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# Hydrological monitoring stations in boreholes near the Husavik-Flatey fault zone

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# HYDROLOGICAL MONITORING STATIONS IN BOREHOLES NEAR THE HUSAVIK-FLATEY FAULT ZONE

## November 2001 to March 2003 performance

### Introduction

This short report describes the performance of an automated data logging system, which monitors hydrological parameters in wells near the Husavik-Flatey fault zone. A description on the system and its performance has already been given in two earlier reports (Grimur Bjornsson et.al., 2001: *Hydrological Monitoring Stations In Boreholes Near The Husavik-Flatey Fault Zone. Installment and November to December 2000 performance.* Orkustofnun short report GrB/EHH/ArH-01/01; Grimur Bjornsson and Arnar Hjartarson 2001: *Hydrological Monitoring Stations in Boreholes Near the Husavik-Flatey Fault Zone. November 2000 to November 2001 performance.* Orkustofnun short report ARH/GrB-01/05).

### Well locations and status

Table 1 describes the wells selected for the hydrological monitoring and Figure 1 shows their locations. All the wells in the table are the same as in late 2001.

**Table 1**: *Wells near the Husavik-Flatey fault zone selected for hydrological monitoring.*

| Well name | Well ID | Logger name | Site name | Depth (m) | Location Hjörsey datum | Well status |
|---|---|---|---|---|---|---|
| FE-01 | 56811 | S-8 | Flatey | 555 | 66.163476 N 17.841316 W | Non-artesian Waterlevel at 16.5 m |
| AA-01 | 59701 | S-9 | Arnes | 1250 | 65.875338 N 17.405956 W | Artesian flow of a few liters/minute |
| ST-06 | 57226 | S-10 | Storu-Tjarnir | 595 | 65.709058 N 17.738454 W | Artesian flow of a few liters/minute |
| ST-07 | 57227 | S-10 | Storu-Tjarnir | 452 | 50 m to the south of ST-06 | Closed most of the time and with pressure |
| HU-04 | 51031 | S-11 | Husavik | 504 | 66.055088 N 17.347046 W | Non-artesian Waterlevel at 15.75 m |
| TJ-01 | 59501 | S-12 | Tjörneshöfn | 105 | 66.142570 N 17.263769 W | Non-artesian Waterlevel at 5 m |

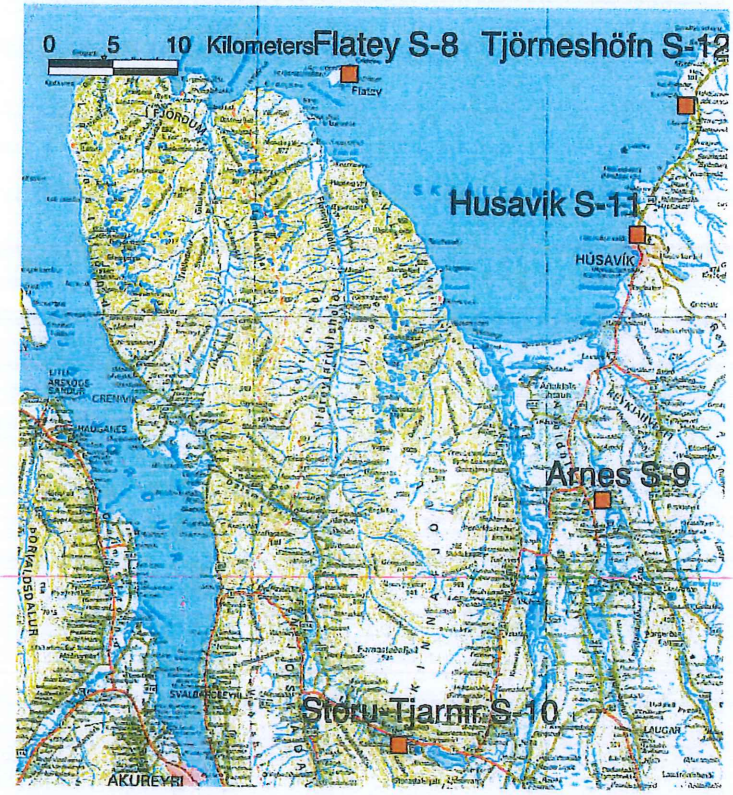


**Figure 1**: *Location of the hydrological monitoring stations in N-Iceland*

## Station S-8 in Flatey

Figure 2 shows all the pressure data collected in Flatey. The well is located next to the lighthouse on the island. The operation of this station was successful until like November 2001 when a gradual but steady rise in the gauge pressure is observed. At this time the pressure sensor was relative to barometric pressure via a "breathing tube" to surface. Most likely a leakage occurred to this tube in November 2001, which resulted in a wrong pressure reference. This led finally to malfunction of the sensor in early February 2002 and consequently a total loss of the pressure signal. Due to the site accessibility, a new sensor was immersed to the well in September 2002, this time with no reference to the atmospheric pressure (absolute). After this replacement the station has run smoothly.

Two interesting low-pressure spikes, which were observed in early August and late October 2001, have already been discussed in an earlier report and their connection to nearby seismic events. The late year 2002 and early year 2003 pressure history is, on the other hand, most uneventful when plotted alone.

Note that the hydrological data for station S-8, as well as for the other stations in the north, can be readily accessed via our web-site www.os.is/ros/eftirlit.

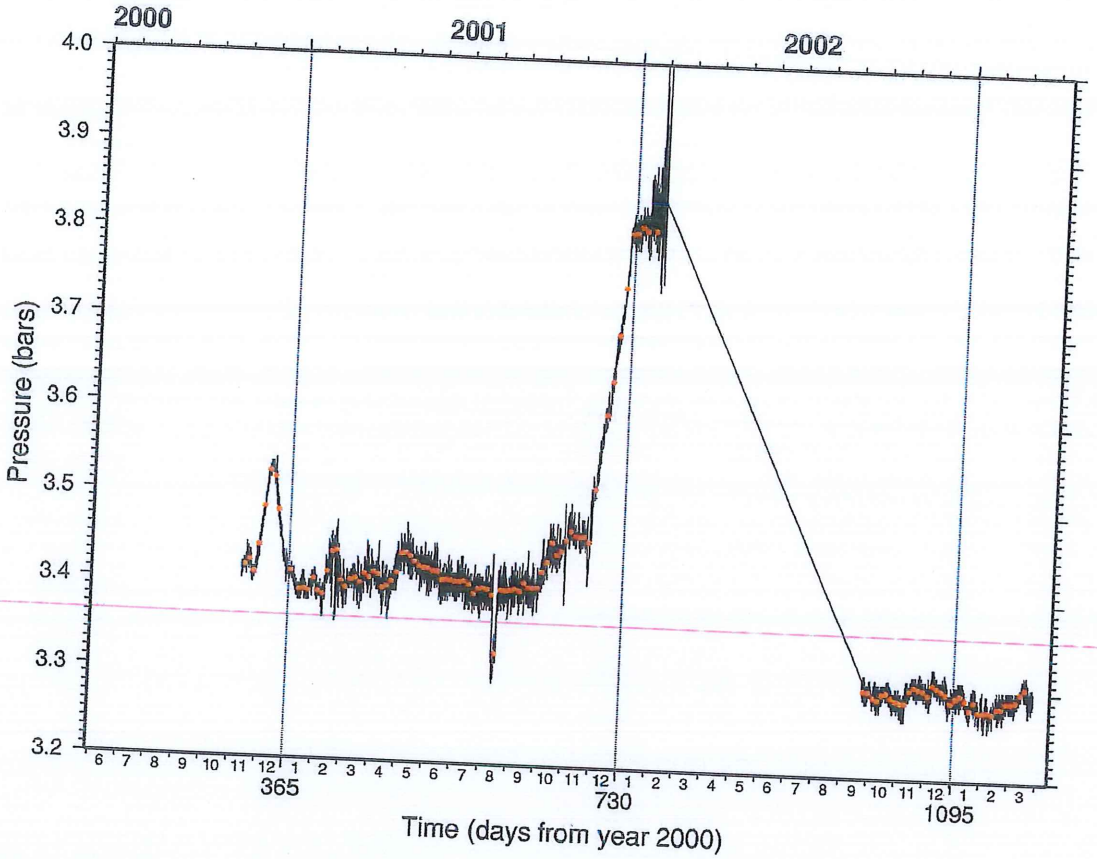


**Figure 2:** *All pressure data for station S-8 in Flatey. The raw pressure data is shown by black line and red dots present a 5 days average for the pressure. The downhole pressure gauge is failing in November 2001 and out of service in February 2002. A new gauge is on-line in September 2002.*

## Station S-10 at Storu-Tjarnir

Figure 3 shows hydrological data collected in wells 6 and 7 at Storu-Tjarnir. These wells belong to a small district heating facility, operated by the local community. Well 6 is used for observation only and is kept open at all times, flowing a few liters per minute. Well 7, on the other hand, is connected to the heating system and used at times of peak demand for the hot water. By using this configuration, well 6 can detect sudden decline in the field pressure while well 7 is able to pick up sharp pressure pulses of tectonic origin. In total three parameters are therefore collected in these wells: 1) pressure at either 70 or 30 m depth in the artesian well number 6, 2) discharge temperature of well 6, and 3) the wellhead pressure of well 7. The immersed pressure sensor in well 6 was initially relative to barometric pressure like in the well in Flatey. Unfortunately this sensor failed almost immediately and, furthermore, cattle chewing of cables and insufficient daylight in mid winter have resulted in sizeable maintenance and only like 60% up time of the station.

The data on Figure 3 is dominated by the irregular hot water production. Any indicators for tectonic driven pressure changes need special analysis. These can be done at later times when periods of suspected pressure changes are provided by other data sources.

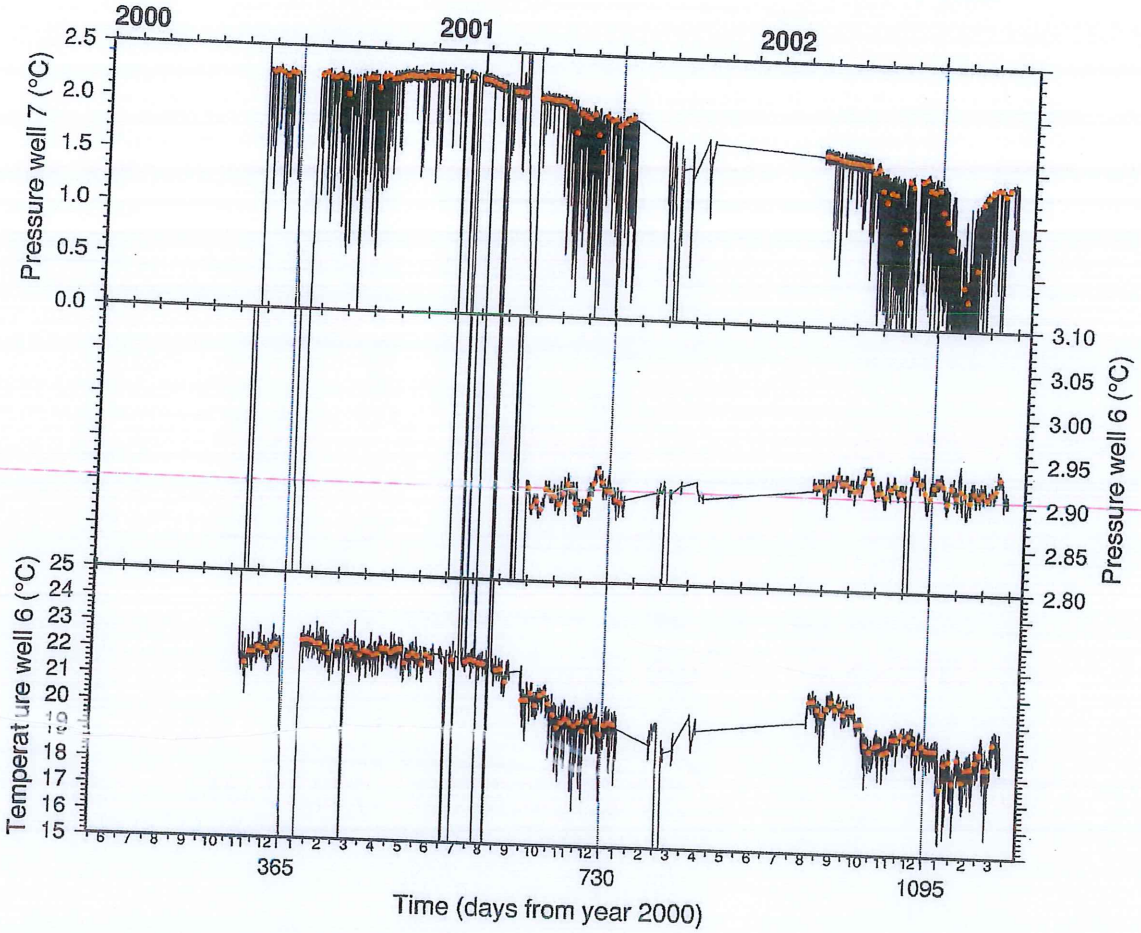


**Figure 3:** *Observed pressure history of well 7 (top), and pressure (centre) and temperature (bottom) of well 6, for the hydrological station S-10 at Storu-Tjarnir. Black lines show the raw field data and red dots present 5 days averages.*

## Station S-11 in Husavik

Pressure data from station S-11 in Husavik is presented on Figure 4. The well pressure transducer is absolute and immersed to a depth of 40 m. To be short, no drastic pressure changes have been observed in the well after November 2001, when the last monitoring report was issued. A closer look may reveal interesting pressure events, but requires some additional work. This station has excellent performance and has hardly missed out a single minute of recording since commenced in June 2001.

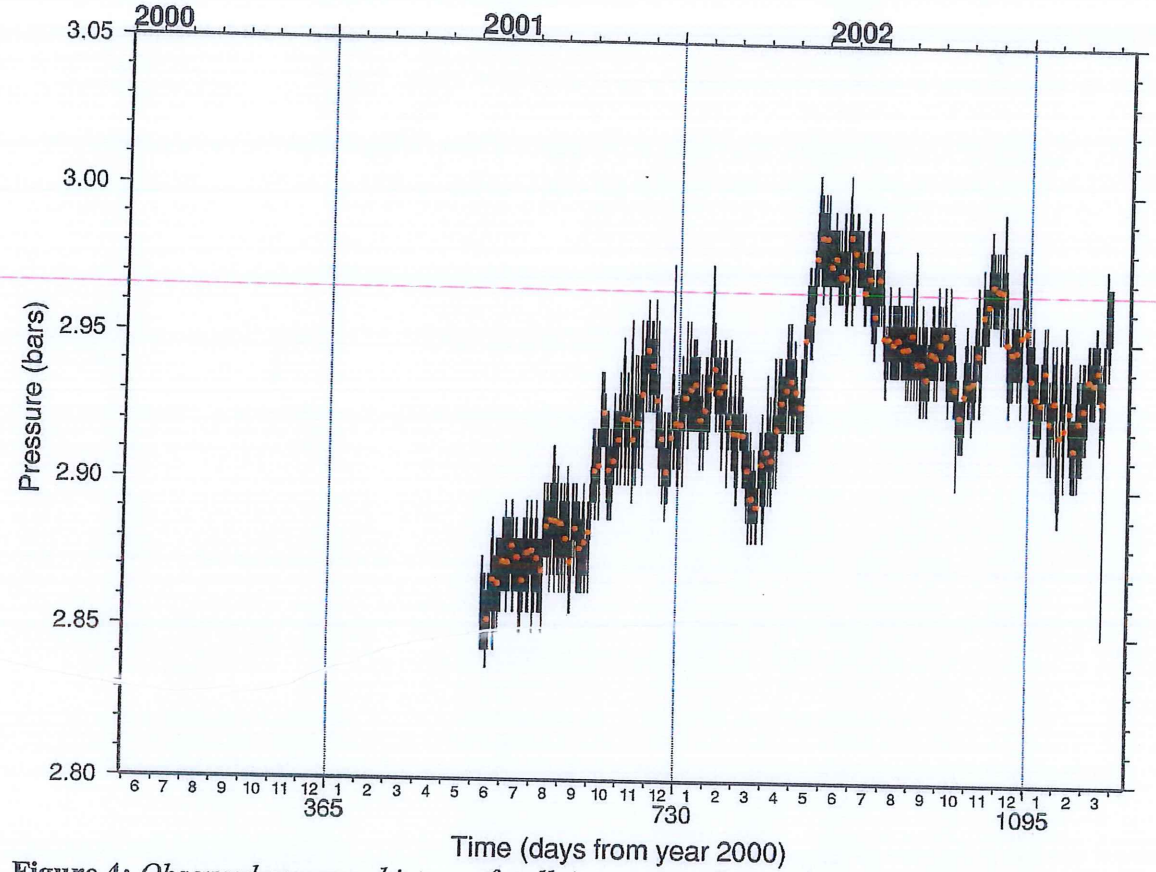


**Figure 4:** *Observed pressure history of well 4 at station S-11 in Husavik. The raw pressure data is shown by black line and red dots present a 5 days average for the pressure*

## Station S-12 in Tjörneshöfn

This station began operation in early October 2001, after being transferred from Arnes. The well is on the shore and some 10 km to the north of Husavik. This station is the only one currently located to the north of the Husavik-Flatey fault zone. Figure 5 shows the recorded pressure history. Tidal fluctuations are dominant in the pressure signal here. Note that the pressure signal appears also be influenced by wind and waves, resulting in "noisy" pressure occasionally. Similar feature is observed in Flatey. Like in Husavik, data acquisition works fine here with the exception of February to March 2003 when the station fell out of service temporarily.

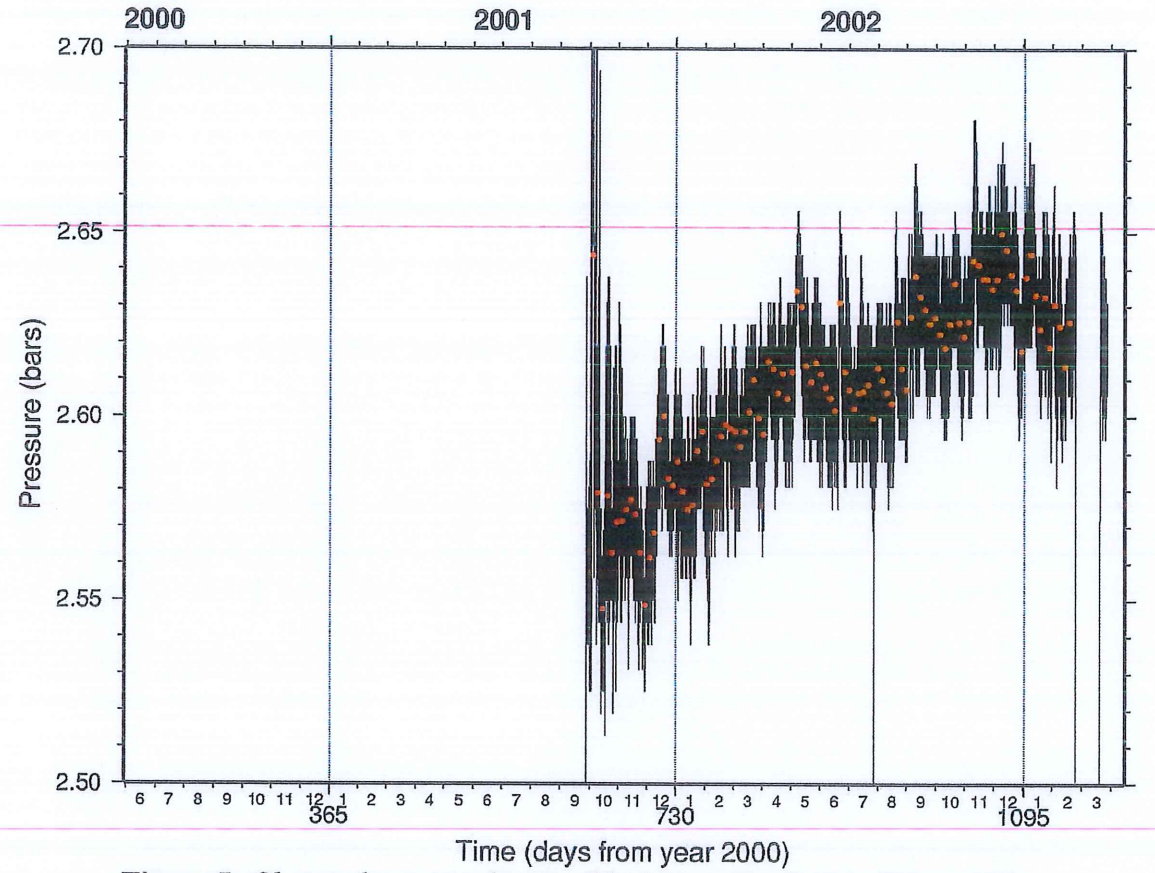


**Figure 5:** *Observed pressure history (blue) at station S-12 in Tjörneshöfn.*

## Concluding remarks

The above figures present the raw field data collected by the hydrological monitoring system for 2-3 years. Over all one can say that the system operation has been successful and that the up time is adequate up to perfect depending on the siting. Interesting pressure behavior in late year 2001 has already been described in earlier report. These are clearly associated with tectonic events near the Husavik-Flatey fault zone and clearly demonstrate that the monitoring may have relevance with tectonic sciences. A closer look on these pressure data may show additional events when analyzed in more details.

March 26

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