Polanen

Seismic Interpretation 3D Depth survey R-2629

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1 Samenvatting (Nederlands)

In oktober 2018 heeft PanTerra een geologische studie voor de Polanen licentie verricht. De seismische interpretatie was verricht op de 3D tijd survey L3NAM1990c, geschoten in 1990. Een SDE+ subsidie was aangevraagd en toegekend, gebaseerd op de geologische studie. ETP ontving de herbewerkte 3D diepte survey R-2629 (2011) van de NAM begin 2019. De herbewerkte diepte seismiek is over het algemeen van betere kwaliteit dan de originele L3NAM1990c survey, met een betere definitie van breuken, meer continue reflectoren en verminderde ruis. Bovendien kan de basis van het Delft reservoir geïdentificeerd worden, wat (bijna) niet mogelijk was op de oude L3NAM1990c survey. Daarom is er een herevaluatie van de seismische interpretatie voor het Polanen gebied uitgevoerd gebaseerd op de herbewerkte 3D diepte survey. De nieuwe interpretatie maakt een duidelijke interpretatie van de top Delft mogelijk – die op de oude data als basis Delft was geïnterpreteerd. De dikte van het Delft reservoir in Polanen varieert van 35 tot 70 meter, gebaseerd op de seismische data.

2 Introduction

In October 2018, PanTerra performed a geological study of Polanen. The seismic interpretation was performed on 3D time survey L3NAM1990c, shot in 1990. Based on the geological study, an SDE+ subsidy was requested and granted. ETP received the reprocessed 3D depth survey R-2629 (2011) from the NAM early 2019. The reprocessed depth cube is generally of a better quality than the original L3NAM1990c survey, with better definition of faults and more continuous reflections and reduced noise. Moreover, the base of the Delft reservoir can be identified, which was not / hardly the case on the original time survey. Therefore a seismic reinterpretation was performed of the Polanen area based on the depth survey.

3 Seismic interpretation and depth model

3.1 Method

Seismic interpretation was performed in Petrel 2019. Horizons were interpreted using auto-tracking where possible and otherwise picked every 8th in- and crossline, finer where necessary. Faults were mostly mapped on inlines, perpendicular to the overall strike of the faults. The 3D depth cube, R-2629, has SEG reverse polarity.

3.2 Seismic interpretation and well to seismic ties

The interpreted horizons are listed in Table 3-1 and include top and base reservoirs. The tie between the depth survey and wells is generally excellent, which is to be expected since the wells were probably used for time-depth conversion of the seismic data. Also wells HON-GT-01 & 02, that were drilled after the depth reprocessing, tie the seismic (Figure 3-1). This result gives good confidence in the time-depth model used in the reprocessing. In general, there is good confidence in the seismic picks; the seismic character of the horizons (e.g. hard kick, soft kick, see Table 3-1) is in good agreement with the sonic logs of the wells.

In the original seismic interpretation of the time survey, only the base Delft was interpreted, the top Delft could not be identified. The new interpretation shows that the base Delft interpretation of the time survey is actually the top Delft. This reflector runs roughly parallel to the top Rodenrijs. In Honselersdijk, the base Delft appears to onlap on the underlying Alblasserdam member. The seismic character of the Delft and Alblasserdam is different; the Delft is more reflective than the underlying Alblasserdam. The thickness of the Delft changes significantly within the graben in which Polanen and Honselersdijk are situated. The wells show that the thickness of the Delft increases towards the southeast. This is confirmed by the R-2629 depth survey. The Delft looks like a bowl-shaped feature in Honselersdijk, with greatest thickness just east of the Honselersdijk wells. The Honselersdijk wells are drilled in the western flank of the bowl, with greatest thickness in HON-GT-02, confirmed by the seismic data and wells. The basal Delft sands in HON-GT-02 appear to shale out towards HON-GT-01-S1. Based on the seismic data, the thickness of the Delft reservoir in Polanen ranges between 35 m and 70 m.

Table 3-1: Interpreted horizons.

Horizon	Lithostrati-graphic code	Seismic character	Quality	Interpretation method
Base North Sea	BNS	Strong hard kick	Excellent	Auto-tracked
Base Ommelanden	BCKGR	Strong soft kick	Excellent	Auto-tracked
Base Holland	BKNGL	Hard kick, lowest hard kick above 'transparent' Vlieland section	Moderate to good	Auto-tracked /Manual pick
Base Vlieland	TSLDNR	Strong Hard kick	Good	Auto-tracked /Manual pick
Base Rodenrijs	TSLDND	Soft kick, usually parallel to TSLDNR	Moderate	Manual pick
Base Delft	BSLDND	Character varies, usually soft kick. Near Honselersdijk it is an onlapping surface, whereas it appears concordant in Poeldijk. The Delft has a higher reflectivity than the underlying Alblasserdam sediments.	Moderate	Manual pick

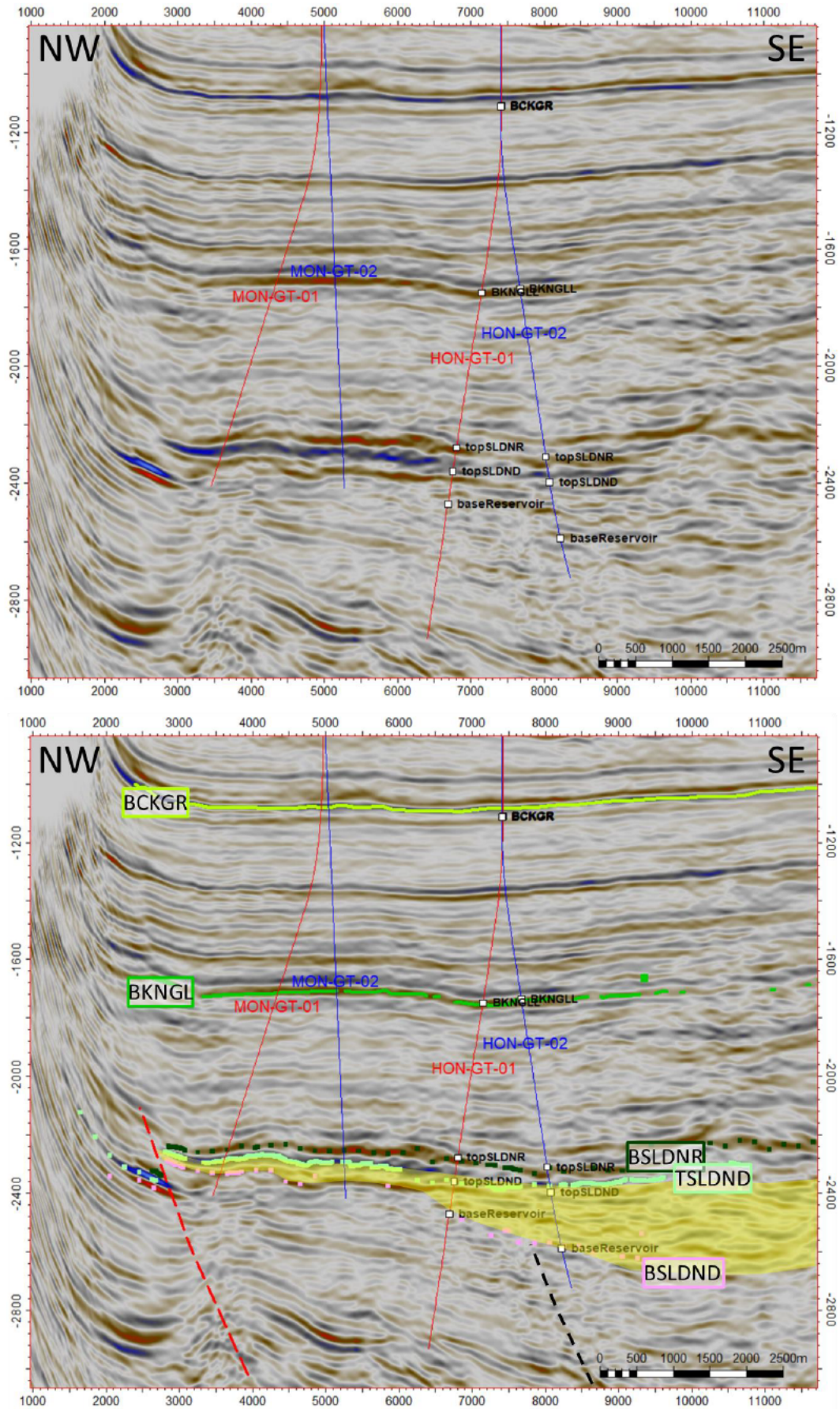

Figure 3-1: Seismic line along Polanen and Honselersdijk. Upper figure without interpretation, lower figure with interpretation. The yellow shading indicates the Delft Sandstone member. Note that the seismic is pulled upwards on the NW side (artefact).

3.3 Gridding algorithm

All horizons were gridded using the convergent interpolation methodology after which grids were smoothed. Cell size is 50m x 50m.

3.4 Time-depth conversion

No time-depth conversion was performed as seismic interpretation was performed on a depth survey.

3.5 Top and base reservoir map

The resulting top and base reservoir depth maps are displayed in Figure 3-2 and Figure 3-3. The top reservoir map is fairly similar to the original map reported in the geological study (Geological report Polanen, G1421, 2018, page 23), the base reservoir map however is clearly different. Note that the seismic data northwest of MON-GT-01 is pulled upwards, an artificial side effect, see Figure 3-1 and Figure 3-2. As a result, the interpretation is also pulled upwards. The grids have been forced downwards to countereffect this artefact in the dotted black box of Figure 3-2. In this area the grids have been manipulated such that they match the depth grids from the original interpretation of the time survey. This issue is not critical as it does not affect the interpretation of the subsurface around the planned wells.

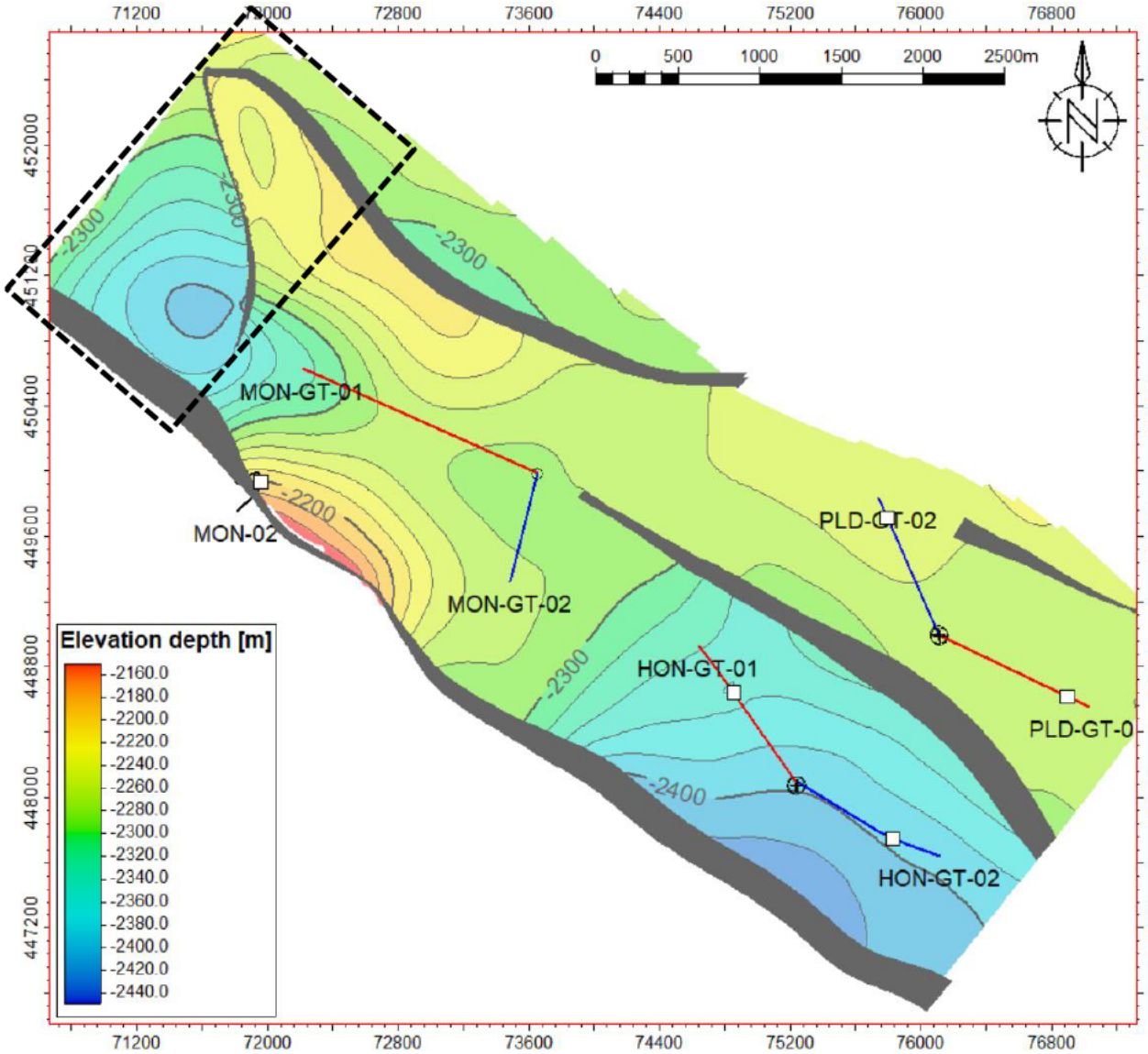

Figure 3-2: Depth map of top reservoir (corrected to wells) with the well trajectories of the planned doublet and other nearby wells. White squares indicate well penetration points at top reservoir. The black dashed polygon indicates the area of the interpretation affected by side effects of the depth survey.

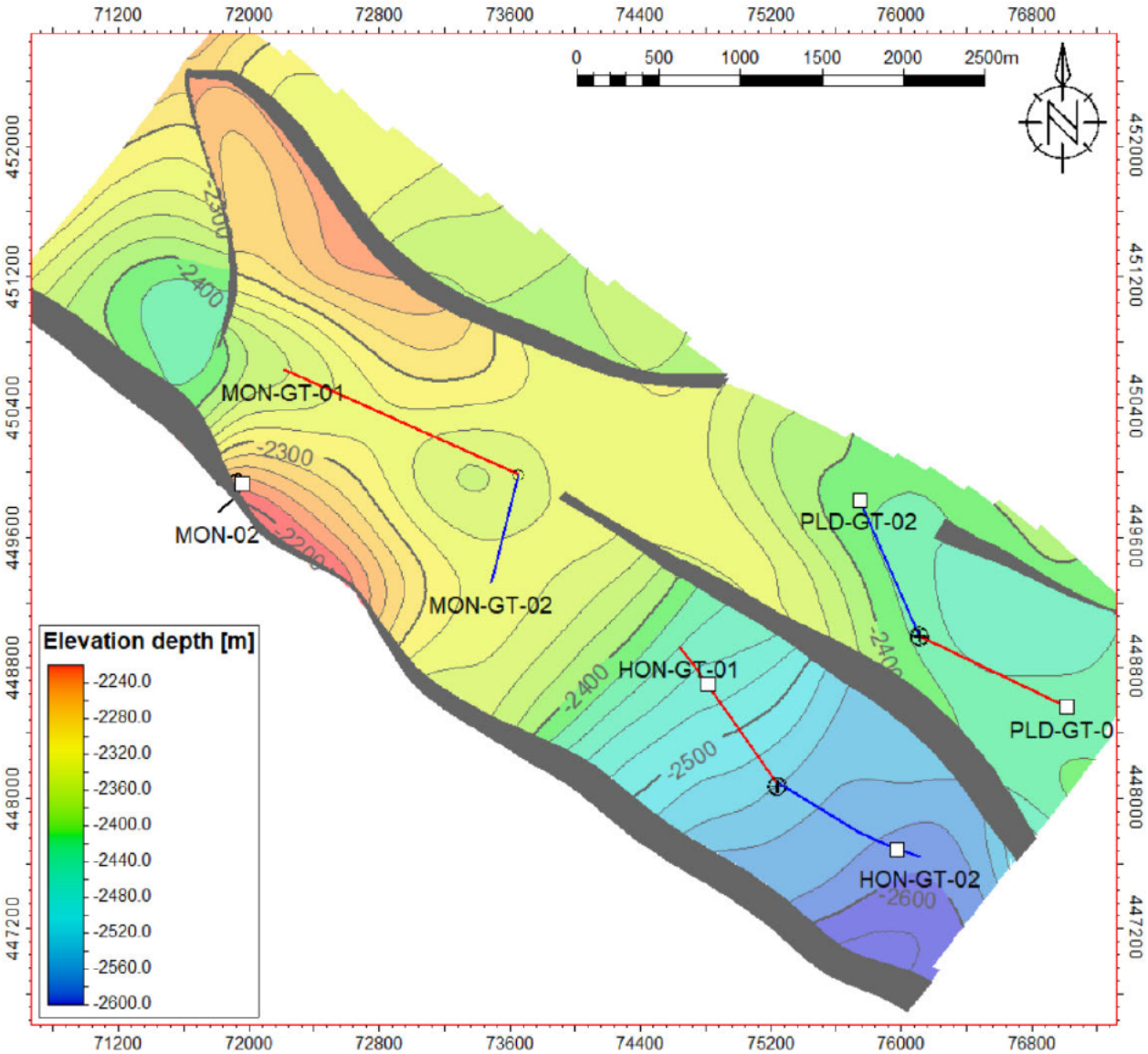

Figure 3-3: Depth map of base reservoir (corrected to wells) with the well trajectories of the planned doublet and other nearby wells. White squares indicate well penetration points at base reservoir.

3.6 Reservoir thickness map

The gross reservoir thickness was calculated from the mapped top and base reservoir. The map is in line with observed thicknesses in the Honselersdijk wells, Poeldijk wells and MON-02. The map shows a sudden eastward increase in thickness between the planned MON-GT-02 well and HON-GT-01. Likely this is caused by a pull-apart basin accompanied with the presence of a NW-SE fault in between Poeldijk and Honselersdijk. This fault likely accommodated increased faulting, resulting in the increase of accommodation space for deposition of the Delft Sandstone Member.

The Delft Sandstone member appears to be thicker in between the planned wells MON-GT-01 and -02. On the seismic survey, there appears to be a channel-like feature, see arrow in Figure 3-1. Its circular shape on the map is odd. Whether the Delft Sandstone Member is indeed thicker here than in the surrounding subsurface is uncertain.

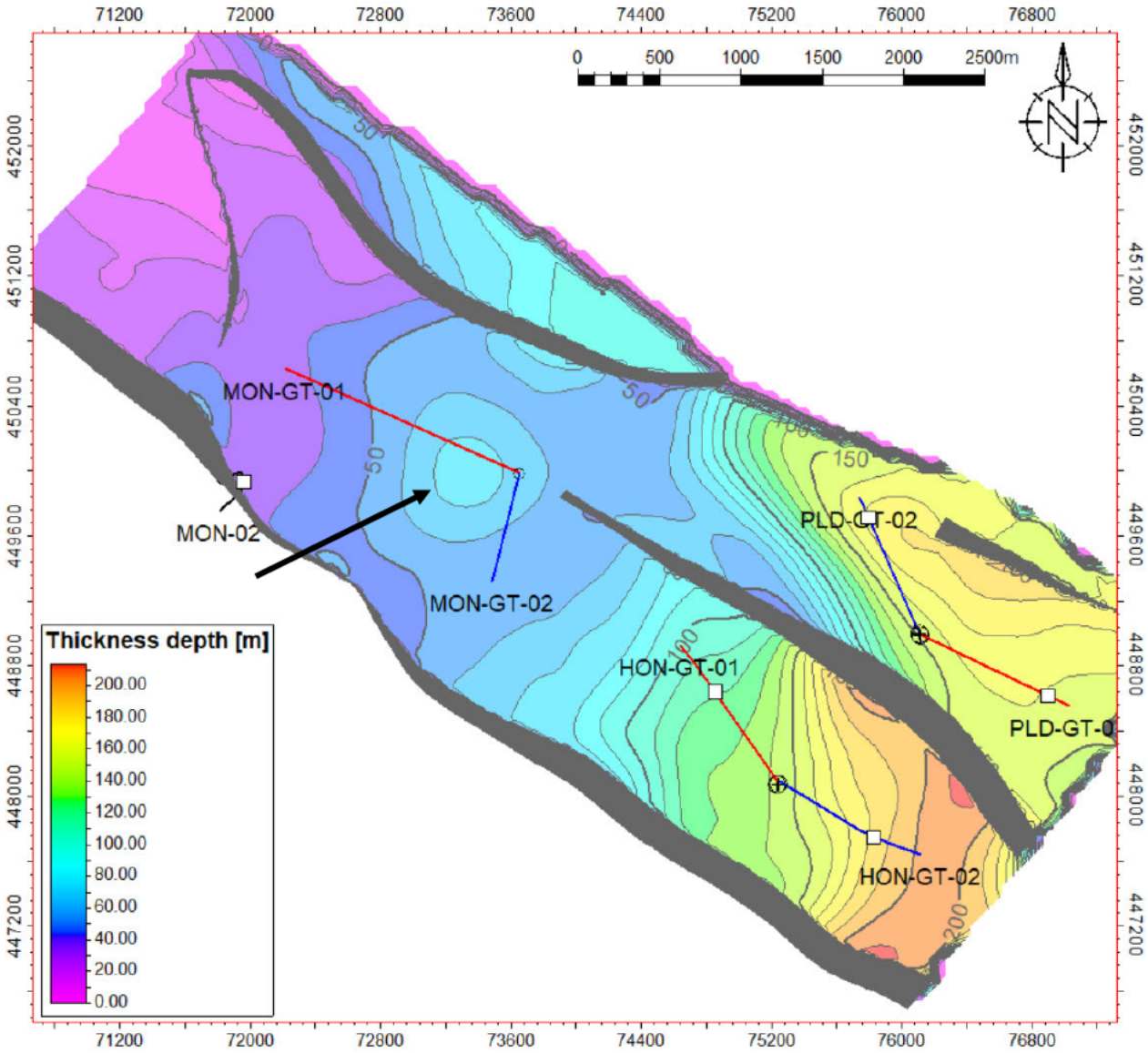

Figure 3-4: Thickness map of the reservoir (corrected to wells). White squares indicate well penetration points at top reservoir. The arrow indicates an area of increased thickness, which looks like a channel on the seismic data.

3.7 Uncertainty in the depth maps

The good tie between the 3D depth survey and wells (including wells that were drilled after seismic reprocessing) and high density of wells give confidence to the depth maps. The mistie of the interpretation with nearby wells HON-GT-01 and -02 is up to 30 m, which correlates to an uncertainty of approximately 1% at reservoir level and up to 5% at shallow levels.