Methane Characteristics in AMY, Korea, 2012

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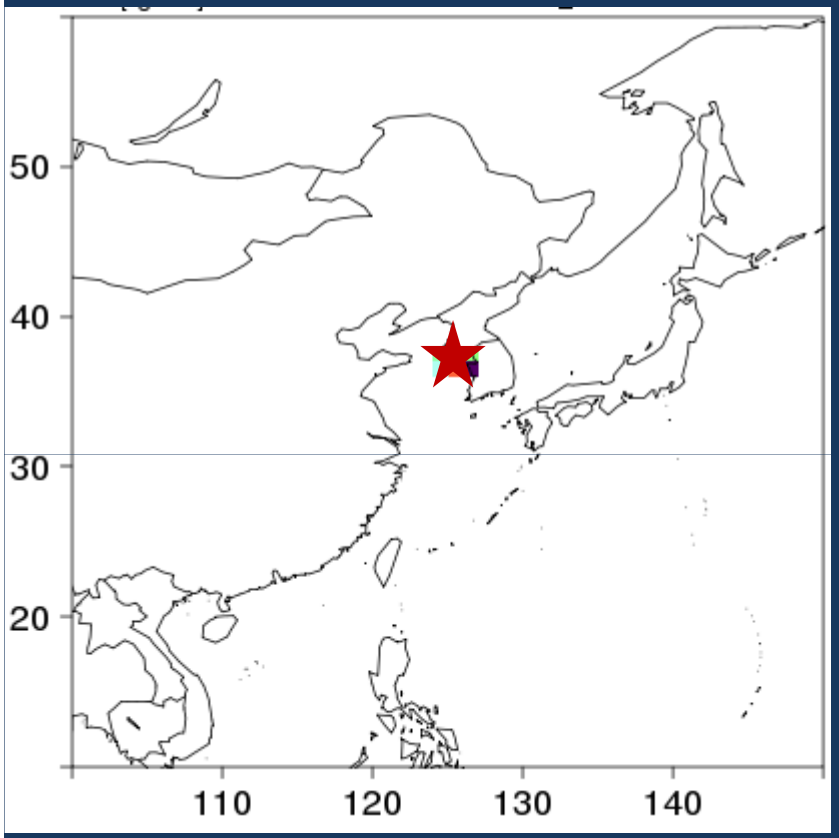
Background

- Methane concentration has increased due to human activity and exceed the pre-industrial levels by about 150% (IPCC AR5 SPM, 2013).
- Its radiative forcing is larger than AR4(2007) when it considered ozone and stratospheric water vapour due to methane emission and other emission indirectly affecting methane(IPCC AR5 SPM, 2013).
- However, the relative contributions for the various processes that produce methane are uncertain, while sink are quite well understood from the activity of hydroxyl radical (OH).
- The growth rate of methane concentration reflects the global methane budget which delicately balance large sink and sources at present.
- Especially Asia regions are main source of methane including as rice paddies, biomass burning, wetland and plateau (Khalil et al., 1998; Ye and Wu, 1998; Huang et al., 2004; Dlugokecky et al., 2009) .

Regional GAW Station, AMY



-AMY is located between China and Korea and downwind area from China due to westerly wind.

-Seasonally flow patterns are changed that we can assume main source region of greenhouse gases.

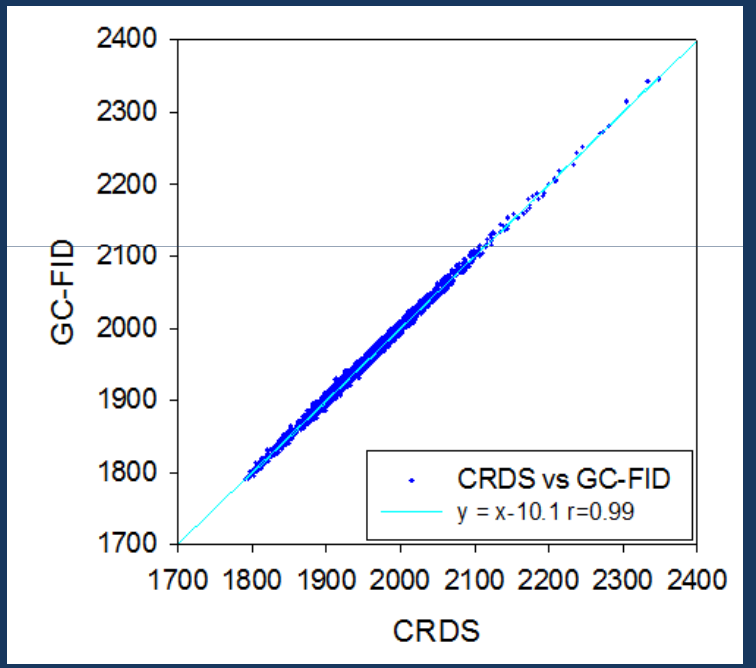
In this presentation

- Methane data containing all high concentration event in AMY is shown to explain its characteristics

-Selected data with wind speed over 6m/s were classified according to wind direction and analyzed to seasonal characteristics

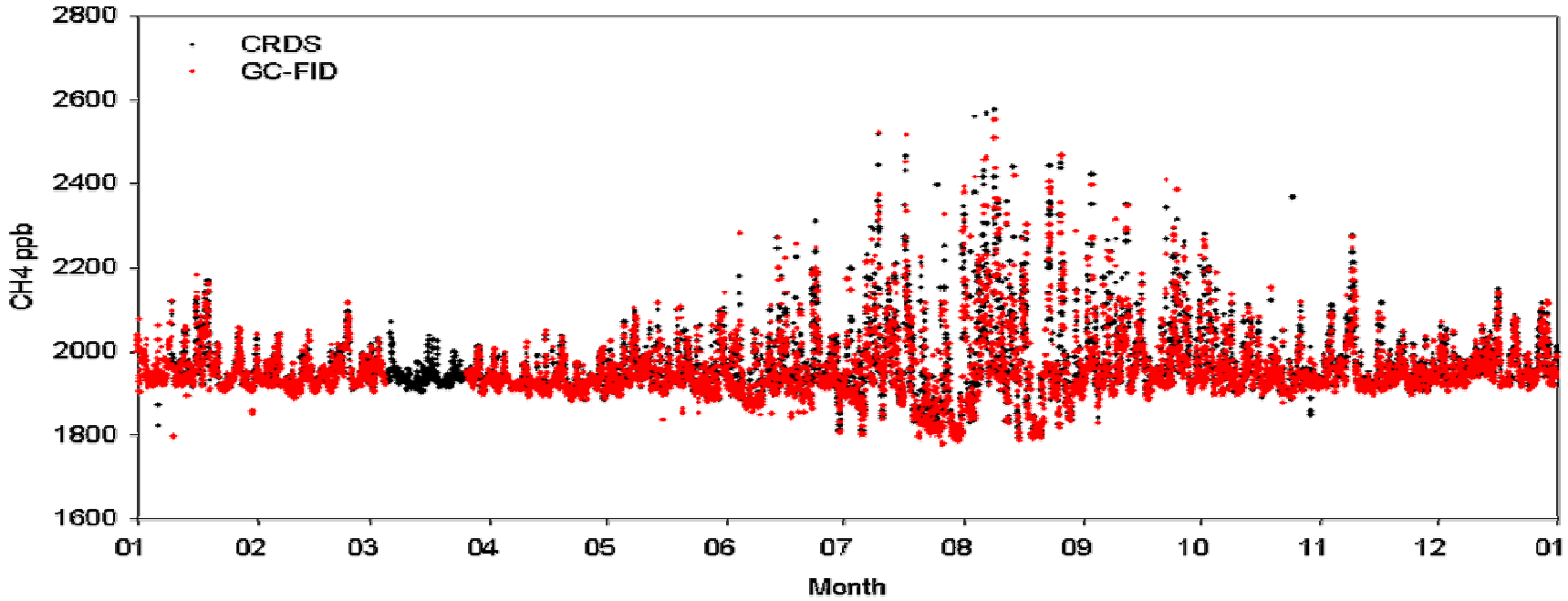
Methane measurement method

GC-FID: every 30min, 4times calibration/day with one point



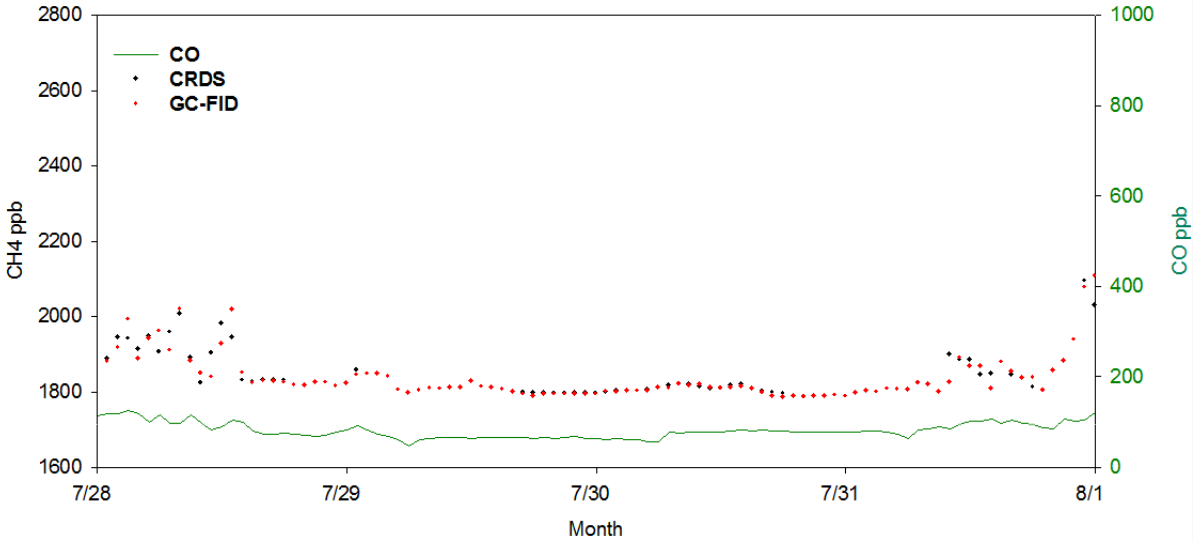
CRDS: every 5sec, 2times calibration/month with two points

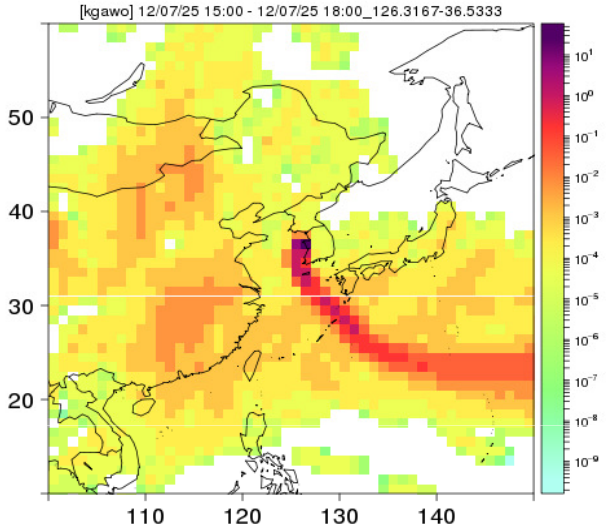
Hourly concentration in AMY, 2012

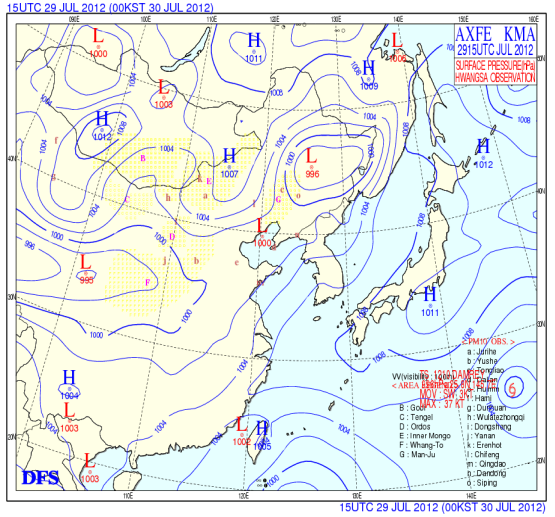


- Generally methane has seasonal variation with lowest level in summer but not in AMY
- In 2012, methane concentration containing events periods showed winter>autumn>summer>spring in order of high concentration while summer>autumn>winter>spring in order of large daily variation
- In summer time OH radical lead the low concentration and rice agriculture lead the high concentration in Anmyeondo (Dlugokencky *et al*., 1993).

Case study of low concentration in SUMMER

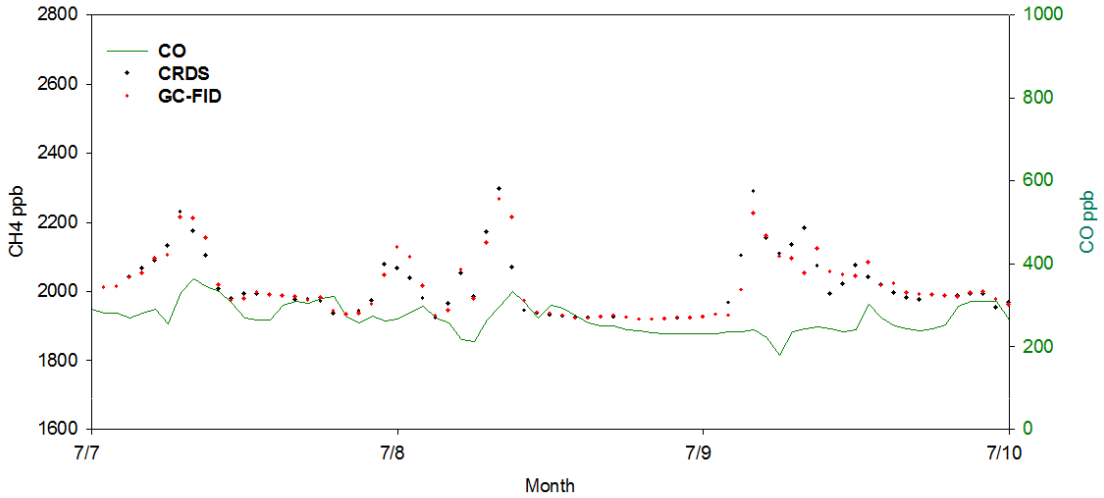


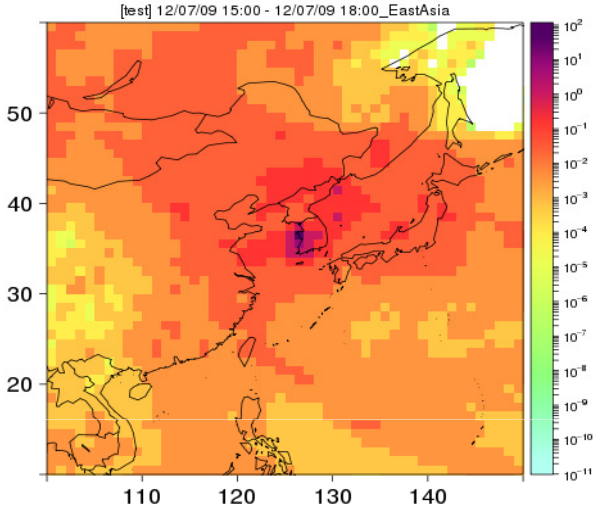




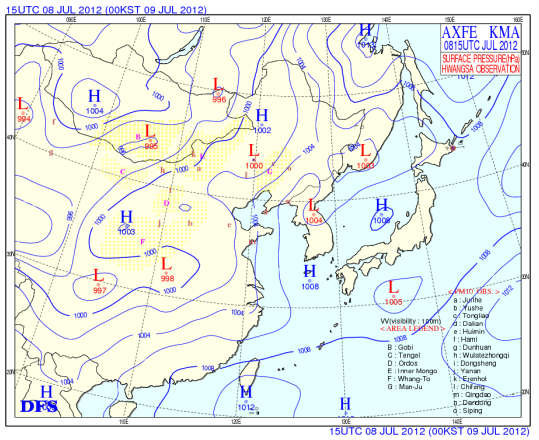
- When AMY was affected by North Pacific air mass directly, the concentration was lower than other period with no daily variation.

Case study of high concentration in SUMMER

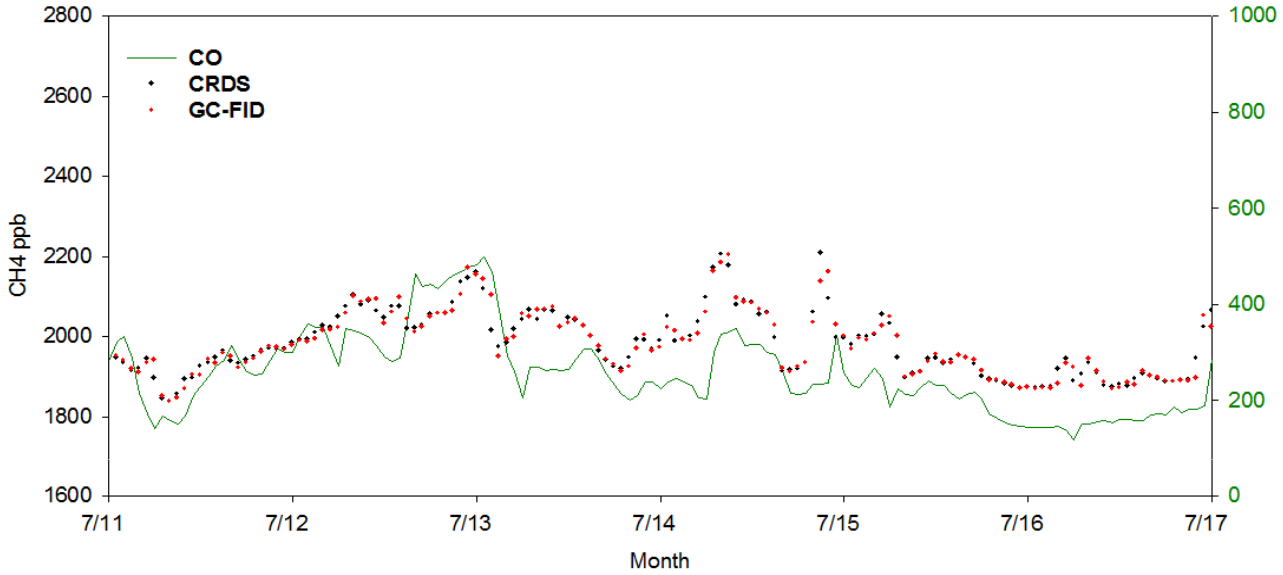




- When AMY was under the stagnated condition the concentration peaked at 2100ppb showing large daily variation.
- CH4 and CO trend are different from each other.
- It was assumed that rice agriculture around the station, local source, affected high concentration in summer time.

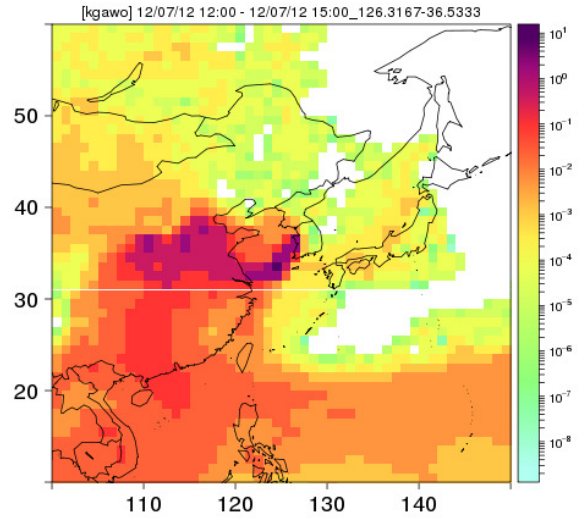


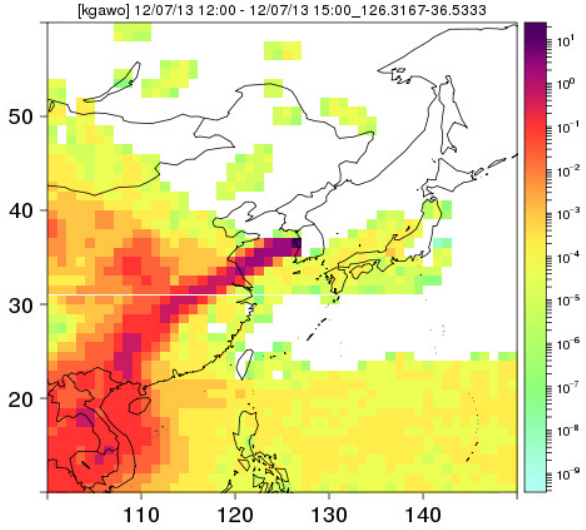
Case study of high concentration in SUMMER

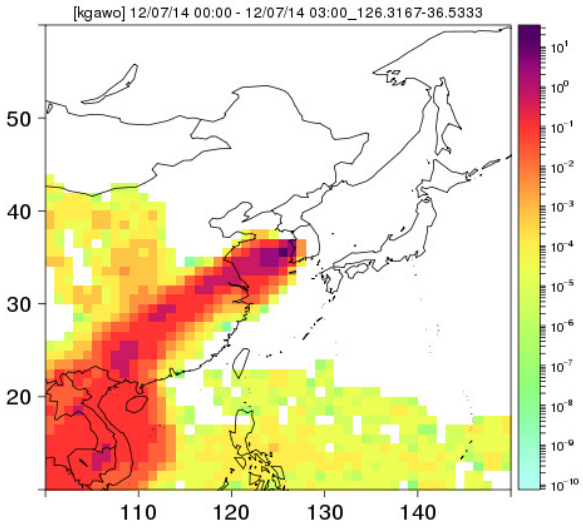


-When airmass came from or through Southern part of China, methane concentration peaked at 2050 ppb while daily variation was lower than stagnated condition.

-CH4 and CO trend were same indicating their source would be same.

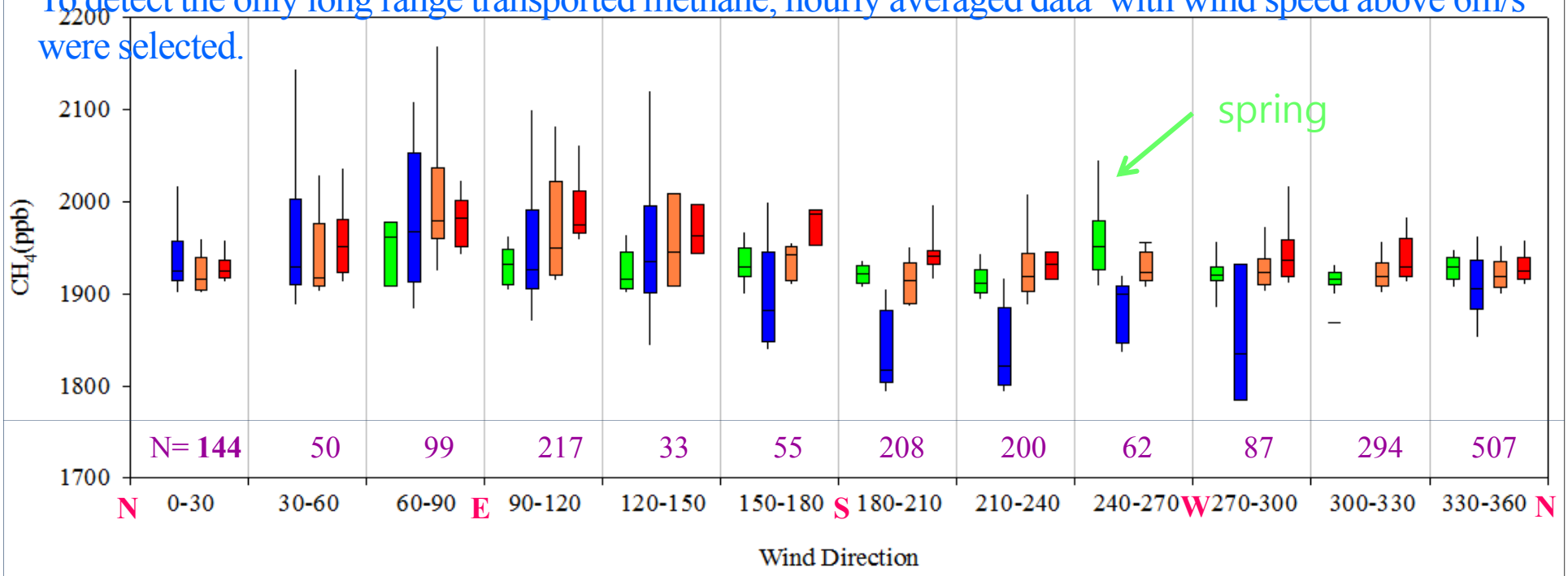


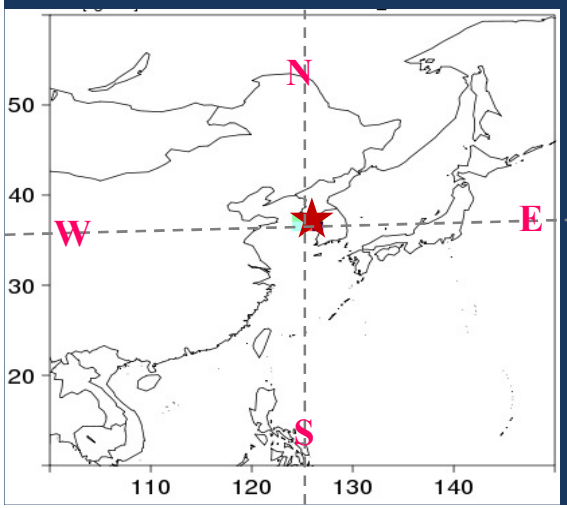




Long Range Transported Methane in AMY

To detect the only long range transported methane, hourly averaged data with wind speed above 6m/s were selected.





-It showed high concentration in order of Winter> Autumn> Spring > Summer

-From summer to winter, methane with easterly wind showed higher concentration compared to other direction while main wind stream is southwesterly in summer, easterly in autumn and northwesterly in winter .

-However in spring the methane from continental of China showed highest concentration and main wind stream is from southwest.

-Summer showed large variation according to wind direction due to strong north pacific air mass from sink region.

Summary

- When containing events period,
  - The pattern is characterized by high concentrations in winter and low in spring
  - During summer period, its variation was the largest among four season.
  - It showed low concentration when it came from sink region with north pacific wind.
  - It showed high concentration when it came from Southern part of China indicating good relationship with CO.
  - Under the stagnated condition it was affected by local source showing the high concentration
- When detecting long transported methane.
  - The pattern is characterized by high concentrations in winter and low in summer.
  - The concentration showed higher when it came from eastern part while only in spring it showed highest level from western part than other directions.
  - According to wind direction, strong north pacific airmass contributes to the large va riation in the methane mixing ratio in summer.
  - During winter this variability was reduced with the cessation of the north pacific wi nd from methane sink region.

Thank you !