months after finishing the research cruise**

**- Scientific publication within the following three years**

## COASTAL STATE: Iceland

SCIENTIFIC EQUIPMENT

11. Complete the following table - SEPARATE COPY FOR EACH COASTAL STATE  
( indicate 'YES' or 'NO' )

List of all major Marine Scientific Equipment it is proposed to use and indicate waters in which it will be deployed	Fisheries Research within Fishing Limits	Research concerning Continental Shelf out to Coastal State's Margin	Within 3 NM	Between 3 - 12 NM	Between 12 - 50 NM	Between 50 - 200 NM
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<b>a)</b> <b>vessel mounted systems:</b>						
<b>Hydroacoustic mapping / measuring (incl. ADCP, Parasound and Multibeam)</b>	No	No	No	Yes	Yes	Yes
<b>permanent surface water sampling / pumping (incl. Thermosalinograph)</b>	No	No	No	Yes	Yes	Yes
<b>b)</b>						
<b>CTD-Rosette</b>	No	No	No	Yes	Yes	Yes
<b>Underway CTD</b>	No	No	No	Yes	Yes	Yes
<b>Atmospheric measurements, ceilometer, cloud camera</b>	No	No	No	Yes	Yes	Yes



## List of intended sampling stations during Meteor cruise

CTD sections (approx. 127 stations), Yo-Yo casts in the east and west of Iceland (Denmark strait and the the Western Valley of the Northern Iceland-Faroe ridge area, see map above); from approximately 63° N, -11° W to 65° N, -15° W on the eastern side and from approximately 65° N, -24° W to 67° N, -30° W on the western side, without crossing the polar water border (blue line in map).

Two short-term ADCP moorings (WV1-20-1 and WV2-20-1) within the Western Valley described in the table and map above. We also request permission for two long-term ADCP moorings (WV1-20-2 and WV2-20-2) at the same location. After recovering the short-term ADCP moorings, they will be reconfigured and redeployed as long-term moorings at the same locations. They will be recovered in summer of 2021.

Long-term mooring recovery and redeployment (DS2 - 19/20) on the Denmark Strait sill (see table and map above). To be recovered in summer of 2021.

A detailed description of the dates of the cruise plan is in Section 2 of Part B above.

**References:** See list above.