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National Report of Germany

Compiled by

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Within the federal system of Germany, responsibilities for waters bodies are divided between national and federal authorities. Two federal agencies are dedicated to hydrological and environmental matters concerning the coastal waters. Both institutions are higher federal authorities.

The *Bundesamt für Seeschifffahrt und Hydrographie* – Federal Maritime and Hydrographic Agency of Germany (BSH) is the maritime partner to shipping and a supporter of environmental conservation efforts and maritime uses. The BSH offers a wide range of maritime services such as: prediction of tides, water level forecast and storm surge warning service, monitoring of the sea, nautical information systems, and maritime spatial planning in the German Exclusive Economic Zone. The *Bundesanstalt für Gewässerkunde* – German Federal Institute of Hydrology- (BfG) is responsible for the German waterways in federal ownership. In this position it has a central mediating and integrating function. The BfG advises federal ministries, such as the Federal Ministry of Transport, Building and Urban Affairs (BMVBS), and the Federal Waterways and Shipping Administration (WSV) in matters regarding the utilisation and management of the German federal waterways. In this context, the WSV operates a network of gauging stations both in coastal and inland waters. Additionally, the federal states and some harbour authorities operate their own tide gauges.

The coastal tide-gauge network

The coastal tide-gauge network of the WSV at the North Sea coast and the Baltic Sea coast is still in the state of the national report of 2013. The tide-gauge network is briefly described below. A list of selected stations can be found in the appendix. There are about 160 tide gauges along the coasts of Germany. About 100 of them are located on tidal rivers such as the Elbe, the Weser, and the Ems. Figure 1 gives an overview of all coastal tide gauges and GNSS (Global Navigation Satellite System) - stations.

The stations Sassnitz, Warnemünde, and Kiel Holtenau, that are located on the Baltic Sea and the tide gauges Hörnum, Helgoland-Binnenhafen, and Borkum-Fischerbalje on the North-Sea are regional extensions to the GLOSS core network. Cuxhaven-Steubenhöft is the

German contribution to the GLOSS core network. Additionally, a number of tide gauges in the North-Sea contribute to the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS). The BSH is the national Tsunami Warning Focal Point (TWFP) for the NEAMTWS in Germany.

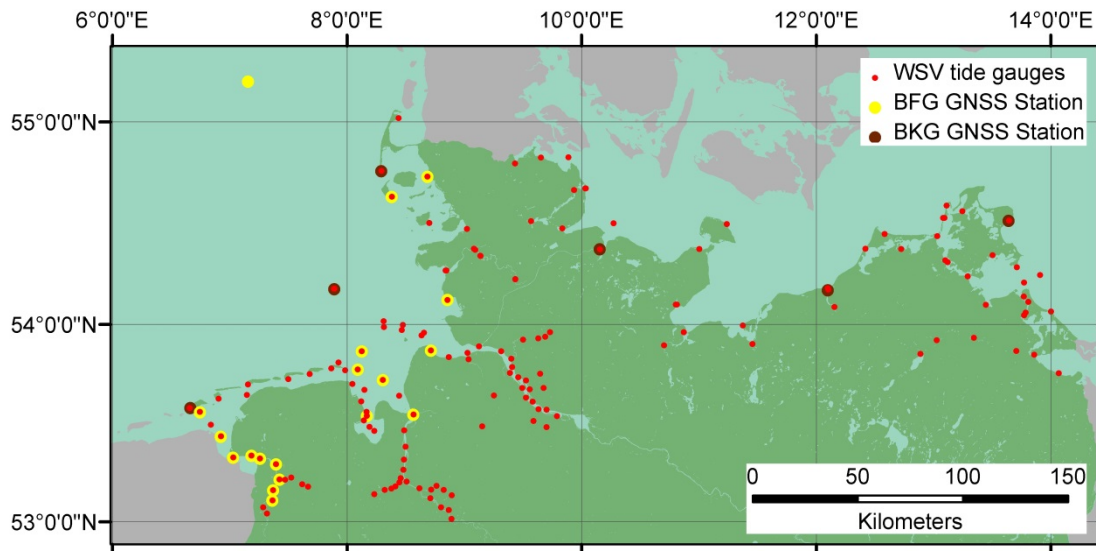


Figure 1: German coastline with tide gauges and GNSS-stations on federal waterways

The raw sea-level data are available at 1-minute intervals and can be retrieved from: <http://www.pegelonline.wsv.de/>. Seven tide gauges, which serve the national Tsunami Warning Focal Point (TWFP) for the ICG/NEAMTWS are available at the 'IOC Sea level data facility' <http://www.ioc-sealevelmonitoring.org/>. The raw data are also used by the BSH for the prediction of tides, water levels, storm surges, and currents.

Regional tide gauge networks

Due to the federal structure of Germany, the coastal federal states Lower Saxony, Schleswig-Holstein and Mecklenburg-Western Pomerania support their own regional gauge networks, including the coastal area as well as rivers and other bodies of water. Some are accessible through the above mentioned PegelOnline website, but PegelOnline does not cover all of the gauges. Webpages for the regional networks are only available in German.

Data from Lower Saxony can be viewed and retrieved from <https://www.pegelonline.nlwkn.niedersachsen.de/Start> (see Figure 2).

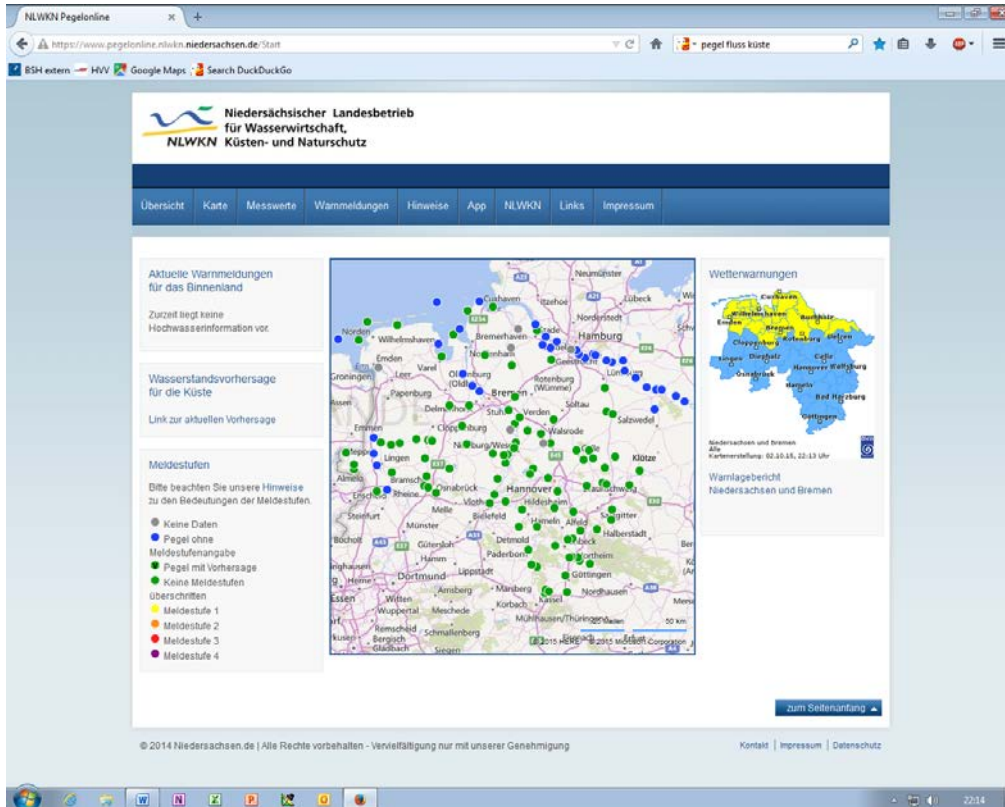


Figure 2: Gauges in Lower Saxony

For Schleswig-Holstein data can be viewed and retrieved through the website <http://www.umweltdaten.landsh.de/public/hsi/index.html> (Figure 3).

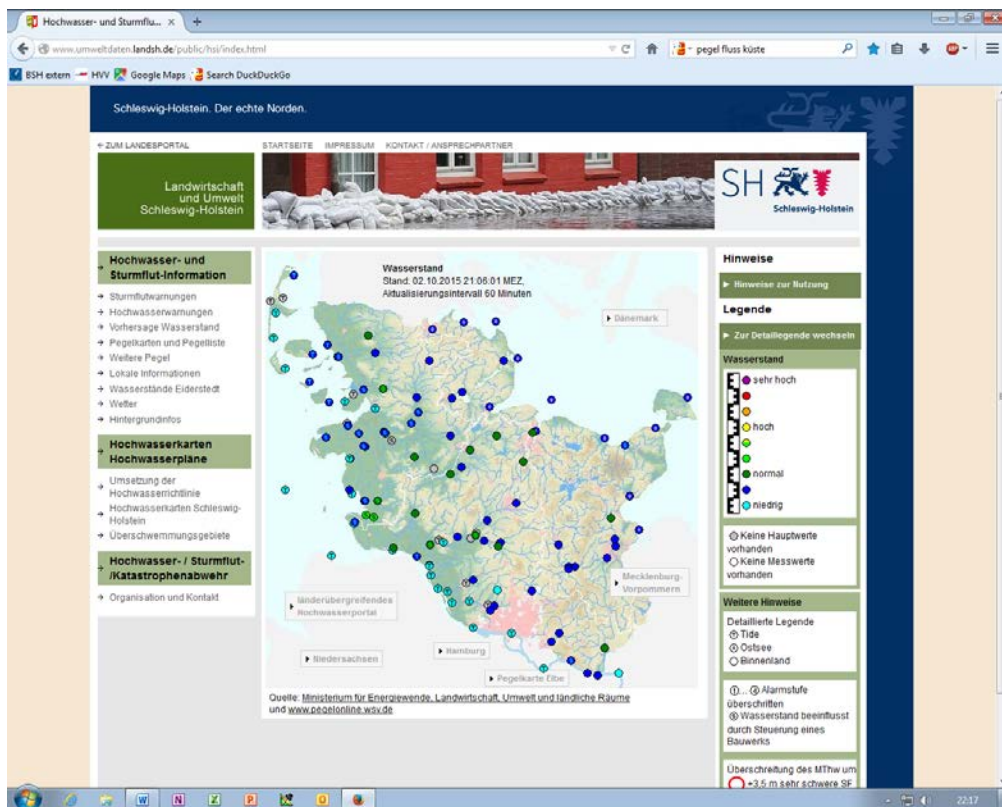


Figure 3: Gauges in Schleswig-Holstein

For data from Mecklenburg-Western Pomerania refer to the webpage www.pegelportal-mv.de/pegel_mv.html (Figure 4).

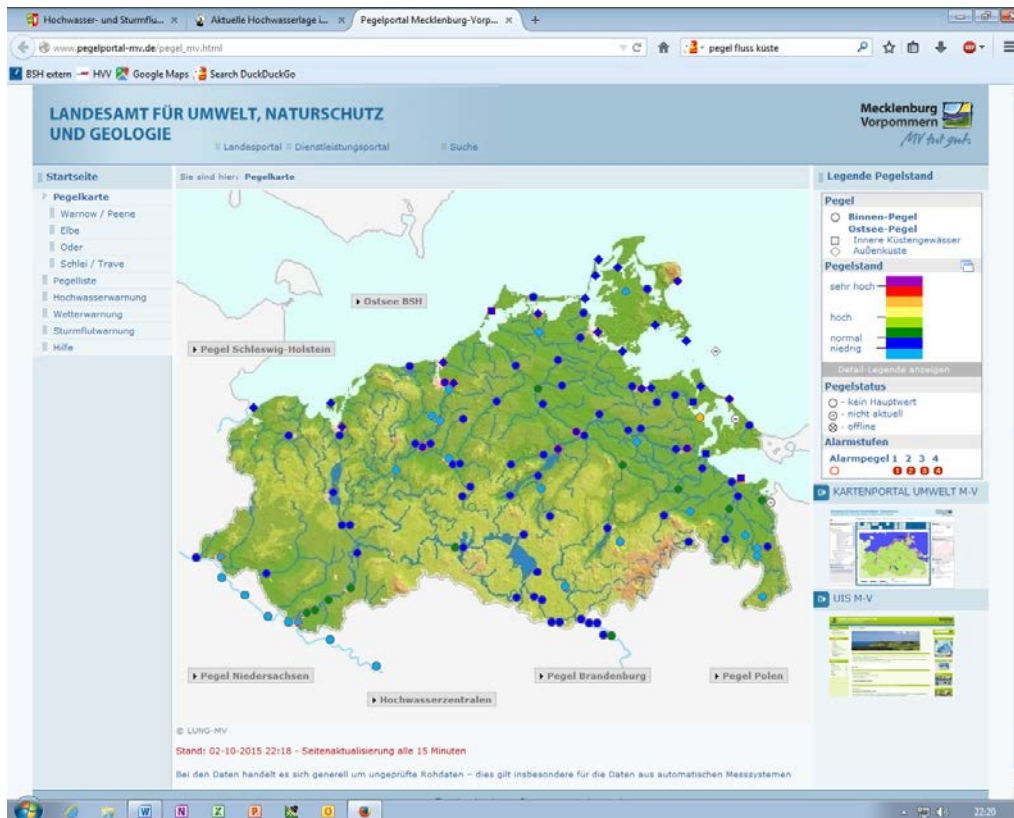


Figure 4: Gauges in Mecklenburg-Western Pomerania

Sea level measurements by radar

Four test sites for radar level gauges are located in the German coastal waters of the North Sea. Two of the test sites are equipped with arrays of four radar level sensors, measuring water level as well as 2D wave spectra. They are located at the research platform FINO 1 and the island of Borkum. At the lighthouse “Alte Weser” a single radar level sensor measures water level and 1D wave spectra. In July 2015 the research platform FINO 3 was equipped with an array of five radar level sensors.

The location of the stations and an impression of the platforms and devices are given in Figure 5. Data can be accessed through the FINO web pages (<http://www.fino1.de/en/live-data-news-from-the-platform/live-data>, <http://www.fino3.de/en/live-data>) or be retrieved from the FINO database after registration.

In the first half of the year 2013, in the framework of the project FINO, radar sensors were installed at the research platforms FINO 1, FINO 2 and FINO 3. As depicted in Figure 2, FINO 1 and 3 are positioned in the North Sea, while FINO 2 is 33km north of the Island of Rügen, in

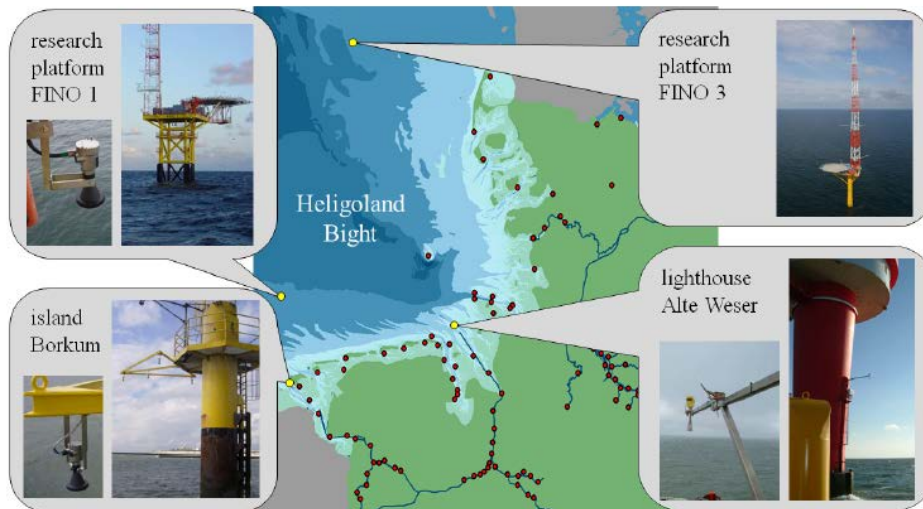


Figure 5: Test sites for the use of radar level gauges in German coastal waters of the North Sea (source BfG)

the Baltic Sea (Figure 6). The devices measure water level and sea state, the data is processed on site and four different mean values (10 s, 1 min, 5 min and 10 min) are transmitted to the FINO database. Until recent this had to be done manually, now the transmission process is automated and realised by means of directional radio systems or via satellite. So far the data is for internal research and thus not freely available. Similar to the data described above, the radar data from BSH can be retrieved from the FINO database after registration.

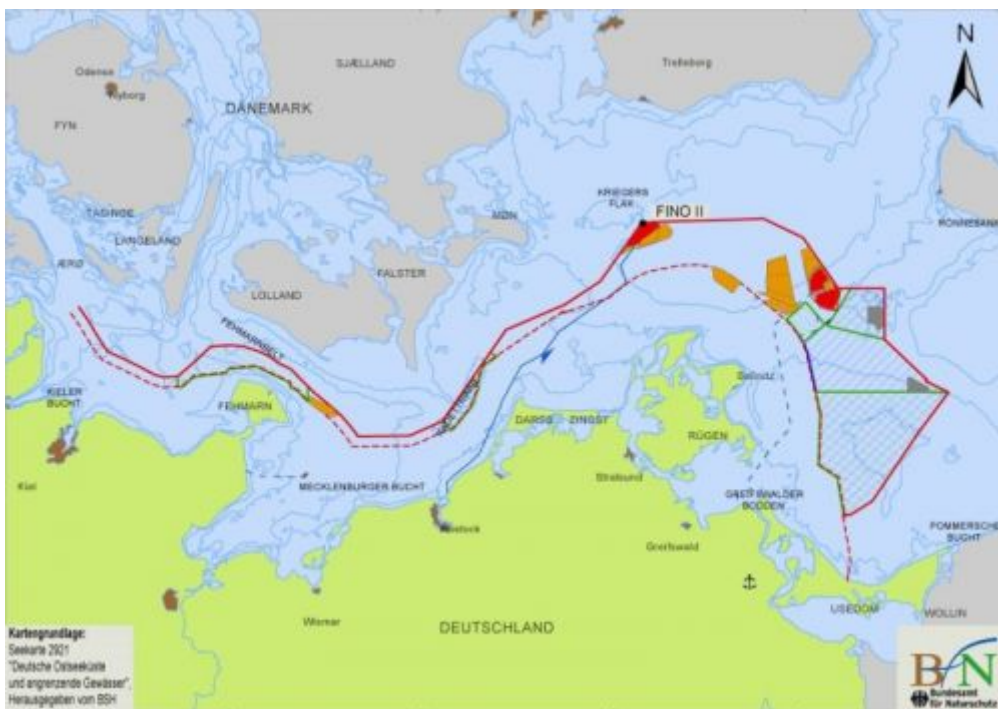


Figure 6: Position of the research platform FINO 2 in the Baltic Sea

As the main tide gauges at the German Coasts belong to the WSV, who are thus responsible for operating and maintaining the tide gauges, it is obviously that the data processing is their hands. On the other side the dissemination of sea level data in the broader context, as of GLOSS, were in the responsibilities of BSH and BfG. Different data streams to various institutes had thus been established. This model proved to be problematic and intransparent. Earlier in 2015, BSH and BfG agreed on following handling of the data transmission to GLOSS: Hydrological data processing will be done by the local offices of the WSV and the BfG. The dissemination will be done by the BSH. This procedure shall be implemented by 2016.

Concerning **sea level data archaeology**, a number of efforts have been expanded at different institutions in the last years. Due to the federal structure archiving has not been uniformed. However, a new four-year project dedicated to the rescue of tabulations as well as complete sets of paper charts was initiated at the BfG in early 2015.

Appendix

List of selected stations

Coordinate Reference System (CRS): DE_ETRS89_Lat- Lon

Station name	Station-ID	Latitude			Longitude			Agency
		Deg	Min	Sec	Deg	Min	Sec	
North Sea								
Büsum	9510095	54	07	12	08	51	35	WSA Tönning
Helgoland, Binnenhafen	9510070	54	10	33	07	53	29	WSA Tönning
Husum	9530020	54	28	20	09	01	34	WSA Tönning
List	9570070	55	00	60	08	26	31	WSA Tönning
Hörnum	9570050	54	45	29	08	17	51	WSA Tönning
Wittdün	9570010	54	37	55	08	23	07	WSA Tönning
Brunsbüttel	5970055	53	53	15	09	07	33	WSA Cuxhaven
Cuxhaven-Steubenhöft	5990020	53	52	04	08	43	03	WSA Cuxhaven
LT Großer Vogelsand	9510050	53	59	44	08	28	36	WSA Cuxhaven
Zehnerloch	9510010	53	57	20	08	39	30	WSA Cuxhaven
Bake A (Scharhörnriff)	9510063	53	59	04	08	18	55	WSA Cuxhaven
Bake Z (Großer Vogelsand)	9510066	54	00	49	08	18	53	WSA Cuxhaven
Scharhörnriff	9510060	53	58	12	08	28	05	WSA Cuxhaven
Mittelgrund	9510132	53	56	31	08	38	10	WSA Cuxhaven
Otterndorf	5990010	53	50	03	08	52	08	WSA Cuxhaven
Osteriff	5970095	53	51	19	09	01	46	WSA Cuxhaven
Brokdorf	5970050	53	51	46	09	19	03	WSA Hamburg
Glückstadt	5970035	53	47	04	09	24	39	WSA Hamburg
Bremerhaven, Alter LT	4990010	53	32	42	08	34	11	WSA Bremerhaven
Alte Weser, Leuchtturm	9460040	53	51	48	08	07	44	WSA Bremerhaven
Dwarsgat, Unterfeuer	9460020	53	43	07	08	18	33	WSA Bremerhaven
Robbensüdsteert	9460010	53	38	21	08	26	48	WSA Bremerhaven
Nordenham, Unterfeuer	4970040	53	27	52	08	29	22	WSA Bremerhaven
Rechtenfleth	4970030	53	22	52	08	30	07	WSA Bremerhaven
Wangerooge, Nord	9420030	53	48	23	07	55	45	WSA Wilhelmshaven
Wangerooge, Ost	9420020	53	46	02	07	59	06	WSA Wilhelmshaven
Mellumplate, Leuchtturm	9420010	53	46	18	08	05	33	WSA Wilhelmshaven
Schillig	9430030	53	41	57	08	02	50	WSA Wilhelmshaven
Hooksielplate	9430020	53	40	09	08	08	55	WSA Wilhelmshaven
Voslapp	9430010	53	36	39	08	07	22	WSA Wilhelmshaven
Wilhelmshaven, Ölpier	9430040	53	33	31	08	10	03	WSA Wilhelmshaven
Wangerooge, West	9420040	53	46	35	07	52	05	WSA Wilhelmshaven
Borkum, Fischerbalje	9340020	53	33	27	06	44	58	WSA Emden
Norderney, Riffgat	9360010	53	41	47	07	09	21	WSA Emden
Spiekeroog	9410010	53	44	57	07	41	00	WSA Emden
Langeoog	9390010	53	43	15	07	40	56	WSA Emden
Memmert	9350010	53	37	29	06	54	30	WSA Emden
Borkum, Südstrand	9340030	53	34	37	06	39	46	WSA Emden
Dukegat	3990020	53	26	01	06	55	39	WSA Emden
Emshörn	9340010	53	29	37	06	50	33	WSA Emden
Knock	3990010	53	19	38	07	01	56	WSA Emden

Coordinate Reference System (CRS): DE_ETRS89_Lat- Lon

Station name	Station-ID	Latitude			Longitude			Agency
		Deg	Min	Sec	Deg	Min	Sec	
Baltic Sea								
Flensburg	9610010	54	47	42	09	26	04	WSA Lübeck
Langballig	9610015	54	49	24	09	39	20	WSA Lübeck
Schleimünde Seepegel	9610025	54	40	22	10	02	17	WSA Lübeck
Eckernförde	9610045	54	28	29	09	50	15	WSA Lübeck
Kappeln	9610035	54	39	52	09	56	22	WSA Lübeck
LT Kiel	9610050	54	29	59	10	16	29	WSA Lübeck
Kiel-Holtenau	9610066	54	22	20	10	09	30	WSA Lübeck
Heiligenhafen	9610070	54	22	23	11	00	25	WSA Lübeck
Marienleuchte	9610075	54	29	48	11	14	25	WSA Lübeck
Travemünde	9620085	53	57	29	10	52	25	WSA Lübeck
LT Kalkgrund	9610020	54	49	29	09	53	22	WSA Lübeck
Althagen	9650024	54	22	18	12	25	08	WSA Stralsund
Barhöft	9650040	54	26	04	13	01	56	WSA Stralsund
Barth	9650030	54	22	16	12	43	23	WSA Stralsund
Greifswald Eldena	9650072	54	05	33	13	26	46	WSA Stralsund
Kloster	9670050	54	35	05	13	06	41	WSA Stralsund
Koserow	9690093	54	03	37	14	00	02	WSA Stralsund
Lauterbach	9670063	54	20	25	13	30	08	WSA Stralsund
Neuendorf Hafen	9670046	54	31	28	13	05	37	WSA Stralsund
Ruden	9690077	54	12	15	13	46	19	WSA Stralsund
Sassnitz	9670065	54	30	39	13	38	35	WSA Stralsund
Thiessow	9690077	54	16	50	13	42	35	WSA Stralsund
Warnemünde Tonnenhof	9640002	54	10	11	12	06	12	WSA Stralsund
Greifswalder Oie	9690078	54	14	28	13	54	26	WSA Stralsund
Karlshagen	9690085	54	06	28	13	48	27	WSA Stralsund

All TGs measure the water level with a float-system in a stilling well. The mechanical signal of the float is transformed by an angle decoder into electrical signals for the data transmission.