International Civil Aviation Organization

The Nineteenth Meeting of the Regional Airspace Safety Monitoring Advisory Group (RASMAG/19)

Pattaya, Thailand, 27-30 May 2014

Agenda Item 5: Airspace Safety Monitoring Activities/Requirements in the Asia/Pacific Region

JASMA ASE SEASONAL VARIATION STUDY

(Presented by JASMA)

SUMMARY

This paper presents an outcome of seasonal ASE seasonal variation obtained from Setouchi height monitoring unit (HMU).

1. INTRODUCTION

1.1 This paper presents an outcome of whether seasonal variation exists on ASE value obtained from Setouchi HMU for the period between 16 April 2012 and 15 April 2014 according by the action item of RASMAG MAWG/1 that JASMA presented the IP/5 (TVE AND ASE TREND OF SETOUCHI HMU). JASMA compared the two periods of the monitoring data to researching the ASE trend between 16 April 2012 and 15 April 2013, and 15 April 2013 and 15 April 2014. It should be noted that the period of data of each months are from day 16th to 15th, which is as same as the period of upload data to the KSN site and due to technical reasons, there were some discontinuities in the data stream between 5 and 11 December 2013.

2. DISCUSSION

2.1 Difference between the geometric height

2.1.1 **Figure 1** shown the every month mean geometric height obtained from Setouchi HMU between 16 April 2012 and 15 February 2014. **Figure 2** shown the every month mean geometric height calculated with pressure altitude and meteorological data between the same periods. The lines of the both figures indicates that higher level in summer, and lower level in winter with keeping relative separation between the line.

2.1.2 In order to know the trend of TVE, shown a difference of two kinds of geometric height. The image of difference of Actual altitude and Assigned altitude was shown in **Figure 3**. The difference between the geometric height of monitoring data and geometric height calculated with pressure altitude and meteorological data shown in **Figure 4** and **Figure 5** for the two periods between 16 April 2012 and 15 April 2013 as (1), and 15 April 2013 and 15 April 2014 as (2). **Figure 6** was shown the mean difference of the two periods. The blue line shows the period from April 2012 to March 2013, red line shows the period from April 2013 to March 2014. It is not every month, the aircrafts geometric heights obtained from HMU are greater than that of geometric height calculated with pressure altitude and meteorological data.

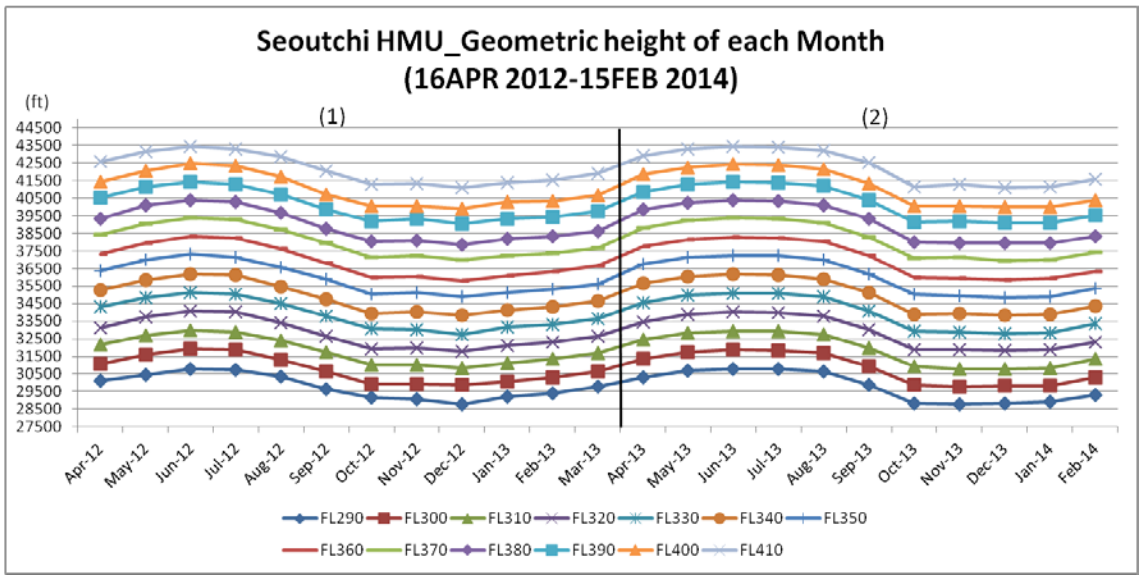


Figure 1: Geometrical height of each month between 15 APR 2012 and 15 FEB 2014

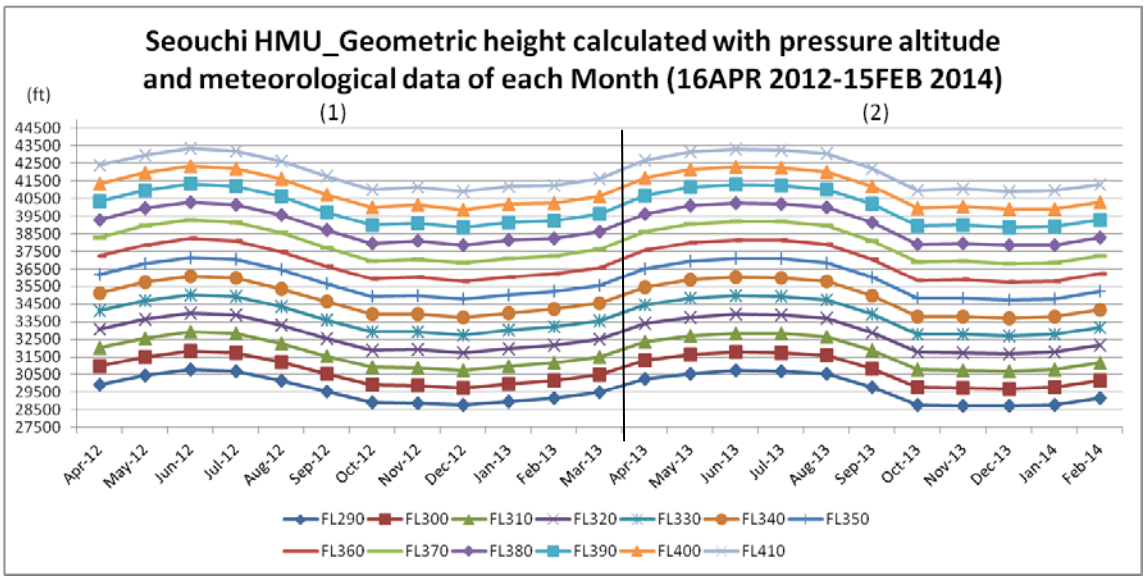


Figure 2: Geometrical height calculated with pressure altitude and meteorological data of each month between 15 APR 2012 and 15 FEB 2014

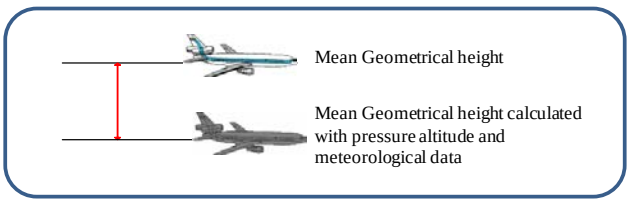


Figure 3: The image of the difference of Geometrical height and Geometrical height calculated with pressure altitude and meteorological data altitude

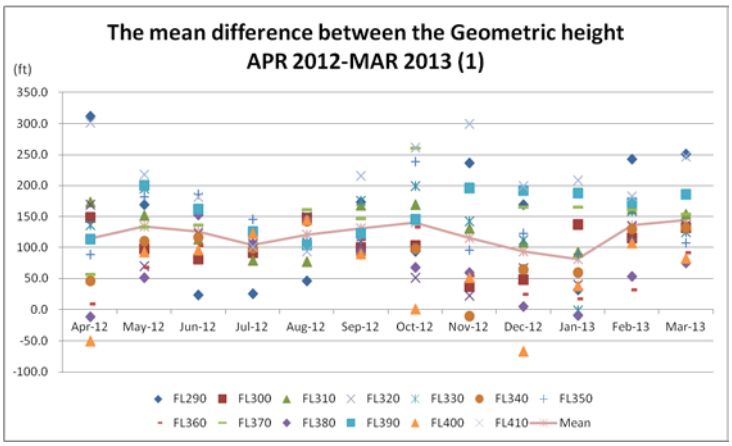


Figure 4: The difference between the two types of geometric height (APR 2012-MAR 2013)

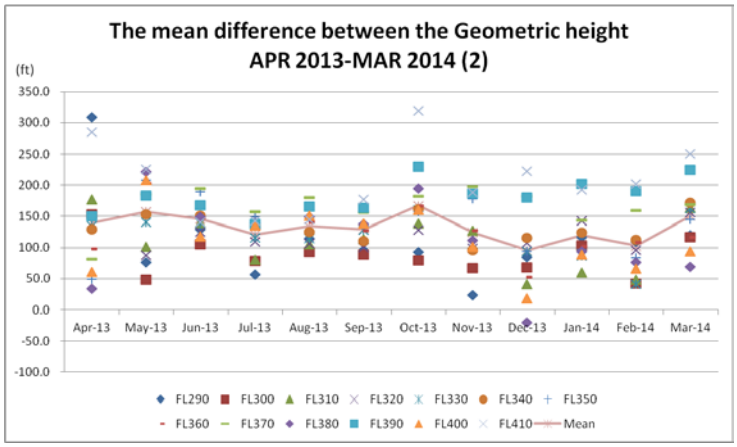


Figure 5: The difference between the two types of geometric height (APR 2013-MAR 2014)

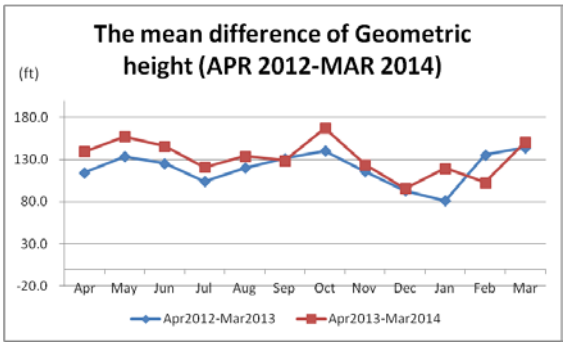


Figure 6: The comparison of the mean difference of Geometric heights (APR 2013-MAR 2014)

2.2 TVE trend

2.2.1 **Figure 7** and **Figure 8** shows the TVE trend of each month and each flight level of the two years. **Figure 9** shows the mean difference of the two periods. Note that the value of differences of two types of geometric height, and the value of TVE obtained from Seoutchi HMU which described in paragraph 2.2 are largely different. Meteorological data provided to Setouchi HMU is divided into 25 areas. TVE is calculated as the average value of the geometric height of where the area including the measurement point. A comparison in this paper, the average value of 25 areas of

meteorological data at each flight levels are used, so the differences of geometric heights are larger than the value of TVE.

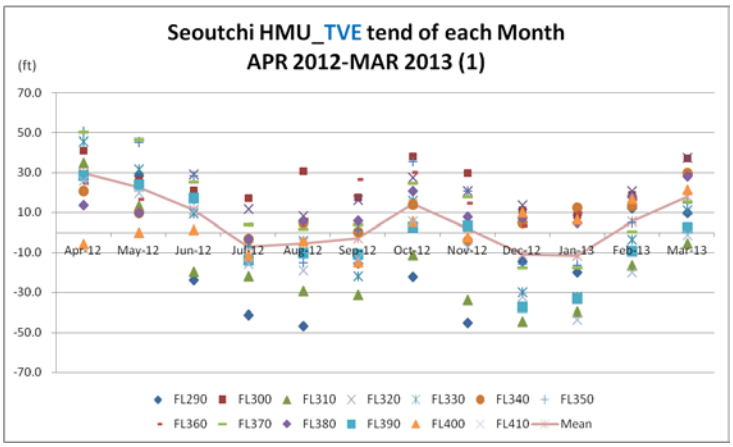


Figure 7: TVE trend of Setouchi HMU of each month (APR 2012-MAR 2013)

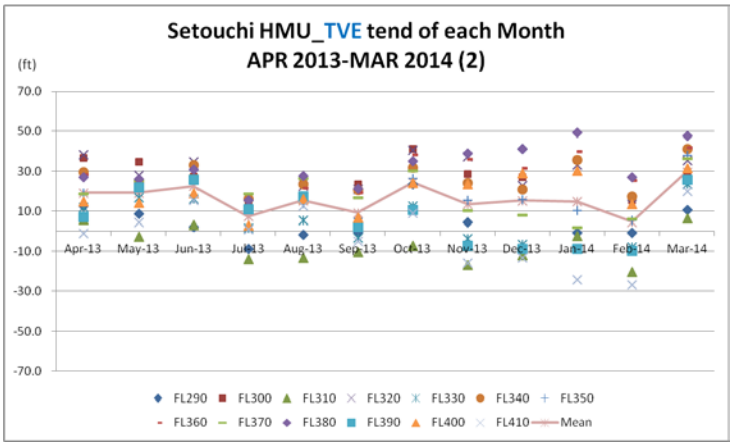


Figure 8: TVE trend of Setouchi HMU of each month (APR 2013-MAR 2014)

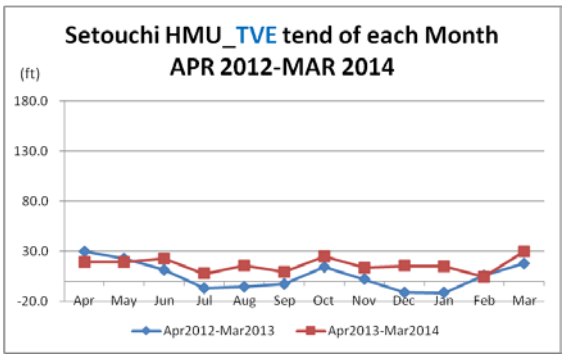


Figure 9: The comparison of the mean TVE trend (APR 2012-MAR 2014)

2.2.2 Setouchi HMU started operation from April 2012 but it could not be obtained a stable measurement result because it had repeatedly adjustment until December 2013. Stable measurement results are obtained from January 2013. As shown in **Figure10**, a remarkable seasonal variation is not seen for TVE, but the standard deviation indicating the variation in the measurements here for winter is larger than the summer.

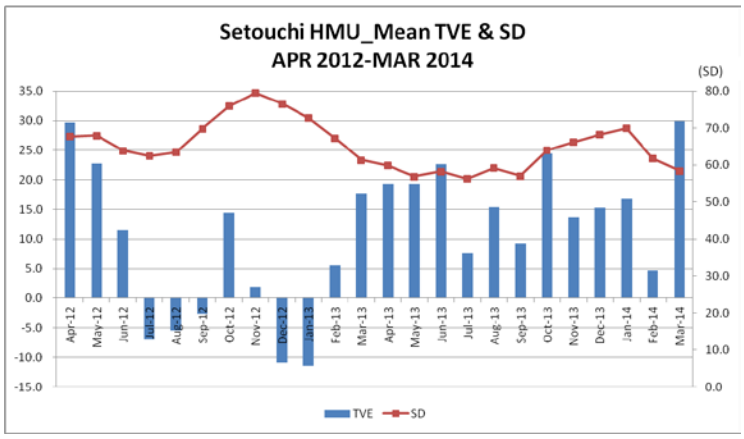


Figure 10: Mean TVE and Standard deviation (April 2012- March 2014)

2.3 ASE trend

2.3.1 **Table 1**, **Figure 11** and **Table 2**, **Figure 12** shows the ASE trend of each month and each flight level of the two years. **Figure 13** shows the mean difference of the two periods. As shown in **Figure14**, a remarkable seasonal variation is not seen for ASE, but the standard deviation indicating the variation in the measurements here for winter is larger than the summer.

Table 1: Setouchi HMU ASE trend of each month (Between April 2012 and March 2013)

ASE	Apr−12	May−12	Jun−12	Jul−12	Aug−12	Sep−12	Oct−12	Nov−12	Dec−12	Jan−13	Feb−13	Mar−13
FL290	27.6	28.1	−24.7	−41.3	−47.8	−16.1	−22.5	−45.2	−15.9	−20.6	10.6	9.5
FL300	40.2	25.2	19.9	17.2	30.4	16.1	37.7	28.9	10.9	8.2	18.5	37.0
FL310	33.7	11.1	−21.3	−23.7	−30.9	−30.7	−13.7	−31.5	−45.4	−41.5	−16.7	−5.9
FL320	28.7	22.6	28.2	10.0	8.2	14.2	25.1	19.9	13.6	10.5	20.2	36.8
FL330	45.5	31.1	9.3	−7.3	−4.6	−20.7	15.8	3.4	−30.3	−32.8	−3.6	10.7
FL340	20.0	8.9	16.3	−3.3	4.9	−0.7	13.1	−4.3	4.8	12.2	12.7	29.7
FL350	50.0	43.8	28.2	−12.4	−17.7	4.5	35.4	20.4	−15.9	−17.1	3.4	13.9
FL360	23.6	16.1	15.5	3.6	5.8	25.5	29.0	14.3	3.0	9.4	15.7	28.5
FL370	49.3	46.2	24.8	3.1	1.3	4.0	23.5	17.7	−17.9	−18.5	0.4	14.9
FL380	12.7	9.3	16.3	−3.6	5.0	5.0	19.9	7.2	7.0	4.6	17.5	27.5
FL390	28.4	24.0	17.1	−14.2	−10.3	−11.5	3.0	3.4	−37.1	−33.0	−9.2	2.5
FL400	−6.0	−0.3	1.7	−12.0	−4.3	−14.9	5.7	−2.2	10.2	6.6	17.3	21.6
FL410	25.9	20.1	10.7	−15.6	−19.0	−12.6	5.6	−7.0	−31.4	−43.3	−19.4	−0.7
Mean	29.2	22.0	10.9	−7.7	−6.1	−2.9	13.7	1.9	−11.1	−11.9	5.2	17.4

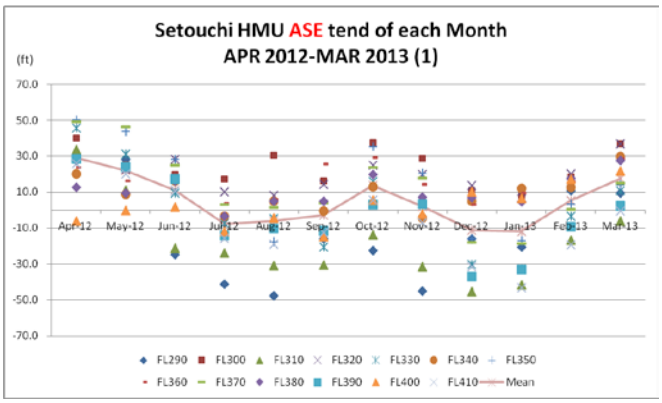


Figure 11: ASE trend of Setouchi HMU of each month (APR 2012-MAR 2013)

Table 2: Setouchi HMU ASE trend of each month (Between April 2013 and March 2014)

ASE	Apr−13	May−13	Jun−13	Jul−13	Aug−13	Sep−13	Oct−13	Nov−13	Dec−13	Jan−14	Feb−14	Mar−14
FL290	12.2	8.7	1.3	−8.8	−2.3	−1.2	22.5	4.1	41.2	−0.8	−2.7	10.6
FL300	36.9	34.4	27.4	12.9	25.1	23.6	41.2	28.8	26.3	35.3	15.3	28.4
FL310	5.1	−2.4	2.9	−13.8	−14.1	−10.3	−7.4	−18.1	−12.1	−3.4	−20.4	6.6
FL320	38.0	27.6	34.3	14.7	22.4	20.6	40.5	37.2	22.8	33.2	13.5	35.0
FL330	11.8	15.9	15.1	1.2	5.1	−3.5	12.1	−3.5	−6.3	−8.7	−8.5	23.1
FL340	29.3	24.3	32.7	15.5	22.7	20.5	32.1	24.2	21.0	35.9	17.0	41.1
FL350	18.9	23.1	29.3	11.1	12.9	6.0	26.4	14.7	15.1	9.8	5.2	37.7
FL360	28.0	22.2	25.6	12.1	21.2	19.1	38.4	35.7	31.3	39.7	25.1	41.6
FL370	18.2	25.6	27.4	18.7	26.2	17.0	30.4	10.0	8.0	1.8	5.4	35.7
FL380	26.6	25.6	30.4	14.9	27.4	21.3	35.5	38.3	41.1	48.7	26.7	46.9
FL390	7.3	22.2	26.1	11.1	17.6	2.3	10.7	−7.0	−8.5	−8.6	−9.5	25.9
FL400	14.8	14.5	19.4	3.2	16.5	7.3	24.4	23.7	29.0	30.8	13.9	31.8
FL410	−0.8	4.9	16.1	1.5	13.2	−4.2	9.7	−15.1	−12.5	−23.9	−26.3	20.4
Mean	19.0	19.0	22.2	7.2	14.9	9.1	24.3	13.3	15.1	14.6	4.2	29.6

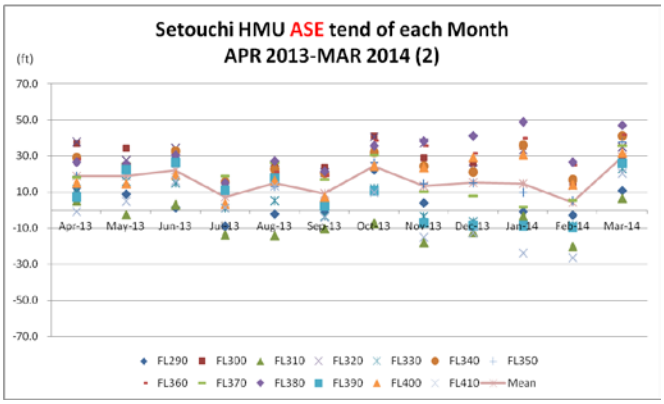


Figure 12: ASE trend of Setouchi HMU of each month (APR 2013-MAR 2014)

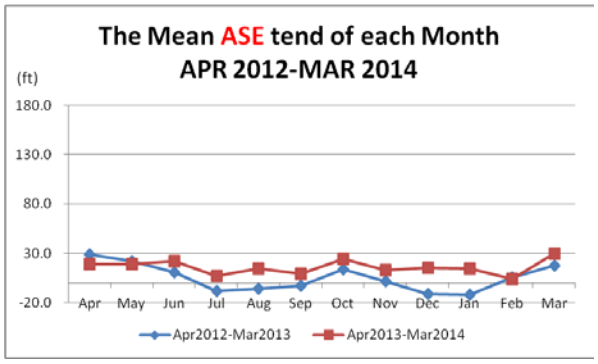


Figure 13: The comparison of the mean ASE trend (APR 2013-MAR 2014)

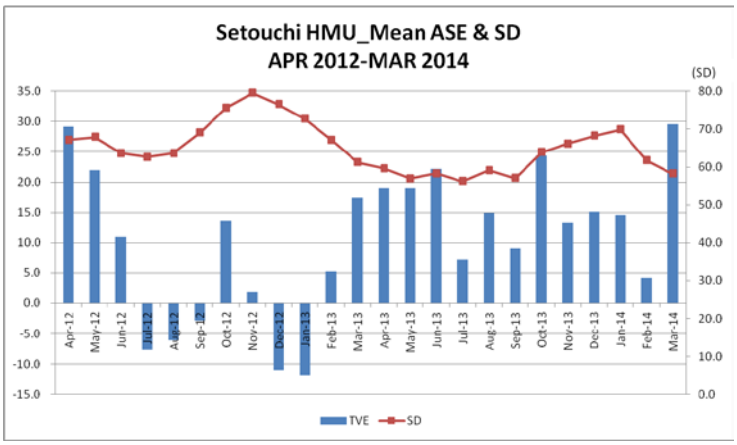


Figure 14: The trend of Mean ASE and Standard deviation

2.3.2 **Figure 15** and **Figure 16** shows the ASE trend of each flight level of the two periods.

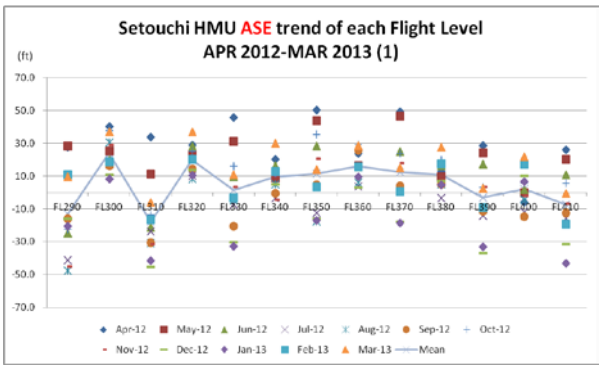


Figure 15: The mean ASE trend of each FL (APR 2012-MAR 2013)

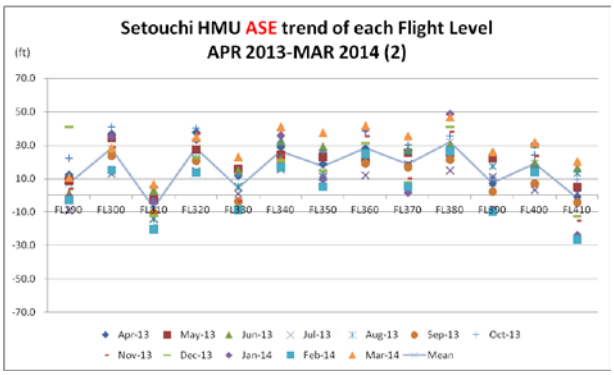


Figure 16: The mean ASE trend of each FL (APR 2013-MAR 2014)

2.4 B737NX ASE trend

2.4.1 In addition, JASMA investigated the trend of ASE of B737NX which is the largest amount of ASE obtained from Setouchi HMU to eliminate the characteristic for every monitoring group. One of the characteristics of Setouchi HMU is measured height is different depending on the location of measurement because of the shape of HMU coverage. As shown in **Figure 17**, JASMA divided into four areas from the center of HMU coverage as northwest (NW), northeast (NE), southeast (SE) and southwest (SW). Higher results obtained in the northwest and northeast area and lower results obtained in the southeast and southwest area. The arrangement of airway around Setouchi HMU, even flight levels for westbound are observed in the northern area (Northwest and Northeast) and odd flight levels for eastbound are observed in the southern are (Southeast and Southwest). From **Figure 18 to Figure 21** was shown the trend of ASE at the four areas of B737NX between April 16, 2013 and April 15, 2014.

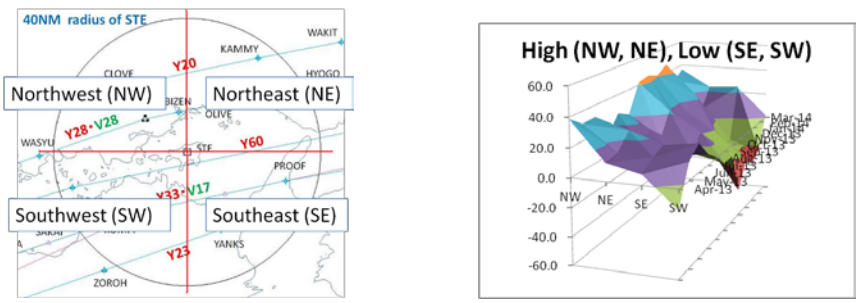


Figure 17: The four areas of Setouchi HMU coverage

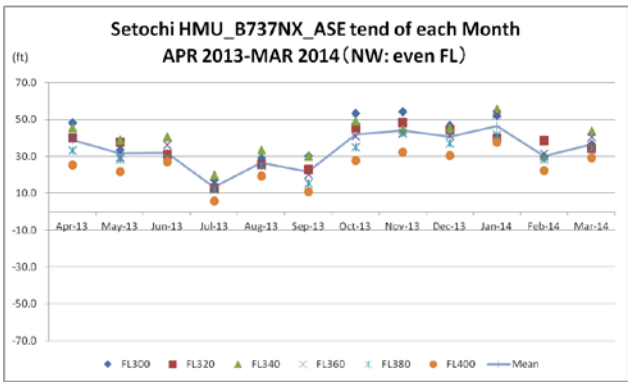


Figure 18: Even FL ASE trend of Setouchi HMU Northwest (NW) area

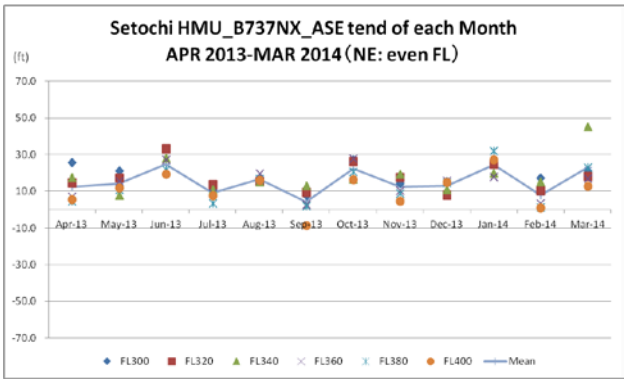


Figure 19: Even FL ASE trend of Setouchi HMU Northeast (NE) area

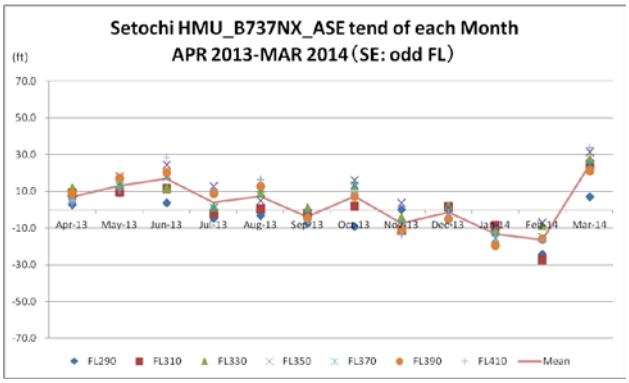


Figure 20: Even FL ASE trend of Setouchi HMU Southeast (SE) area

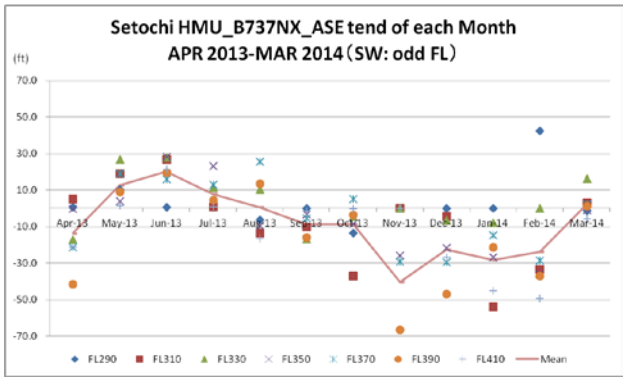


Figure 21: Even FL ASE trend of Setouchi HMU Southwest (SW) area

2.4.2 The difference of two types of Geometric height of each FL shown in the **Appendix A**. The difference of ASE of two years at each FL was shown in the **Appendix B**. It's difficult to conclude that there is seasonal variation clearly.

2.5 Conclusion

2.5.1 JASMA examined for seasonal variation of ASE. Since this investigation has conducted based on the measurement data obtained from Setouchi HMU, it could not eliminate the factors that affect complexity but too much fragmented data is no longer unreliable as statistical data.

2.5.2 While it was not found a seasonal variation clearly, low temperature affects antenna or cable may causes relatively large variation. The ASE and standard deviation for the past two years was shown in **Appendix D** and **Table 3**.

2.5.3 In general, there is a tendency that large in winter and small in summer in the temperature lapse rate which is atmospheric temperature decreases with increasing in altitude but the relationship between the seasonal variations of ASE could not be cleared. The result is different depending on the location of the measurement, it is necessary to know the characteristics of the HMU coverage. Although it is difficult to conclude that there is a seasonal variation, in other words it is consider to able to obtain an stable ASE throughout the year.

3. ACTION BY THE MEETING

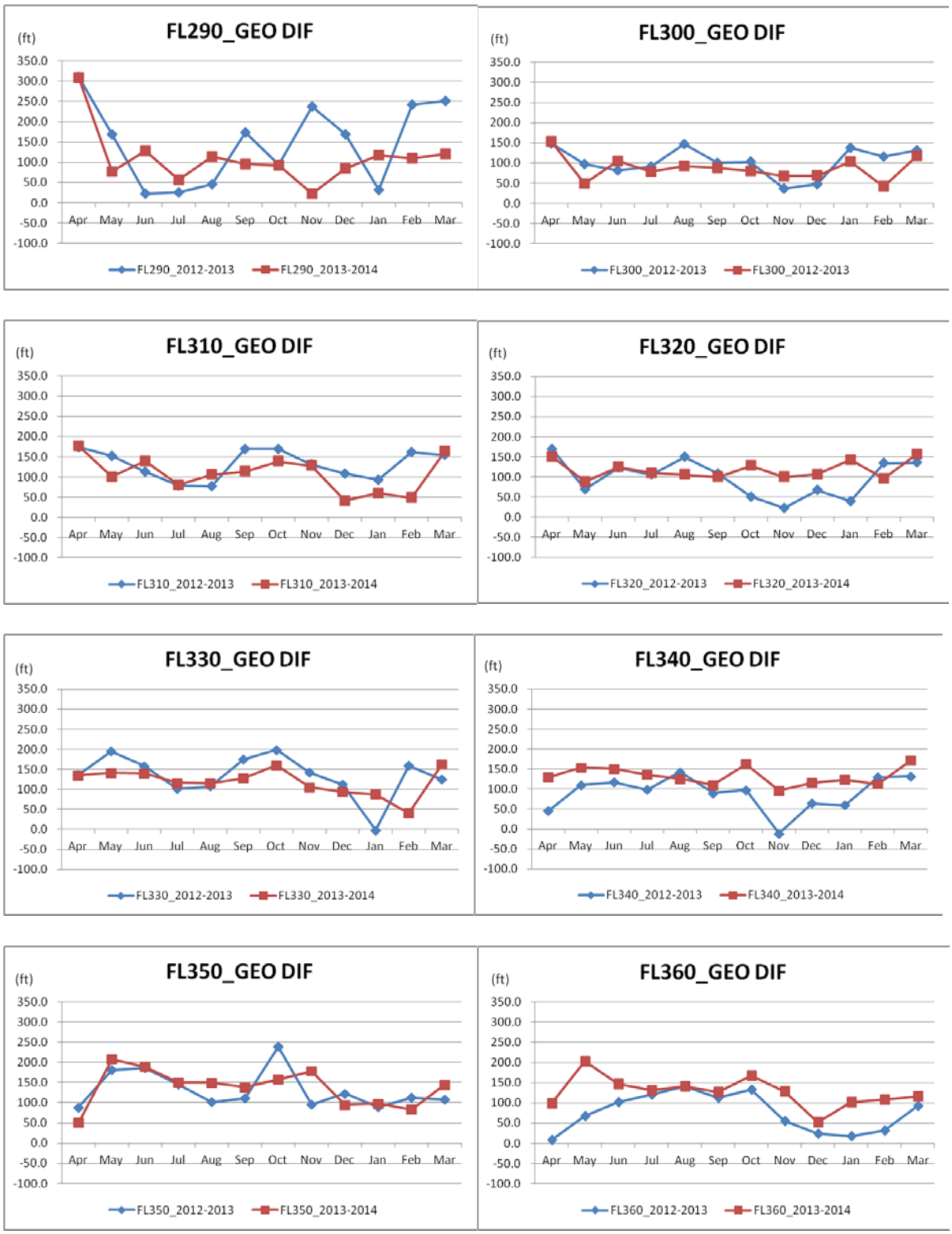
3.1 The meeting is invited to:

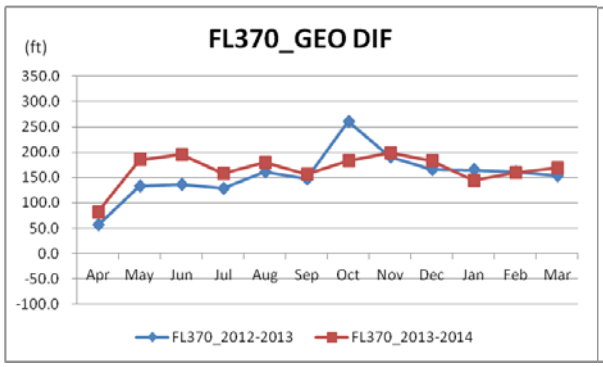
a) note the information contained in this paper; and

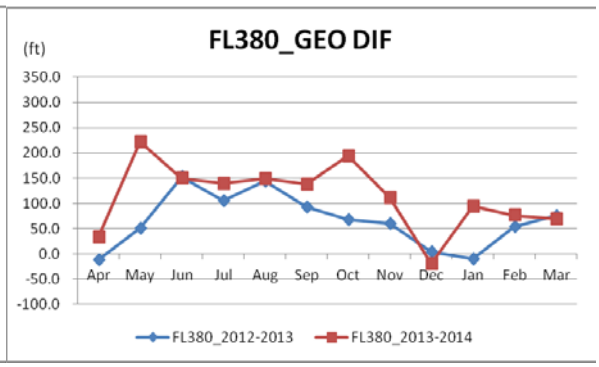
b) discuss any relevant matters as appropriate.

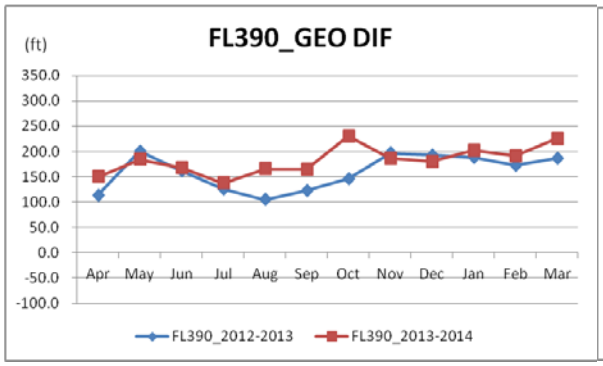
…….

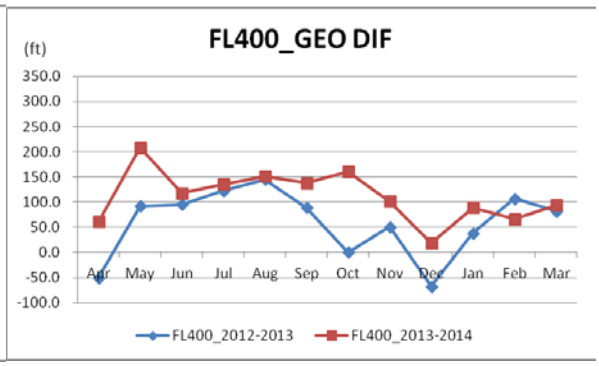
Appendix A: The difference of two types of Geometric height of each Flight Level
(Between APR 2012 and MAR 2014)

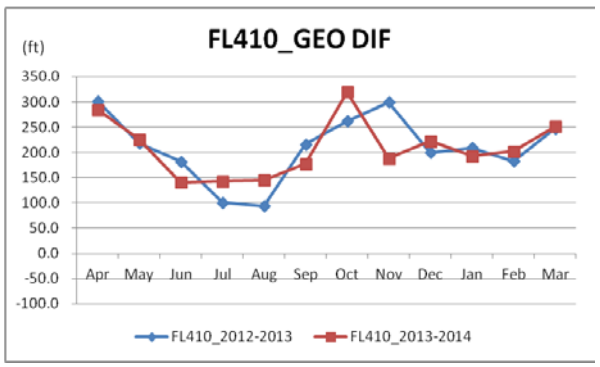



FL370_GEO DIF
(ft)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL370_2012-2013
FL370_2013-2014

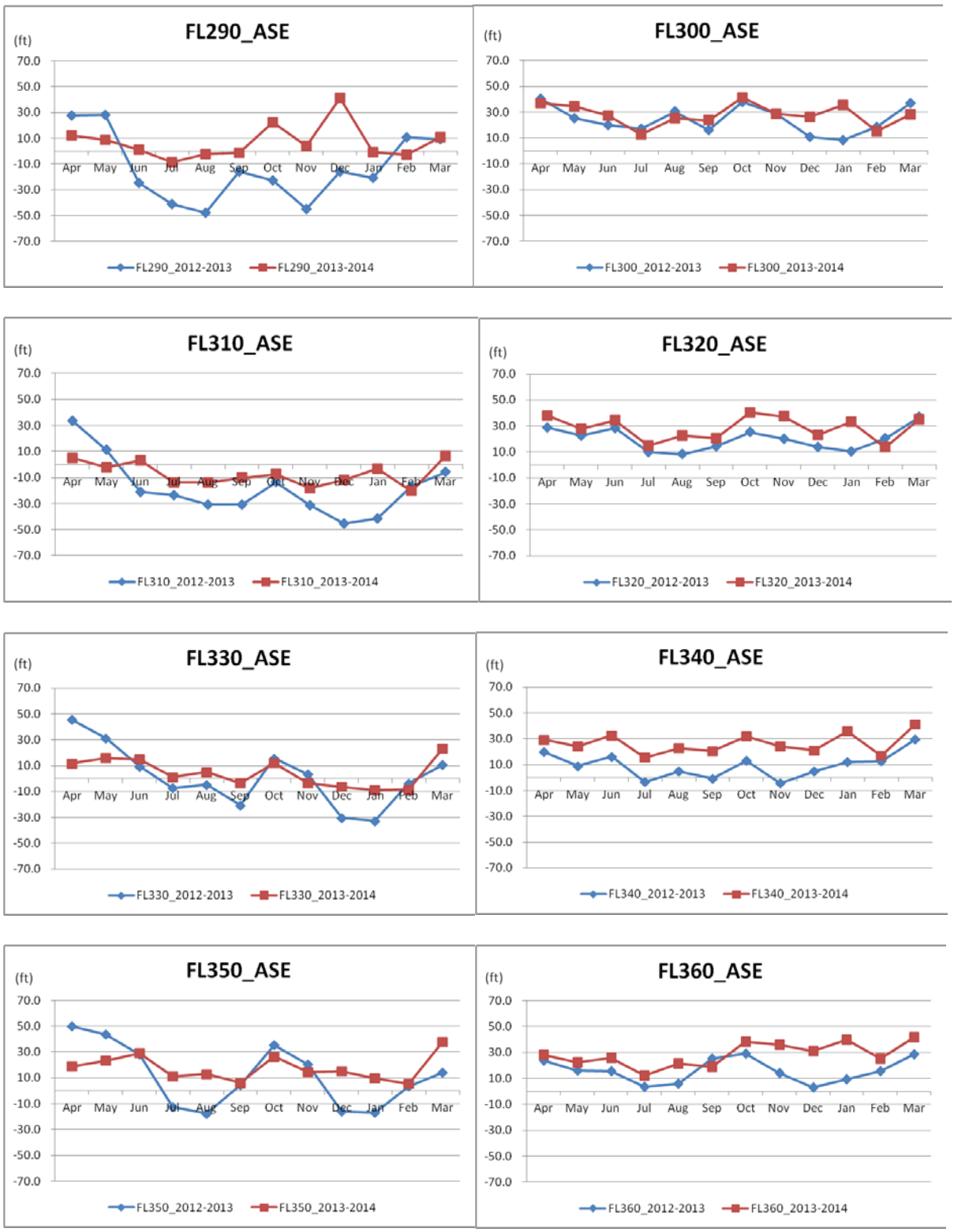

FL380_GEO DIF
(ft)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL380_2012-2013
FL380_2013-2014

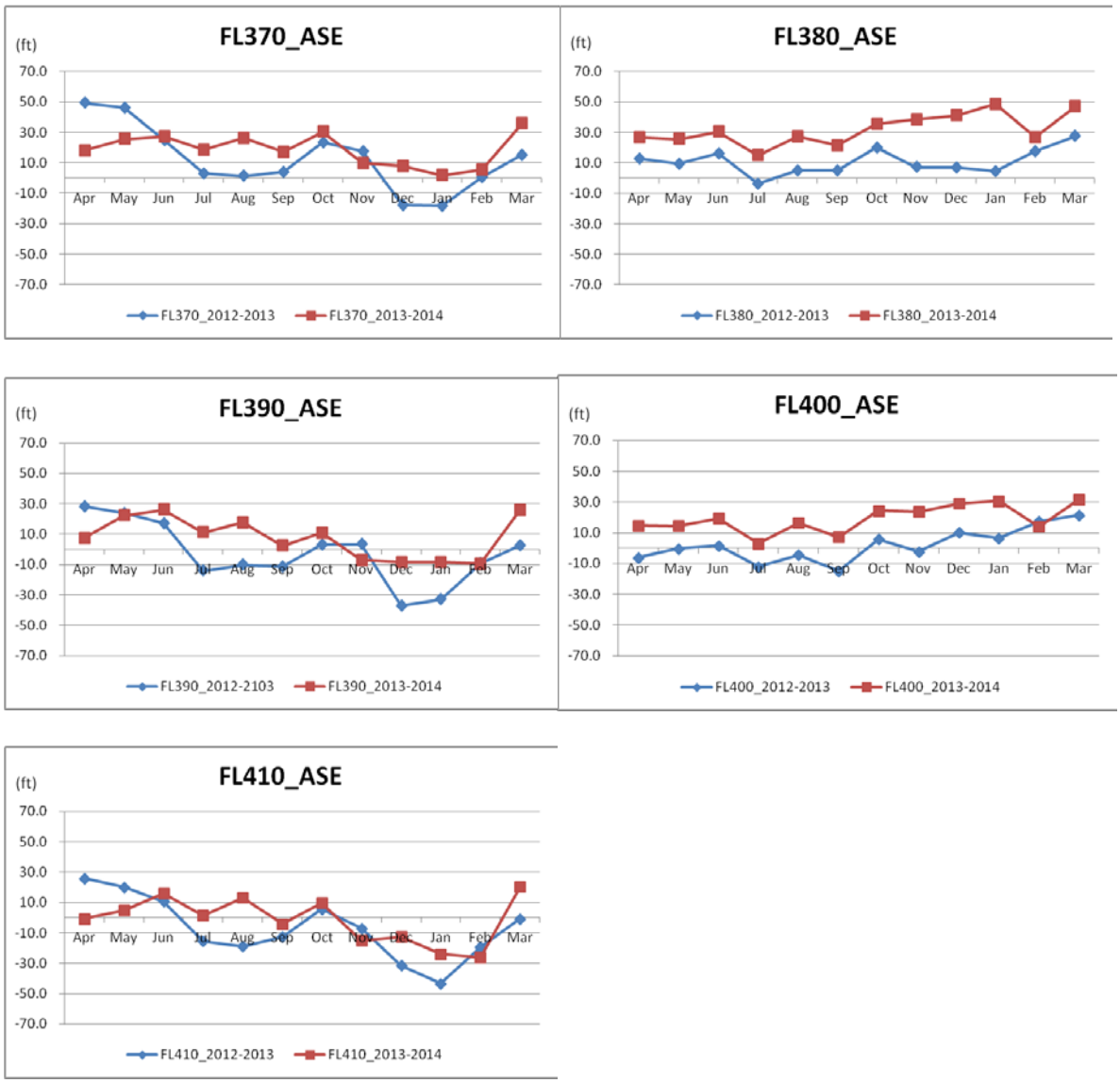

FL390_GEO DIF
(ft)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL390_2012-2013
FL390_2013-2014


FL400_GEO DIF
(ft)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL400_2012-2013
FL400_2013-2014


FL410_GEO DIF
(ft)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
-100.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL410_2012-2013
FL410_2013-2014

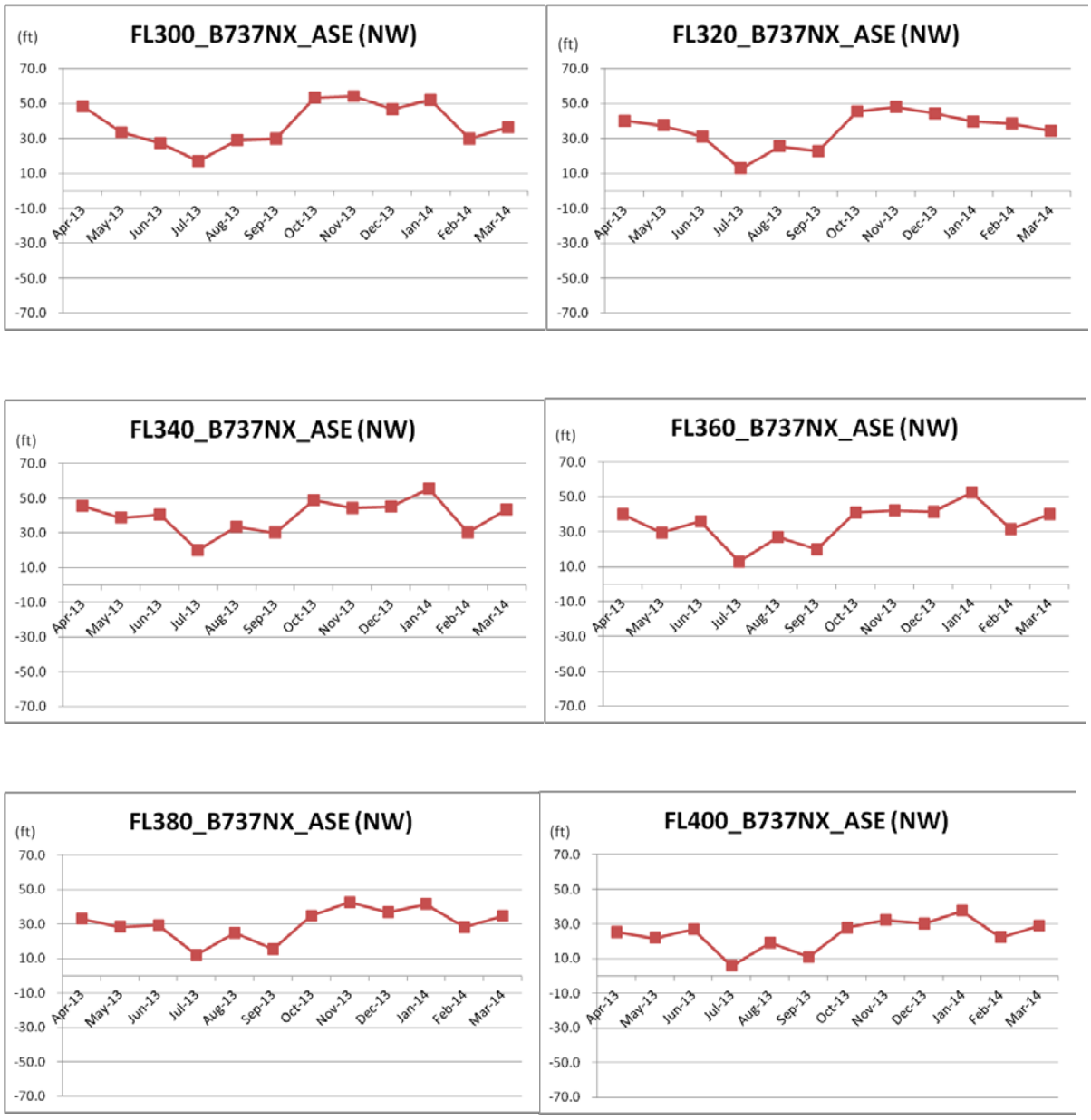
Appendix B: The difference of ASE of two years of ASE at each Flight Level
(Between APR 2012-MAR 2014)



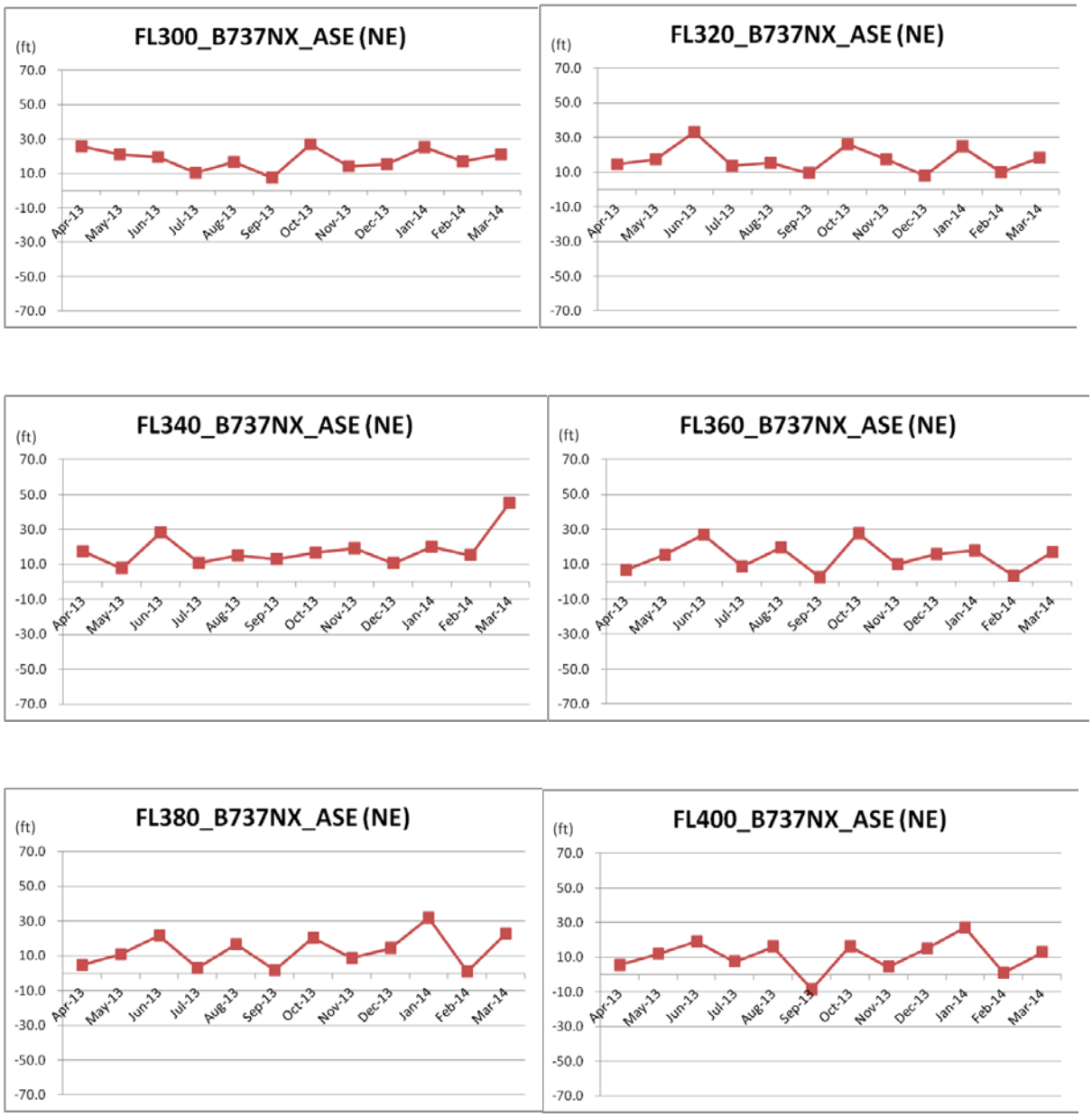

FL370_ASE
(ft)
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
-70.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL370_2012-2013
FL370_2013-2014
FL380_ASE
(ft)
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
-70.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL380_2012-2013
FL380_2013-2014
FL390_ASE
(ft)
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
-70.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL390_2012-2103
FL390_2013-2014
FL400_ASE
(ft)
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
-70.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL400_2012-2013
FL400_2013-2014
FL410_ASE
(ft)
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
-70.0
Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
FL410_2012-2013
FL410_2013-2014

Appendix C: B737NX ASE trend in the four areas (Between APR 2013 and MAR 2014)

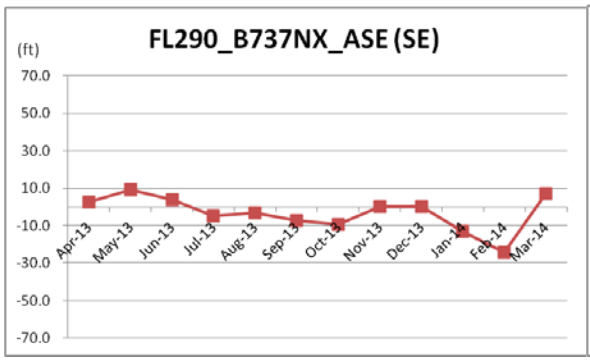
Even flight levels in the Northwest (NW) area:

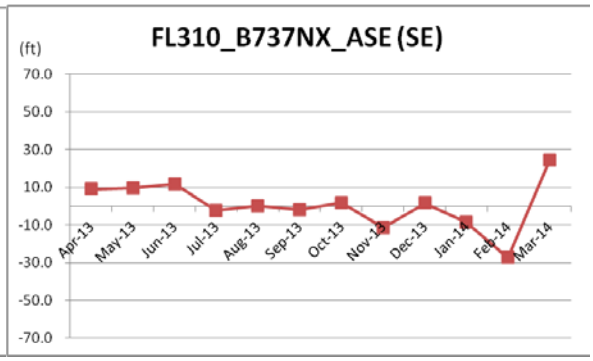


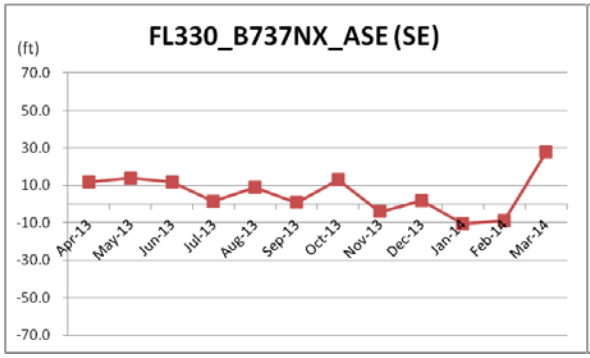
Even flight levels in the Northeast (NE) area:

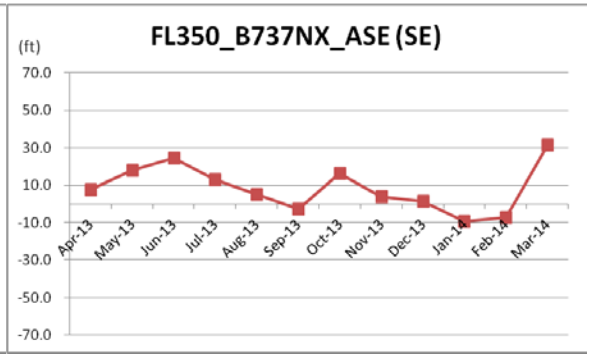


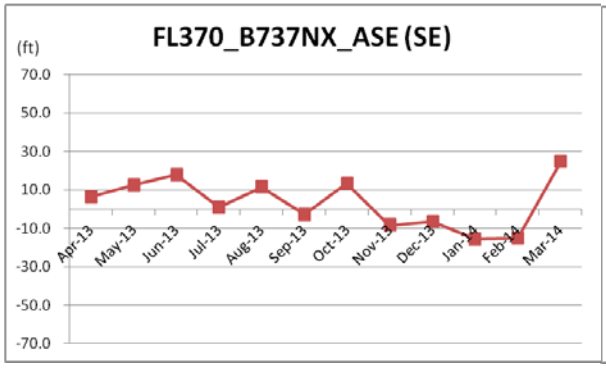
Odd flight levels in the Southeast (SE) area:

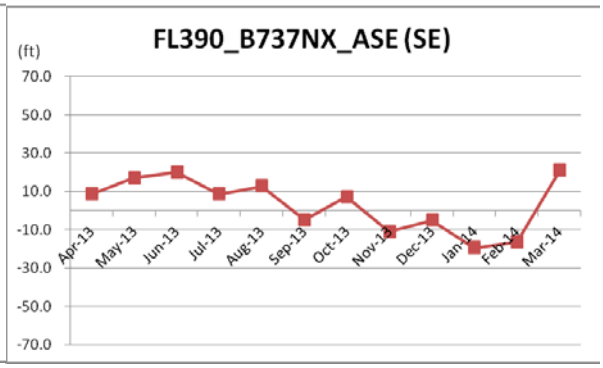


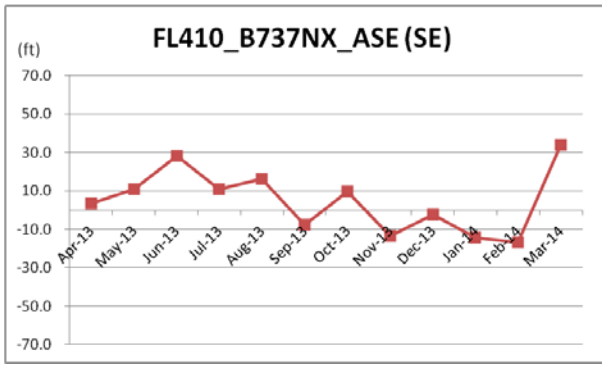




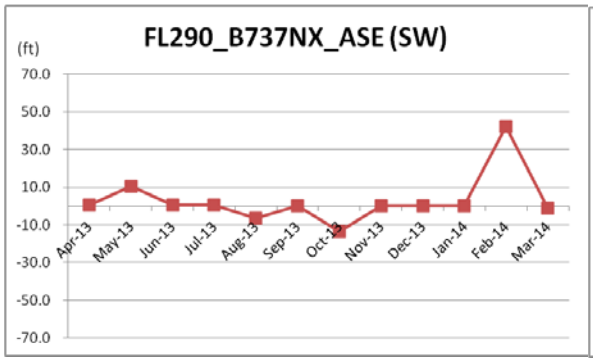


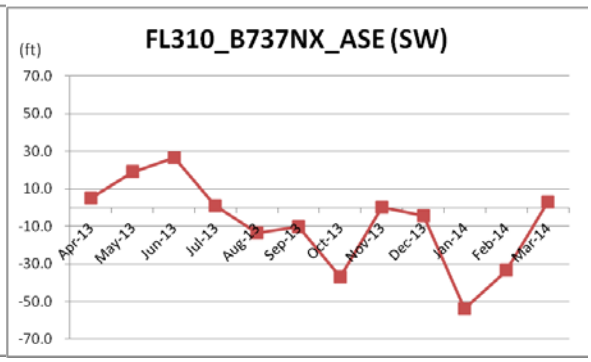


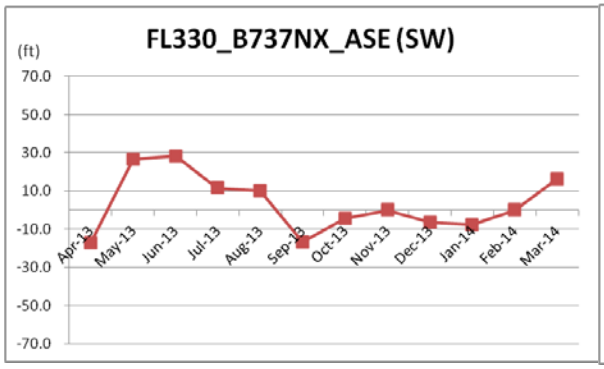


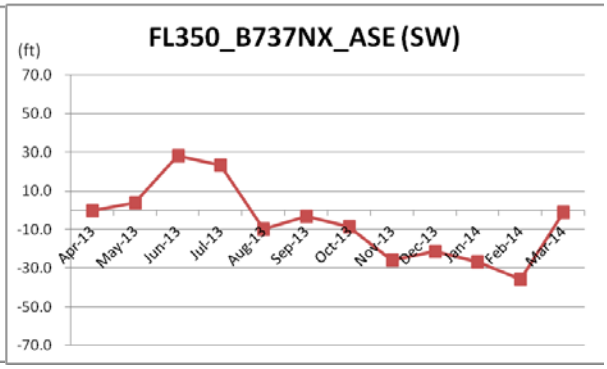


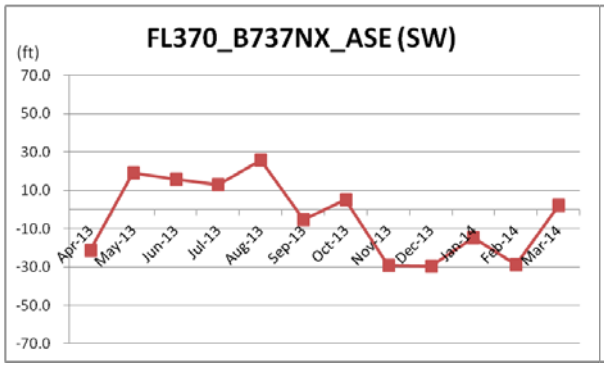
Odd flight levels in the Southwest (SW) area:

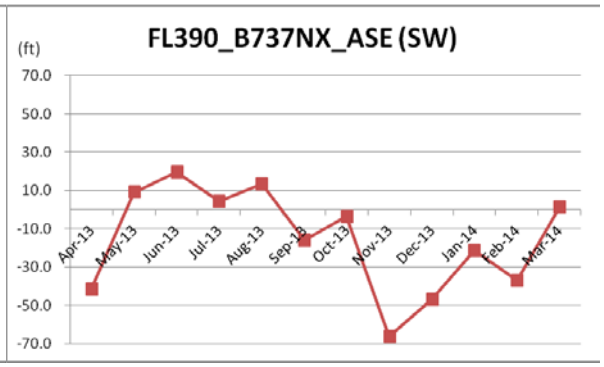


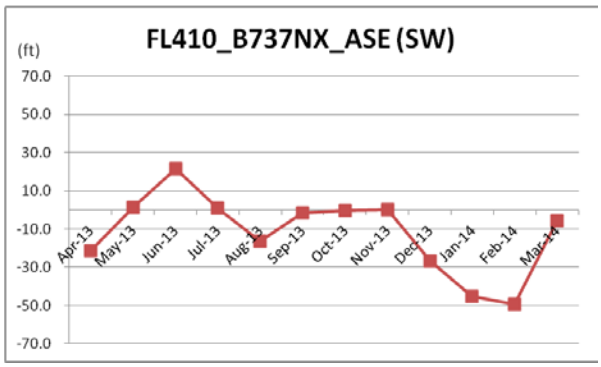




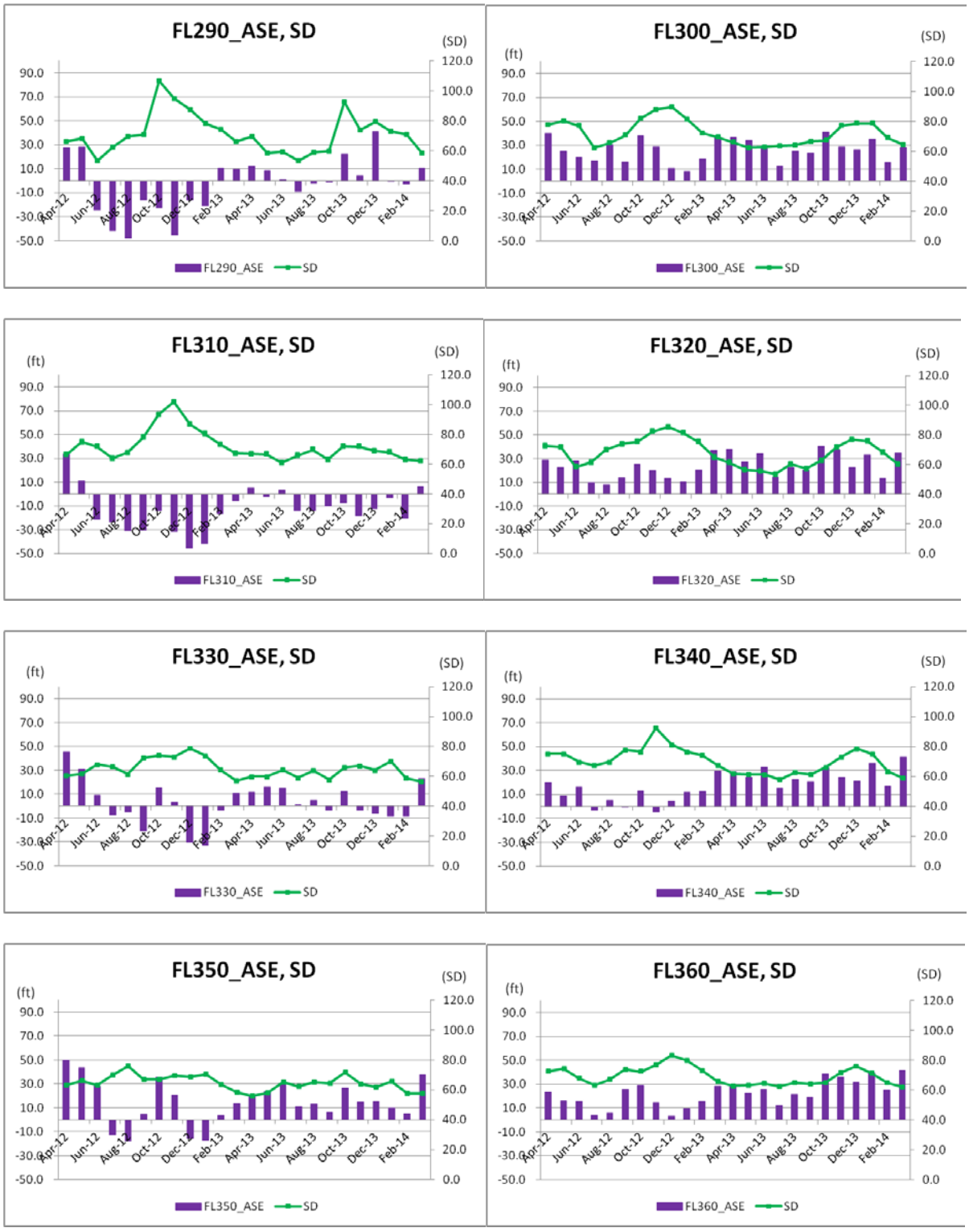


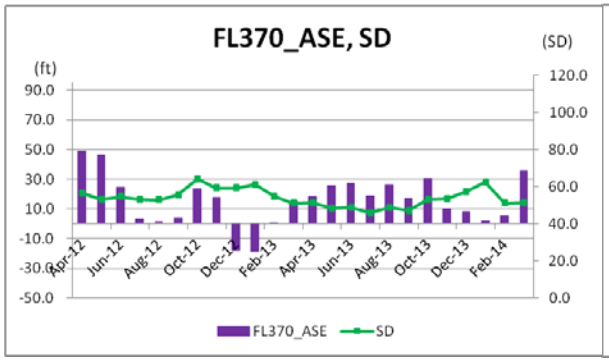


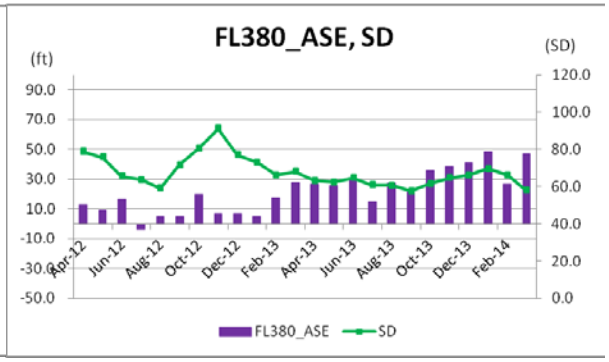


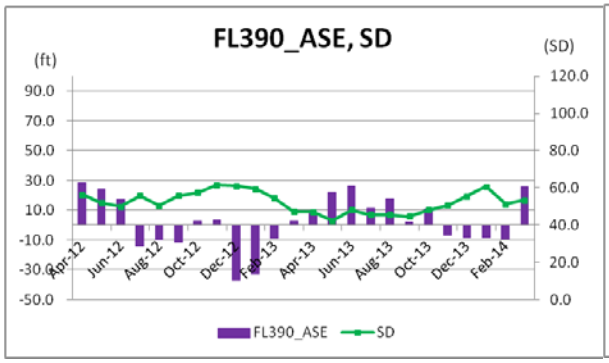


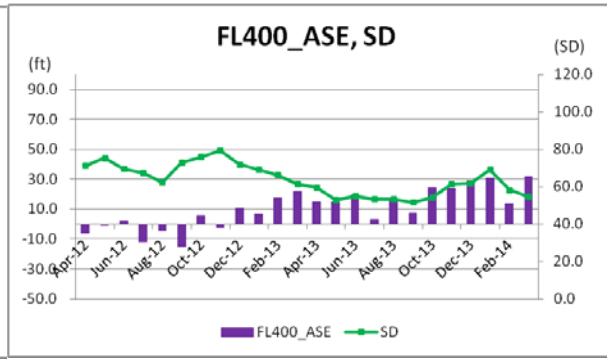
Appendix D: Trend of ASE and Standard deviation (Between APR 2012 and MAR 2014)




FL370_ASE, SD
(ft)
(SD)
90.0
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
FL370_ASE
SD


FL380_ASE, SD
(ft)
(SD)
90.0
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
FL380_ASE
SD


FL390_ASE, SD
(ft)
(SD)
90.0
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
FL390_ASE
SD


FL400_ASE, SD
(ft)
(SD)
90.0
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
FL400_ASE
SD

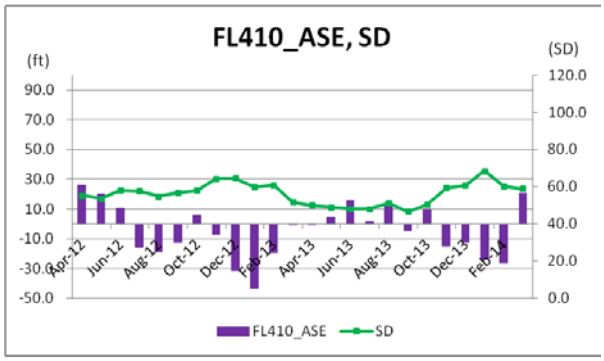

FL410_ASE, SD
(ft)
(SD)
90.0
70.0
50.0
30.0
10.0
-10.0
-30.0
-50.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13
Dec-13
Feb-14
FL410_ASE
SD

Table 3: Trend of ASE and Standard deviation (Between APR 2012 and MAR 2014)

ASE	Apr−12	May−12	Jun−12	Jul−12	Aug−12	Sep−12	Oct−12	Nov−12	Dec−12	Jan−13	Feb−13	Mar−13	Apr−13	May−13	Jun−13	Jul−13	Aug−13	Sep−13	Oct−13	Nov−13	Dec−13	Jan−14	Feb−14	Mar−14
FL290_ASE	27.6	28.1	−24.7	−41.3	−47.8	−16.1	−22.5	−45.2	−15.9	−20.6	10.6	9.5	12.2	8.7	1.3	−8.8	−2.3	−1.2	22.5	4.1	41.2	−0.8	−2.7	10.6
SD	66.3	68.3	53.2	62.4	69.5	71.0	106.5	94.8	87.3	78.2	74.4	66.1	69.4	58.4	59.3	53.4	58.8	59.7	92.4	73.8	79.6	72.9	70.8	58.7
FL300_ASE	40.2	25.2	19.9	17.2	30.4	16.1	37.7	28.9	10.9	8.2	18.5	37.0	36.9	34.4	27.4	12.9	25.1	23.6	41.2	28.8	26.3	35.3	15.3	28.4
SD	77.6	80.2	77.1	62.5	65.6	70.7	82.0	87.8	89.5	81.6	72.3	69.4	66.0	62.5	62.8	63.5	64.1	66.6	67.3	77.1	78.8	78.8	69.0	64.6
FL310_ASE	33.7	11.1	−21.3	−23.7	−30.9	−30.7	−13.7	−31.5	−45.4	−41.5	−16.7	−5.9	5.1	−2.4	2.9	−13.8	−14.1	−10.3	−7.4	−18.1	−12.1	−3.4	−20.4	6.6
SD	66.4	75.0	71.9	64.1	67.7	78.3	93.5	102.1	87.0	80.4	73.4	67.3	67.1	66.8	60.9	65.9	69.8	63.0	72.1	71.9	69.0	68.1	63.3	62.3
FL320_ASE	28.7	22.6	28.2	10.0	8.2	14.2	25.1	19.9	13.6	10.5	20.2	36.8	38.0	27.6	34.3	14.7	22.4	20.6	40.5	37.2	22.8	33.2	13.5	35.0
SD	72.6	71.9	58.4	61.7	70.0	73.9	75.4	82.2	85.5	81.4	75.5	64.9	61.3	56.4	55.6	53.4	60.3	57.4	62.9	71.8	77.0	75.9	68.3	60.2
FL330_ASE	45.5	31.1	9.3	−7.3	−4.6	−20.7	15.8	3.4	−30.3	−32.8	−3.6	10.7	11.8	15.9	15.1	1.2	5.1	−3.5	12.1	−3.5	−6.3	−8.7	−8.5	23.1
SD	60.5	61.7	67.8	66.4	61.5	72.3	74.1	73.0	78.8	73.9	64.2	57.1	59.9	59.7	64.2	59.0	63.9	57.7	66.0	67.1	64.1	70.1	58.7	56.5
FL340_ASE	20.0	8.9	16.3	−3.3	4.9	−0.7	13.1	−4.3	4.8	12.2	12.7	29.7	29.3	24.3	32.7	15.5	22.7	20.5	32.1	24.2	21.0	35.9	17.0	41.1
SD	75.3	75.2	69.7	67.5	69.7	77.9	76.6	92.5	81.2	76.5	74.2	67.3	61.9	61.4	61.2	57.9	62.8	61.5	66.4	73.1	78.7	75.1	63.3	58.8
FL350_ASE	50.0	43.8	28.2	−12.4	−17.7	4.5	35.4	20.4	−15.9	−17.1	3.4	13.9	18.9	23.1	29.3	11.1	12.9	6.0	26.4	14.7	15.1	9.8	5.2	37.7
SD	63.1	65.9	63.3	70.0	75.9	67.0	67.1	69.6	68.7	70.4	63.5	58.2	55.8	58.0	65.3	62.4	65.2	64.2	71.6	64.1	61.9	65.5	57.4	57.6
FL360_ASE	23.6	16.1	15.5	3.6	5.8	25.5	29.0	14.3	3.0	9.4	15.7	28.5	28.0	22.2	25.6	12.1	21.2	19.1	38.4	35.7	31.3	39.7	25.1	41.6
SD	72.7	74.2	67.9	63.2	67.0	73.8	72.4	76.7	83.2	79.9	73.0	65.9	62.9	63.1	64.5	62.2	64.8	64.0	64.9	71.6	76.0	71.2	64.9	62.1
FL370_ASE	49.3	46.2	24.8	3.1	1.3	4.0	23.5	17.7	−17.9	−18.5	0.4	14.9	18.2	25.6	27.4	18.7	26.2	17.0	30.4	10.0	8.0	1.8	5.4	35.7
SD	56.4	53.0	54.5	53.0	52.8	55.7	64.0	59.2	59.2	61.2	54.8	51.1	51.3	48.3	48.9	45.8	48.8	47.0	52.9	53.4	57.3	62.5	51.1	51.3
FL380_ASE	12.7	9.3	16.3	−3.6	5.0	5.0	19.9	7.2	7.0	4.6	17.5	27.5	26.6	25.6	30.4	14.9	27.4	21.3	35.5	38.3	41.1	48.7	26.7	46.9
SD	78.7	75.7	65.5	63.5	59.2	71.7	80.8	91.1	77.1	73.0	66.2	68.1	63.1	62.3	64.6	60.8	60.5	57.6	61.6	64.7	66.1	69.7	66.2	57.8
FL390_ASE	28.4	24.0	17.1	−14.2	−10.3	−11.5	3.0	3.4	−37.1	−33.0	−9.2	2.5	7.3	22.2	26.1	11.1	17.6	2.3	10.7	−7.0	−8.5	−8.6	−9.5	25.9
SD	56.4	52.0	50.0	55.7	50.5	55.7	57.4	61.4	61.1	59.4	54.5	47.2	47.1	42.4	48.1	45.5	45.6	44.7	48.1	50.7	55.6	60.7	51.3	53.4
FL400_ASE	−6.0	−0.3	1.7	−12.0	−4.3	−14.9	5.7	−2.2	10.2	6.6	17.3	21.6	14.8	14.5	19.4	3.2	16.5	7.3	24.4	23.7	29.0	30.8	13.9	31.8
SD	71.3	75.3	69.4	67.3	62.3	73.0	75.9	79.2	71.8	69.1	66.1	61.4	59.5	52.9	55.0	53.4	53.3	51.6	54.1	61.3	61.9	69.0	58.2	54.5
FL410_ASE	25.9	20.1	10.7	−15.6	−19.0	−12.6	5.6	−7.0	−31.4	−43.3	−19.4	−0.7	−0.8	4.9	16.1	1.5	13.2	−4.2	9.7	−15.1	−12.5	−23.9	−26.3	20.4
SD	55.3	53.6	58.2	57.5	54.9	56.9	57.9	64.2	64.5	59.8	60.8	51.8	49.9	48.9	48.0	48.0	51.1	46.5	50.5	59.2	60.6	68.5	60.1	59.0