

Recent History of CO₂ Standard Gases in JMA

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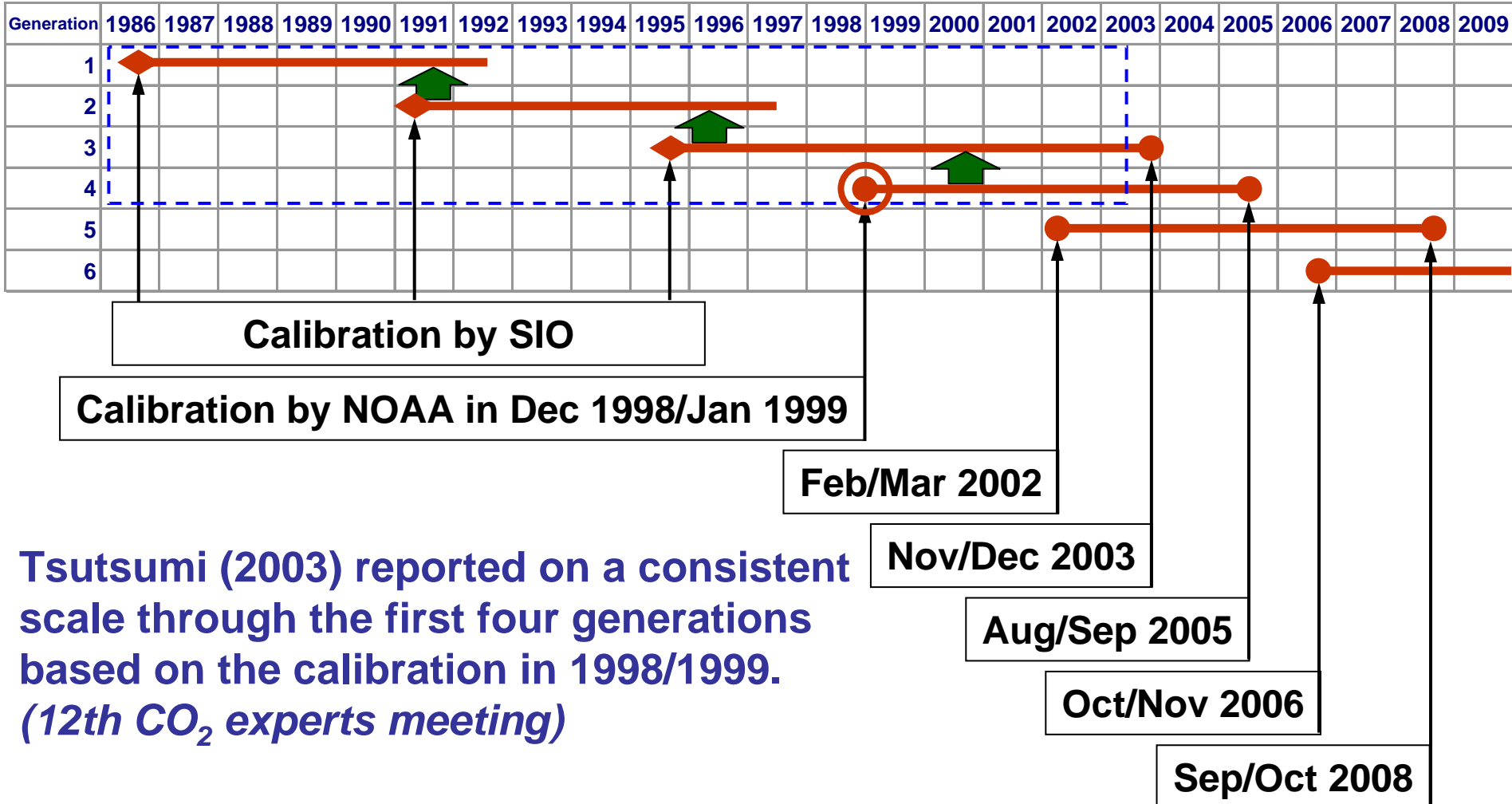
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History of JMA's CO₂ primary standards



❖ JMA maintains CO₂ primary standard gases calibrated by the WMO standard at the beginning and end of use.



Tsutsumi (2003) reported on a consistent scale through the first four generations based on the calibration in 1998/1999. (12th CO₂ experts meeting)



Calibration system and standard gases



**Calibration system
HORIBA VIA-510R**



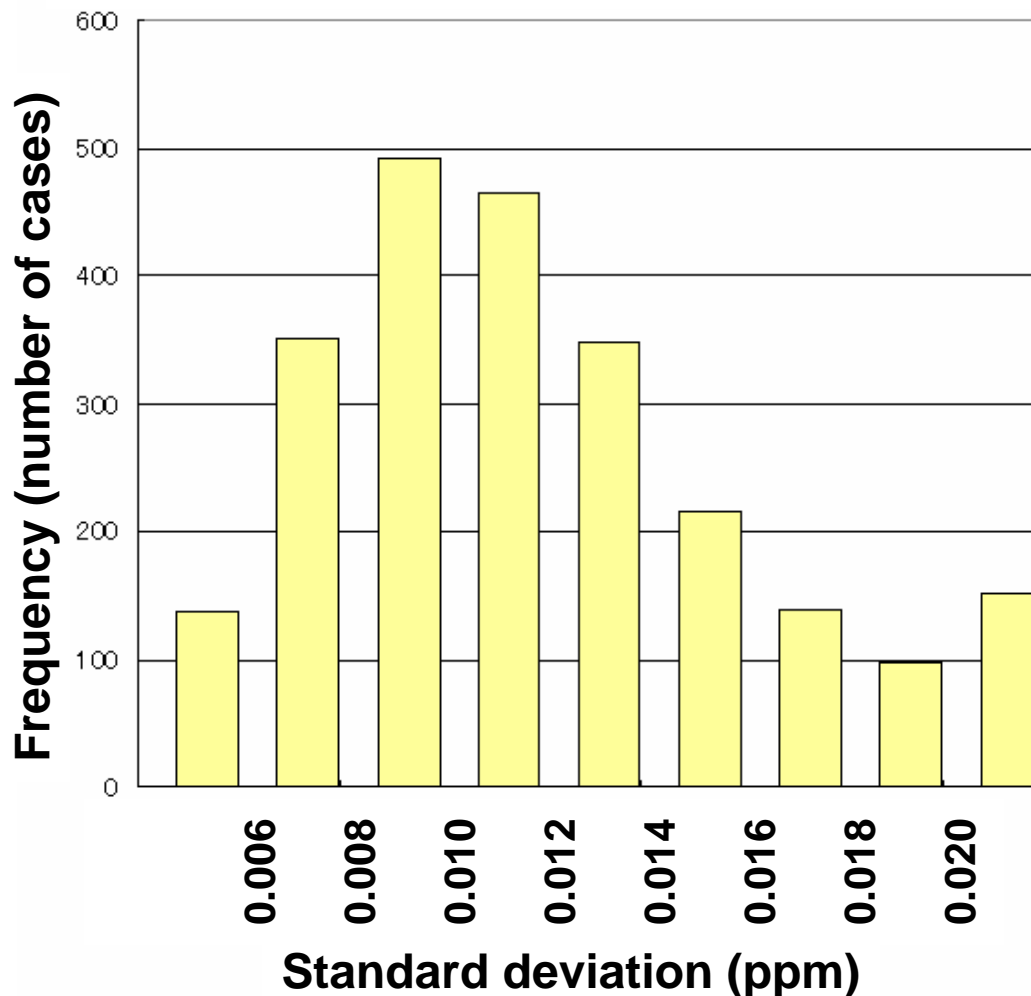
CO₂ Primary Standard Gases

**Range: 210 – 460 ppm in 14 cylinders
(48-litre aluminum)**

Content: Purified Air + CO₂

Manufacturer: Taiyo Nissan Corp.

**Distribution of standard deviations of
the mixing ratios analyzed repetitively
by JMA's CO₂ calibration system**

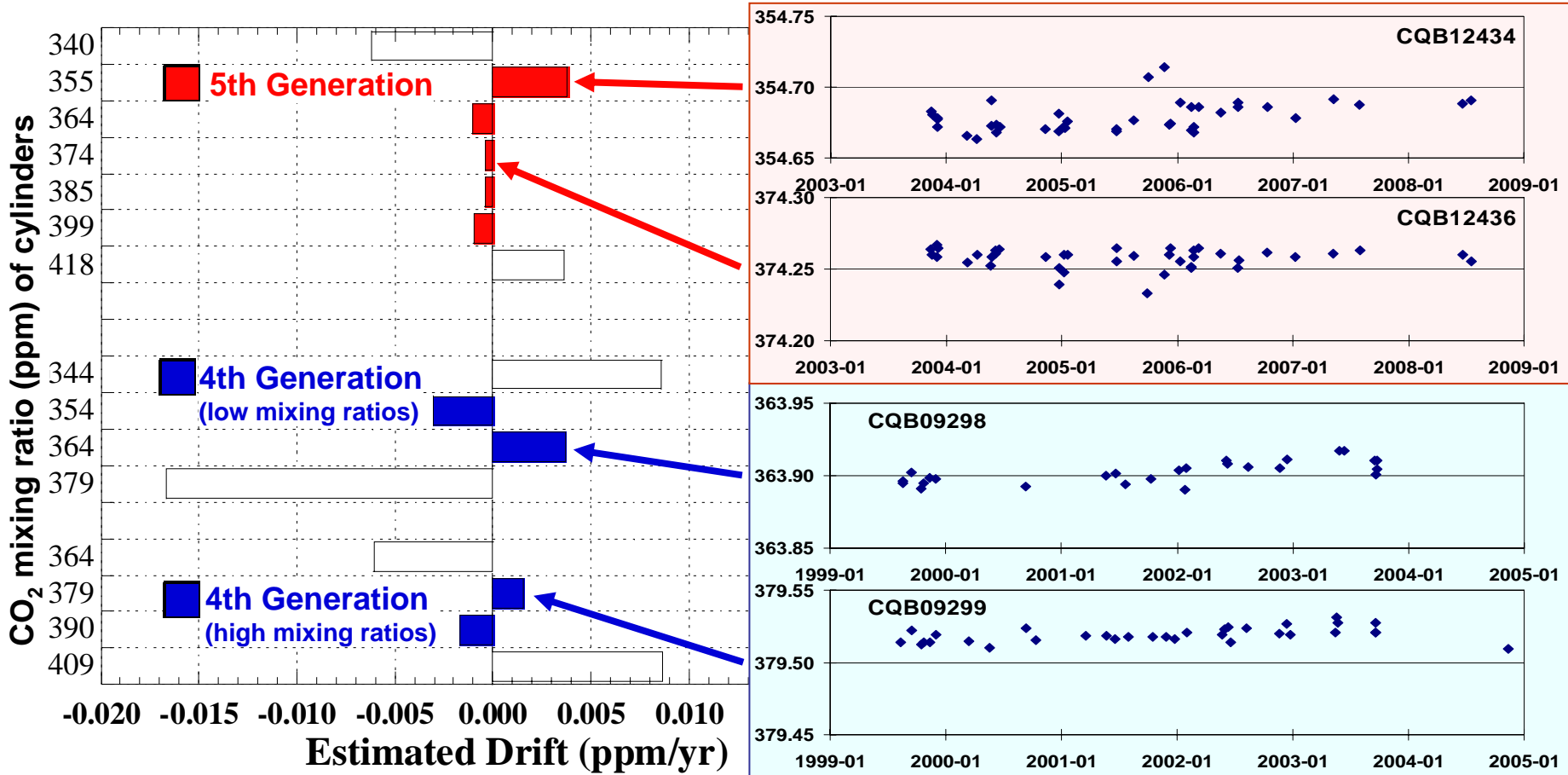




Results of internal consistency tests



❖ JMA has confirmed the stability of its primary standards by internal consistency tests.



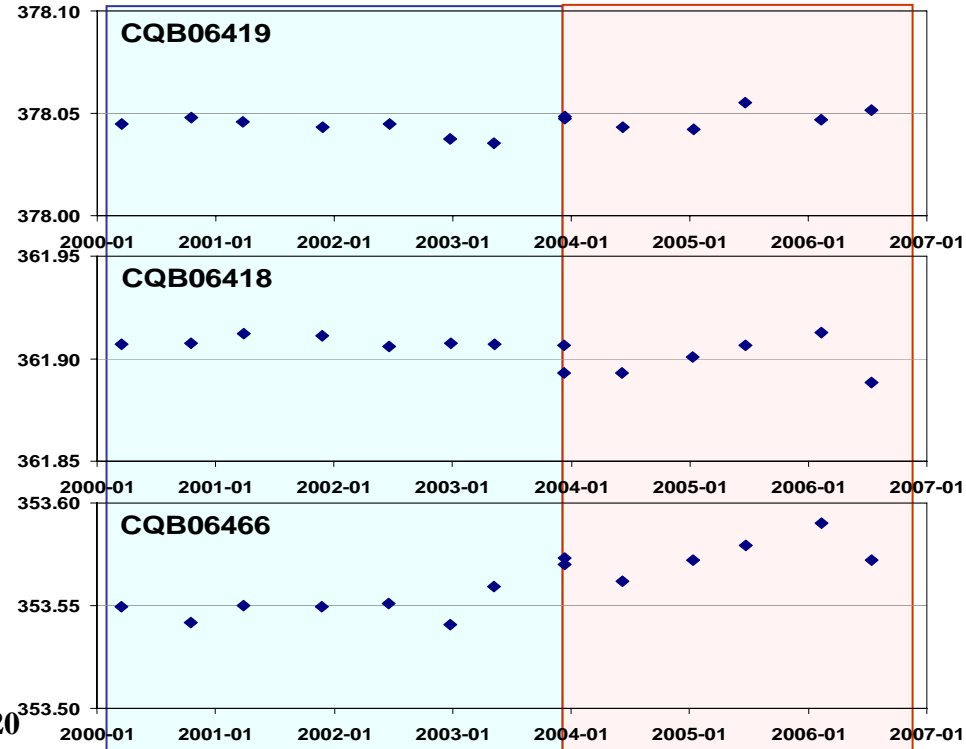
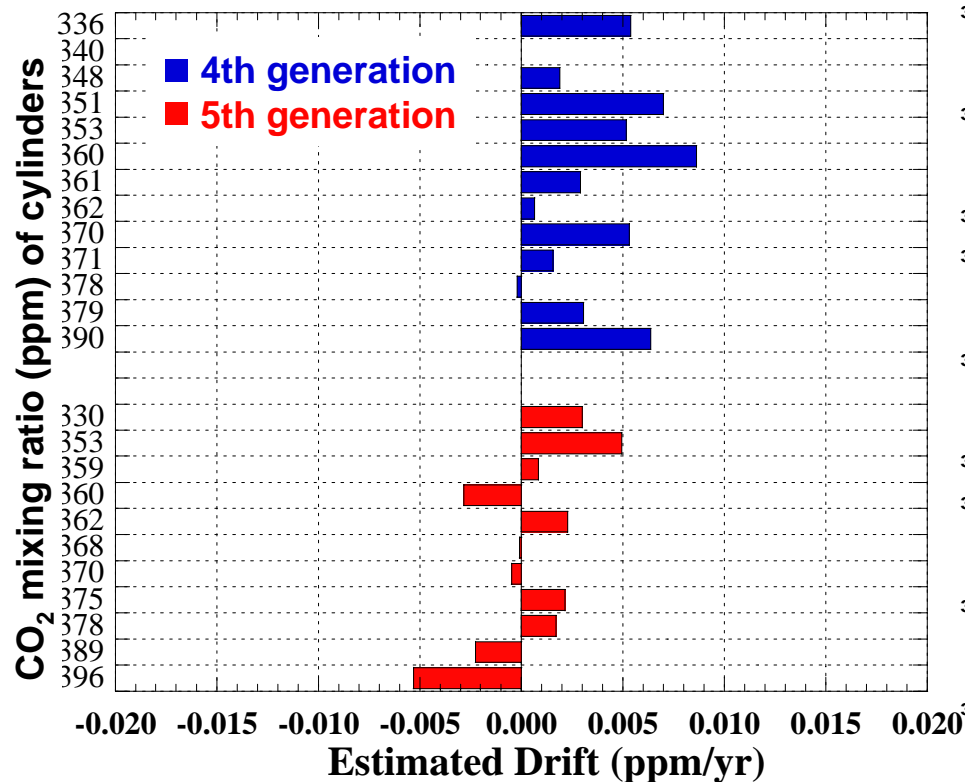
Stability of JMA's primary standards in the 4th and 5th generations, estimated from internal consistency tests.



Comparison between JMA and MRI



- ❖ Stability of JMA's standards were evaluated by regularly comparing with the standards of MRI.
- ❖ No significant drifts were found in the comparison between the standards of JMA and MRI.



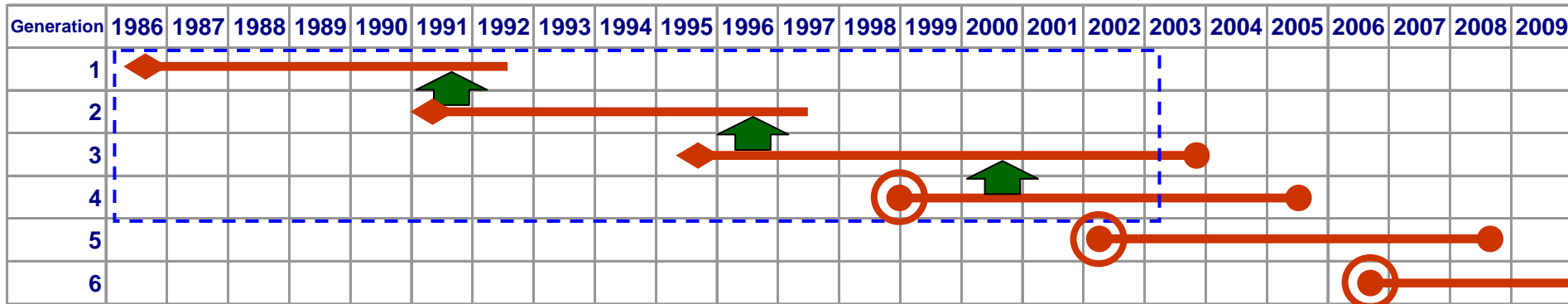
Mixing ratios of MRI's cylinders determined by JMA's standards



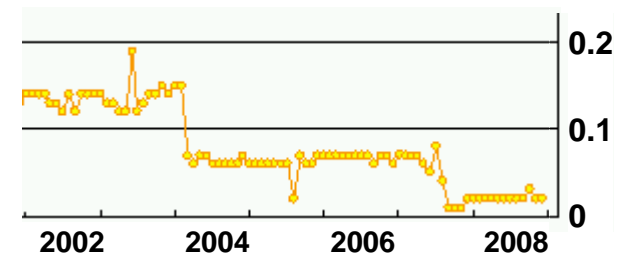
Integrated scale through the generations



- ❖ JMA currently adopts different scales calibrated at the start of use for the 4th, 5th and 6th generations.
- ❖ These scales need to be integrated into one to create a consistent data set through the generations.



Gaps of 0.05–0.1 ppm have been estimated in the measurement data

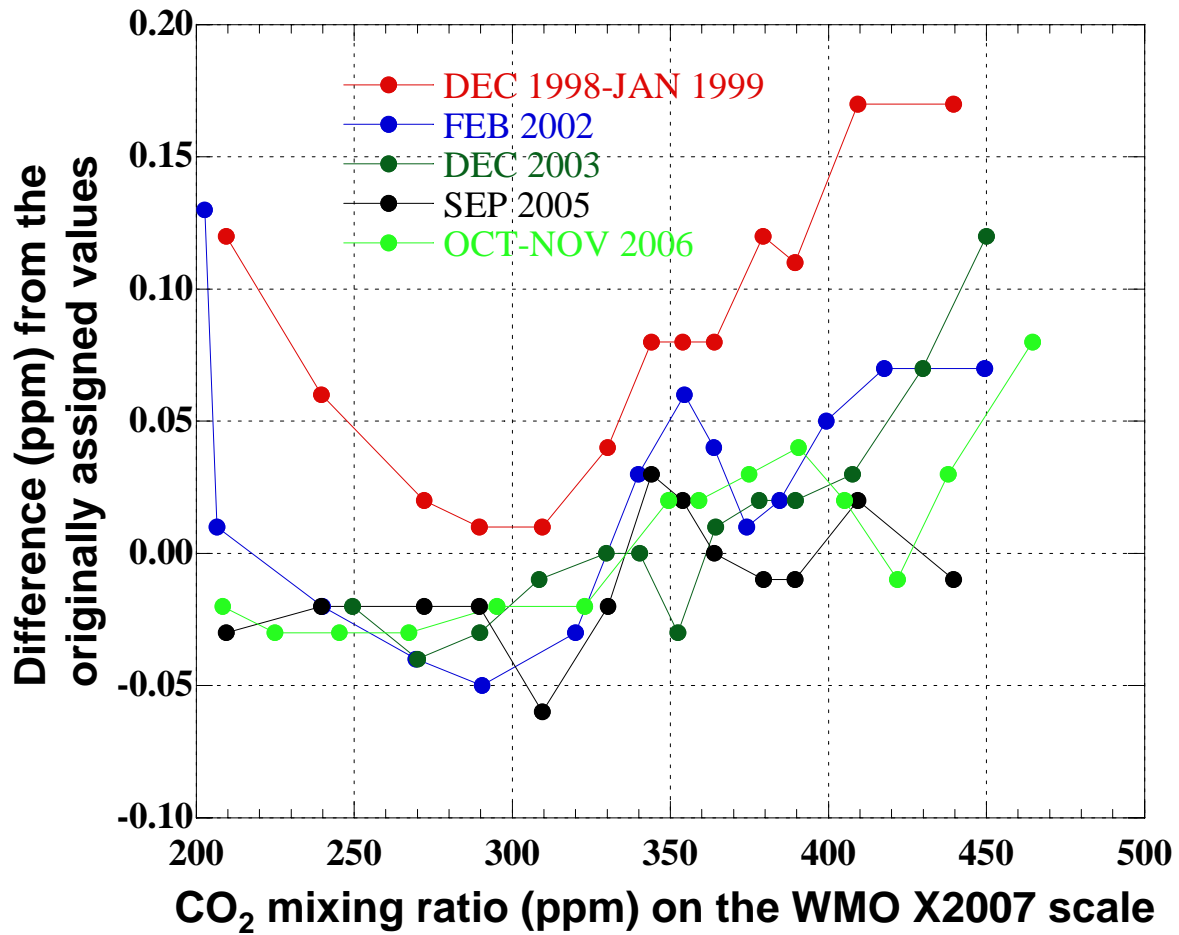




Re-assignment on the WMO X2007 scale



- ❖ NOAA/ESRL has re-assigned the past calibration results on the WMO X2007 scale.
(<http://www.esrl.noaa.gov/gmd/dv/ccg/refgas/index.php>)

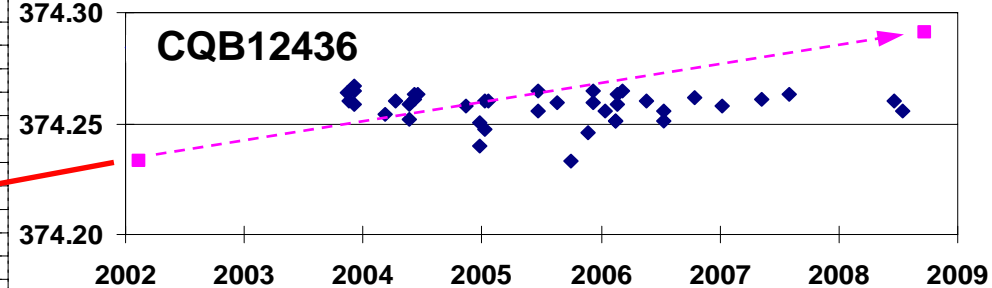
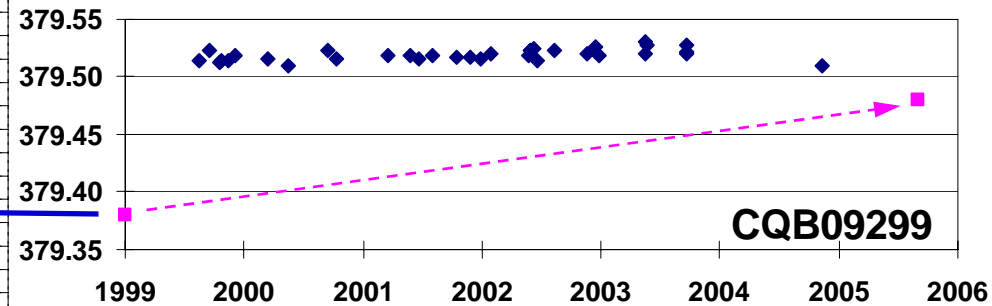
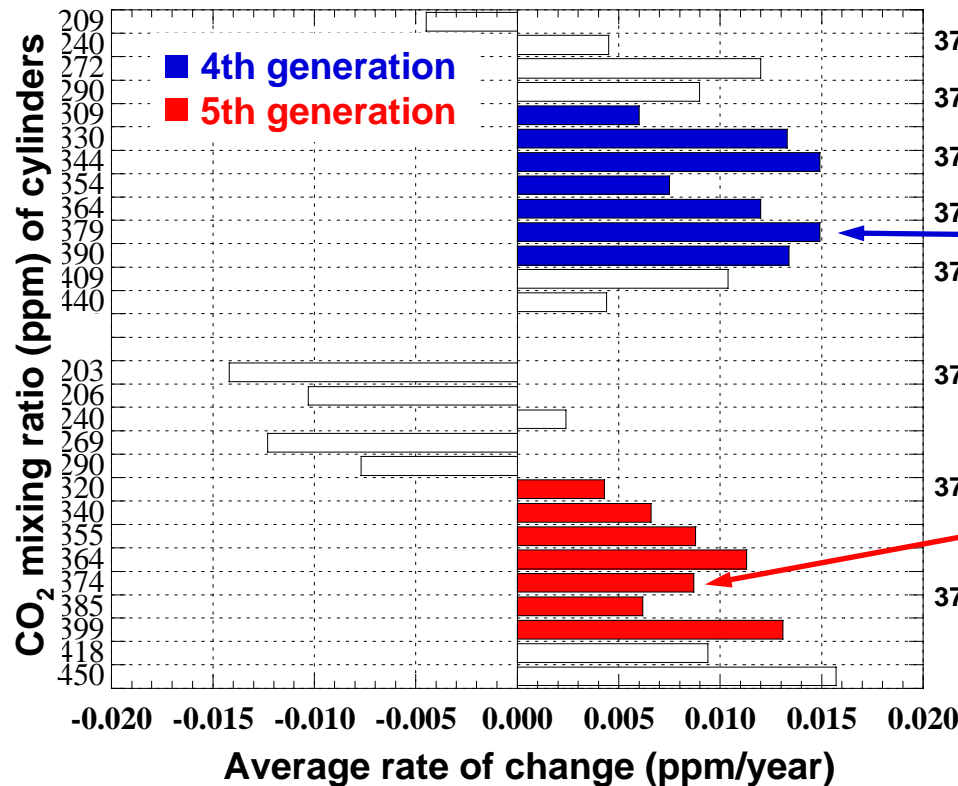




Change in the mixing ratios



- ❖ Changes of ~ 0.01 ppm/year are seen in the mixing ratios of JMA's primary standards.
- ❖ They are larger than those estimated from the internal consistency tests and comparison with MRI's standards.



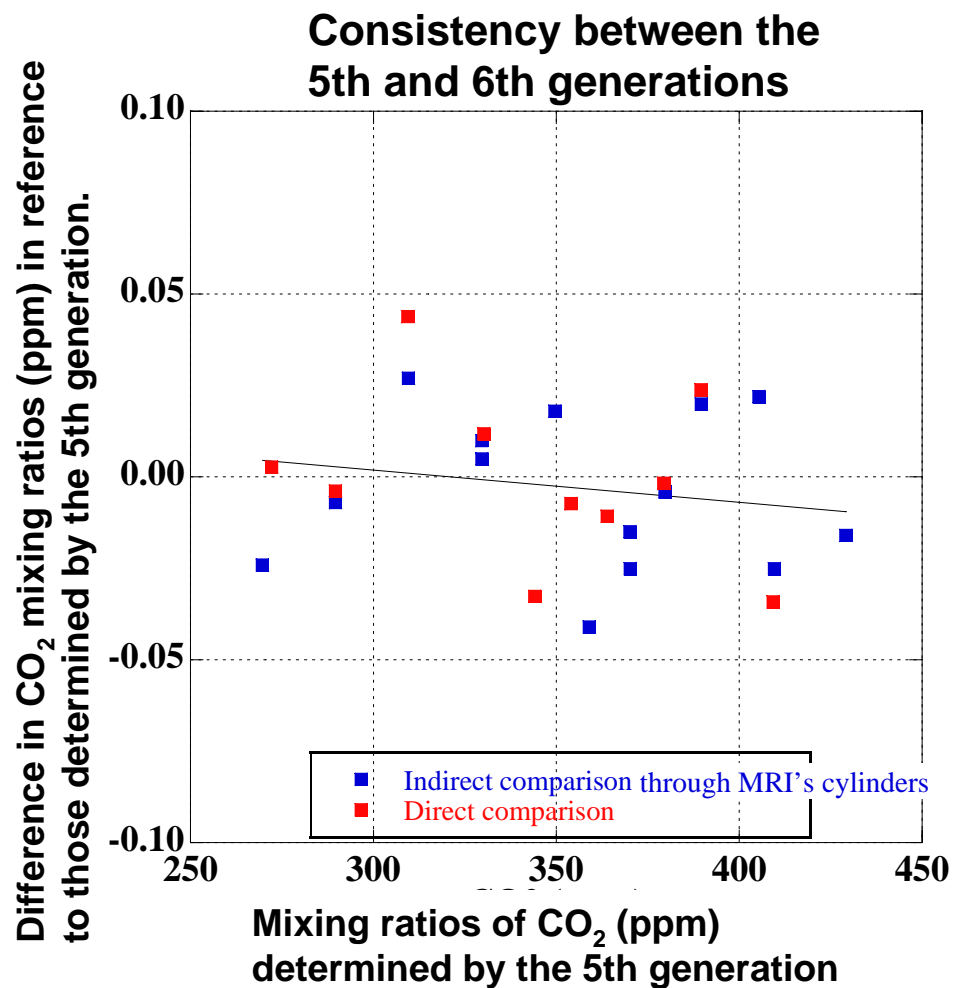
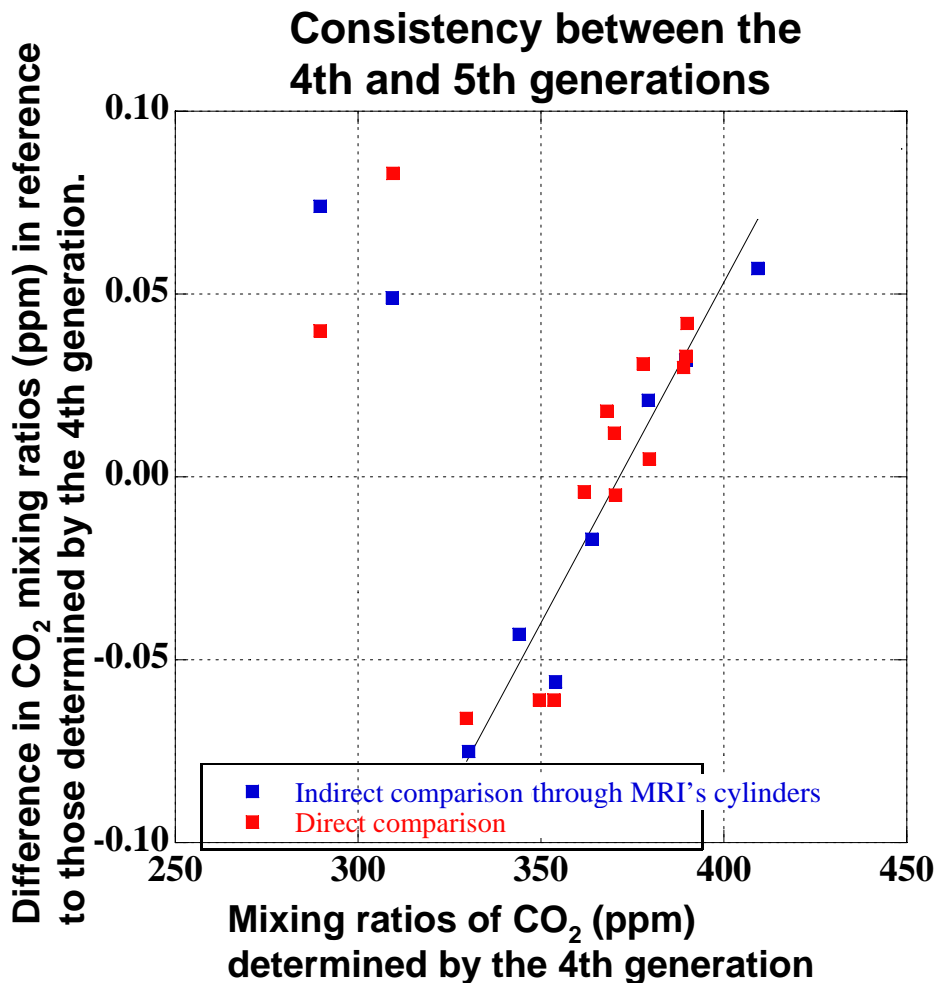
◆ : Results of internal consistency tests
■ : Re-assigned values on the X2007 scale



Consistency in different generations



- ❖ Difference in mixing ratios between different generations is found to depend on mixing ratio in some cases.





Summary



- ❖ **JMA maintains a relay of primary standards that are calibrated by the WMO/CCL every 2–3 years.**
- ❖ **JMA's primary standards are sufficiently stable during their life time, with a drift of less than 0.005 ppm/year, estimated from internal consistency tests and intercomparison with independent standards.**
- ❖ **JMA is to establish a consistent scale through different generations of primary standards, in reference to the re-assigned results of the past calibrations on the WMO X2007 scale that are provided by NOAA/ESRL.**