Instrumental monitoring of Jason-1 microwave radiometer

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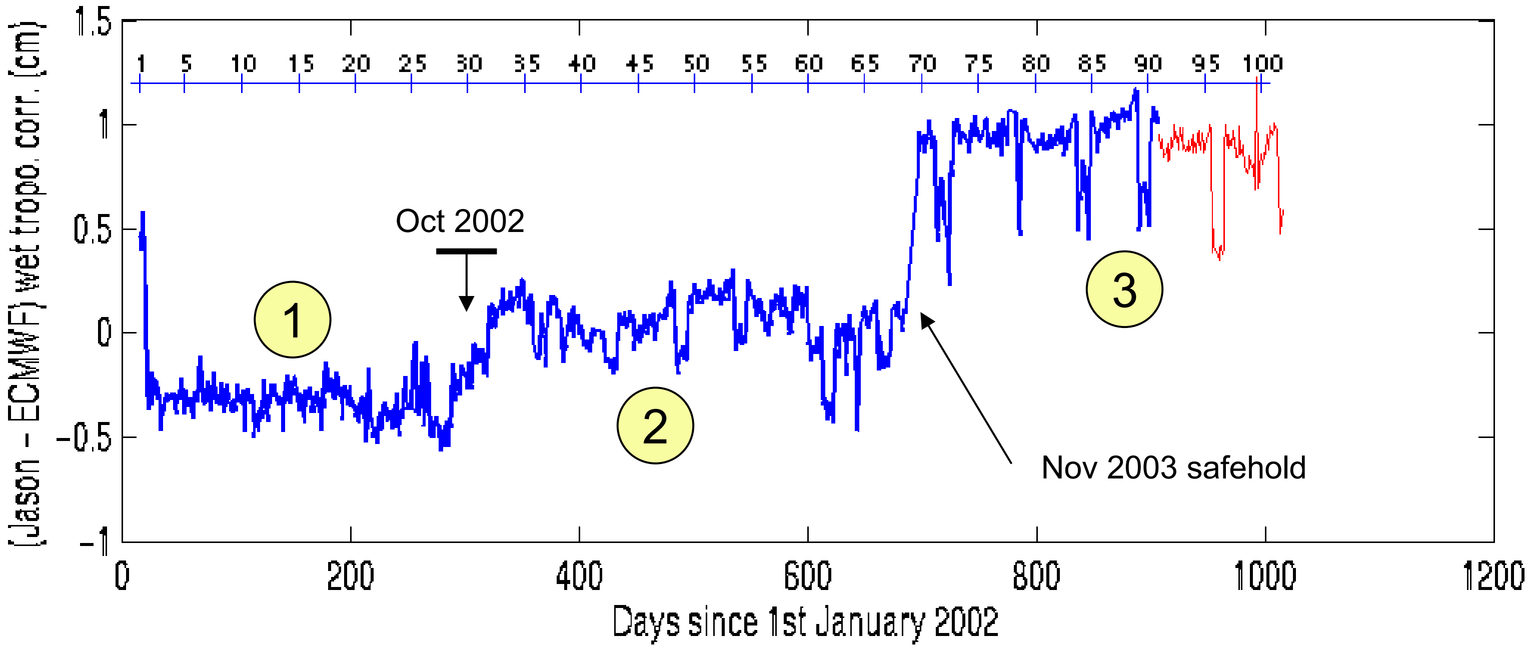
Abstract-

This poster aims at reporting the behavior of Jason-1 microwave radiometer in terms of monitoring of the instrumental characteristics since launch. It is performed on the JMR level 1.0 data products and would help to understand where drift or incident occurs in order to allow an appropriate and accurate correction to be determined.

Daily mean difference between JMR and ECMWF wet tropo. corr.



Two identified regime changes in the JMR tropospheric correction measurements since launch:

- In Oct. 2002 (cycle 28-33 interval), average change of ~4 mm
- Nov. 2003 safehold event (cycle 68-69), average change of ~8 mm with re-apperarance of near 60-day changes associated to yaw steering. The size is ~5 mm.

Monitoring of the radiometer instrumental parameters

- JMR level 1.0 products
- up to ongoing cycle 103 (31 Oct. 2004)
- the 1 Hz JMR antenna temperature (and subsequent brightness temperatures) are derived for each channel from the average of 3 individual noise diode calibrations

$$Ta_{ij} = \gamma_{ij} \cdot TN_{ij} + KR_i \cdot TR_i - TL_{wi} - TL_{fh}$$

(3 Hz)

Reference load and waveguide loss terms depends on channel only

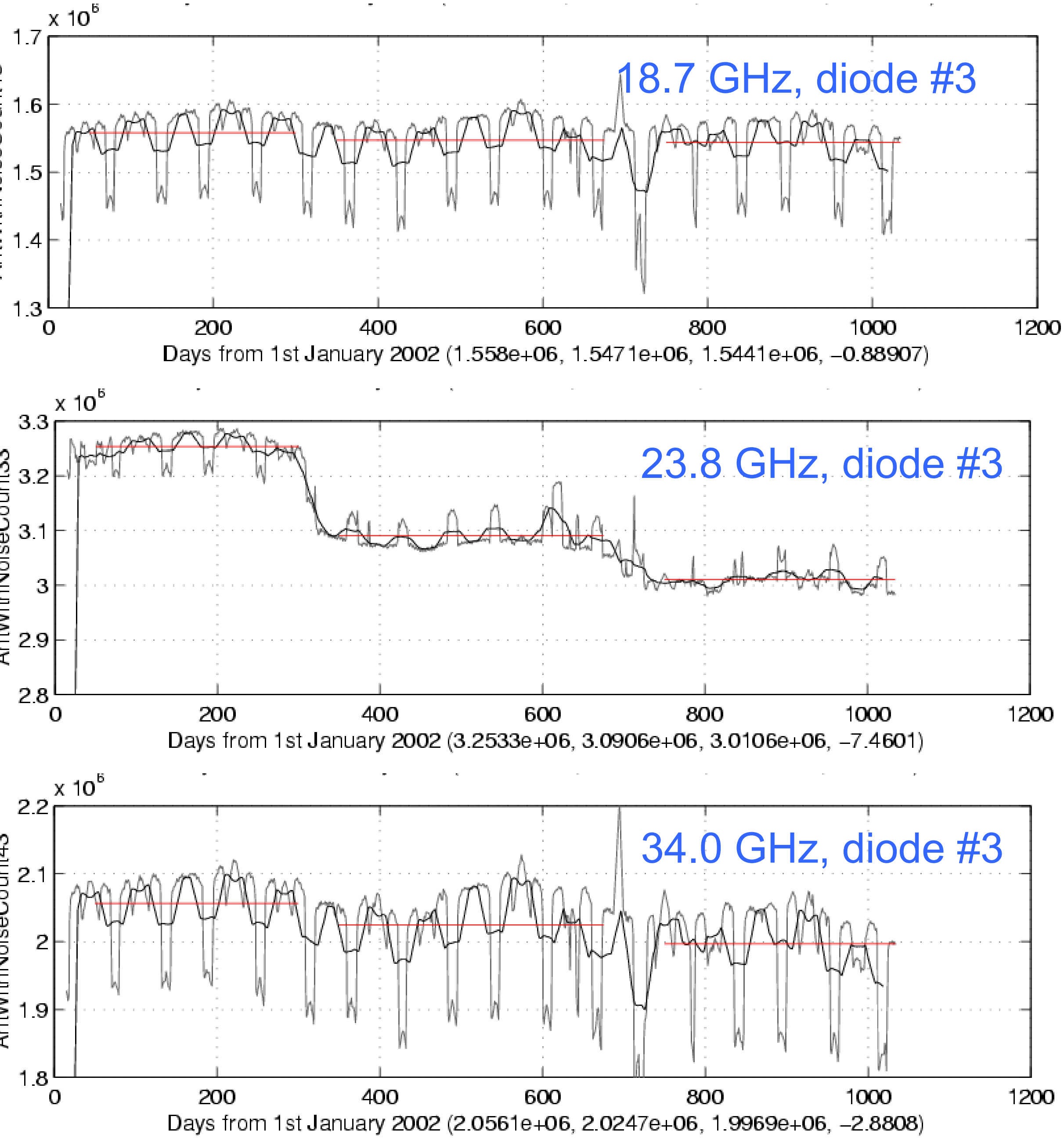
$$TL_{wi} = K_{w1i} \cdot T_{w1i} + K_{w2i} \cdot T_{w2i}$$

$$\gamma_{ij} = \frac{S_{ij} - R_{ij}}{N_{ij} - S_{ij}}$$

depends on channel (i) and on diode (j)

$$TL_{fh} = K_{fh1} \cdot T_{fh1} + K_{fh2} \cdot T_{fh2}$$

Feed horn loss term same for all channels

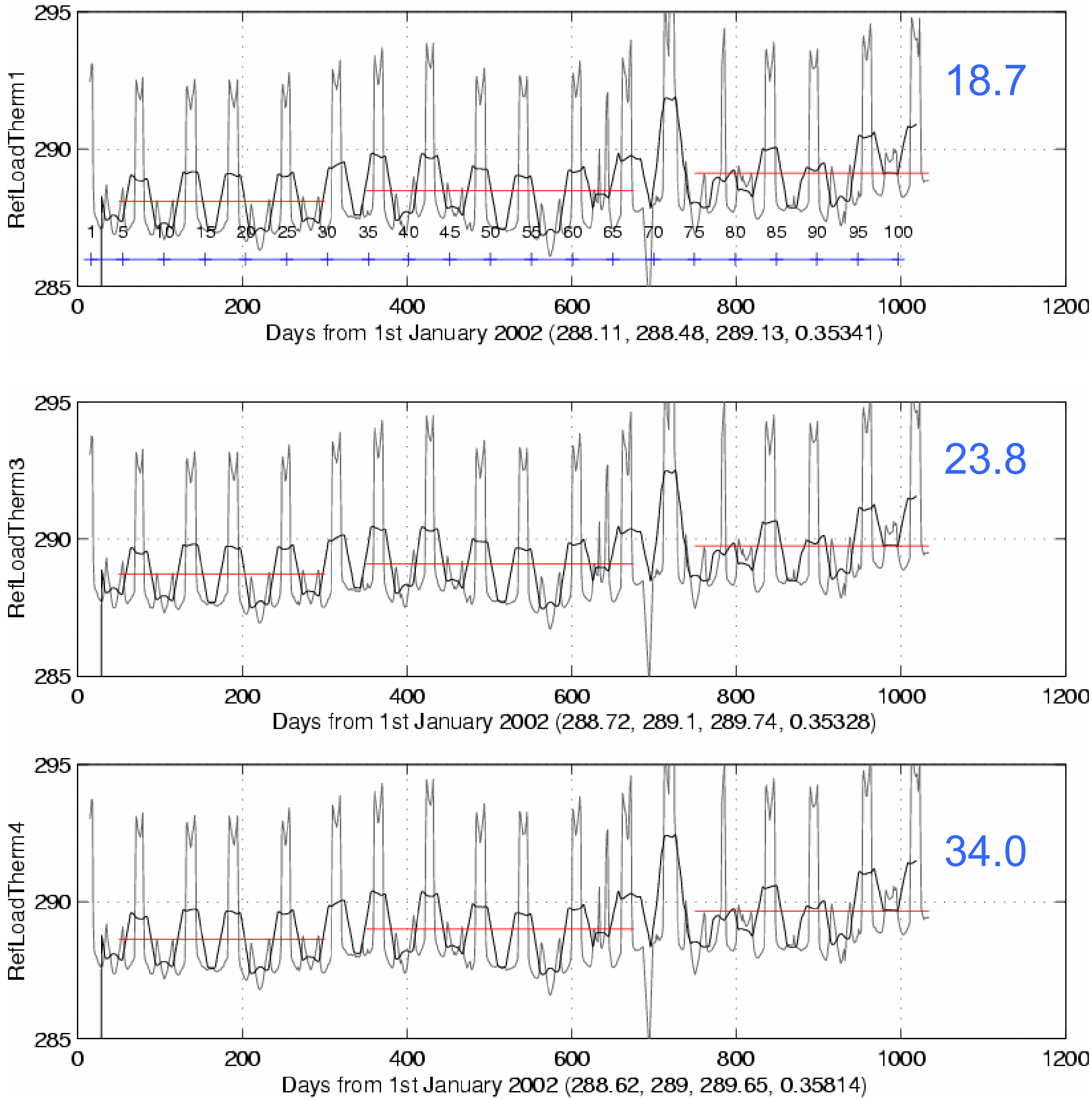


Time series of the daily means of the corrected counts Nij

⇒ Changes in the TA calibration of all 3 channels. It is stronger on the 23.8 GHz data with inversion of the yaw state related variation.

⇒ Smaller shifts associated to the safehold

Time series of the daily means of the reference load thermistor temperatures TRi



⇒ Small shifts across the cycle 28-32 interval for all 3 channels superimposed to the larger yaw state depending variation.

⇒ Larger shifts due to the safehold

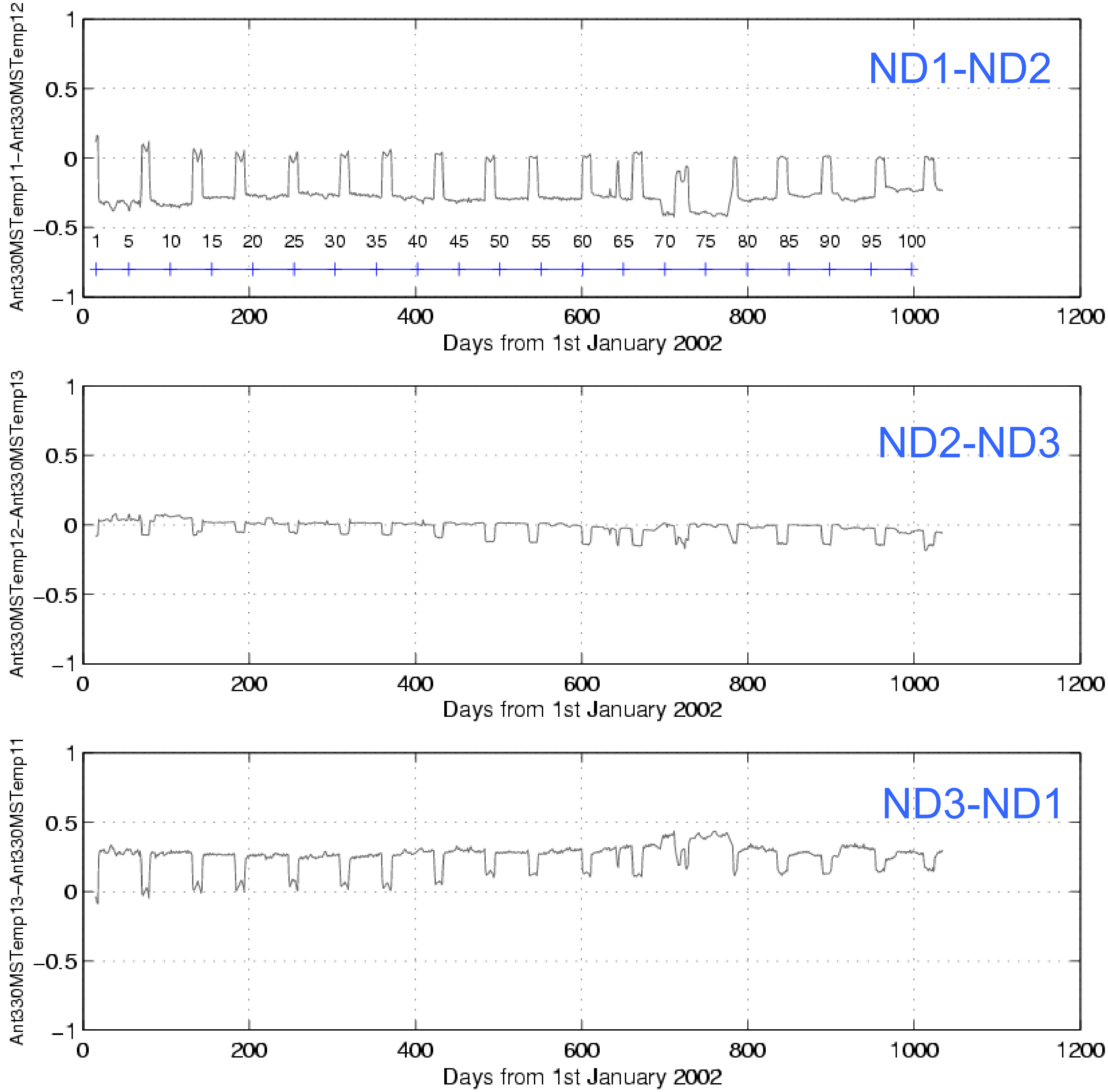
Percentage of variation between period 1 and 3: $\frac{\langle \bullet \rangle_{period\ 3} - \langle \bullet \rangle_{period\ 1}}{\langle \bullet \rangle_{period\ 1}} \times 100$

%	diode	Sij	Rij	Nij	TNij	TRi	Tw1i	Tw2i	Tfh1	Tfh2	Tns1	Tns2
18.7	1	-0.69	-0.75	-0.83	+0.029							
	2	-0.70	-0.76	-0.90	-0.037	+0.35	+0.35	+0.32				
						(ΔT~1.0 K)		(~0.85)				
	3	-0.69	-0.75	-0.89	+0.010							
23.8	1	-7.21	-7.17	-7.35	-0.046							
	2	-7.21	-7.15	-7.44	-0.017	+0.35	+0.35	+0.31	+0.26	+0.27	+0.36	+0.36
						(ΔT~1.0 K)		(~0.85)	(ΔT~0.7 K)		(ΔT~1.0 K)	
	3	-7.21	-7.15	-7.46	-0.019							
34.0	1	-2.84	-2.63	-2.72	-0.079							
	2	-2.85	-2.68	-2.80	-0.132	+0.36	+0.35	+0.32				
						(ΔT~1.0 K)		(~0.85)				
	3	-2.85	-2.70	-2.88	-0.178							

⇒ Slight shift in the JMR front end thermal regimes are seen across both the cycle 28-33 and 68-69 transition intervals. There is a gradient of temperature through the instrument pointed out by the different thermistors in addition to the large thermal difference seen between fixed and sinusoidal yaw states.

⇒ Slight difference in the percentage of variation associated to a channel and a diode (Sij, Rij, Nij) but nevertheless that causes different behaviors of the noise diodes for the channel when they are compared to each other.

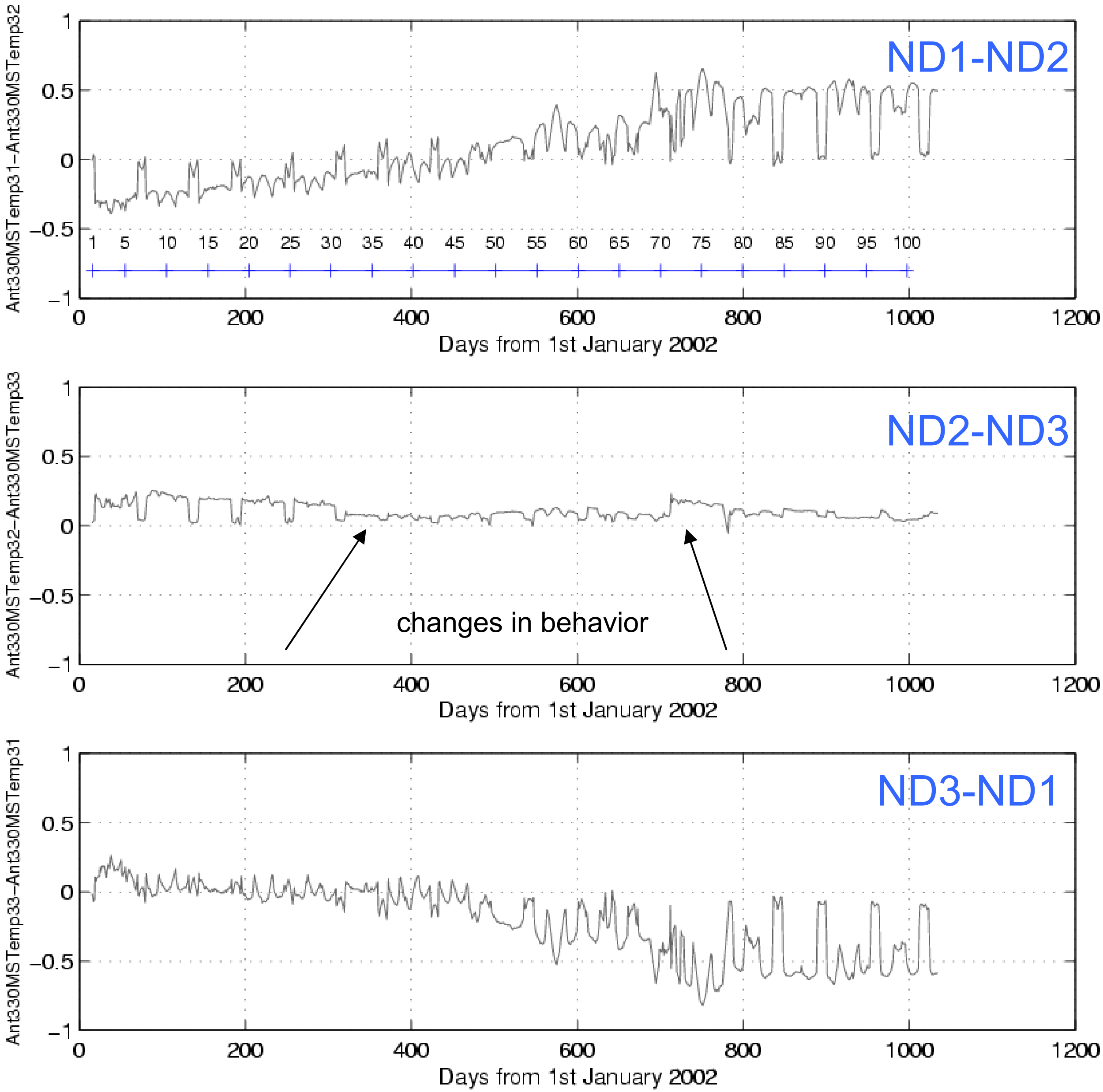
Time series of the daily means of the differences between two individual 330-ms Taij



18.7 GHz

⇒ Difference vs. Time allows to compare only term in Taij depending on noise diode calibration.

⇒ No apparent calibration shift through 28-33 interval between the different ND calibrations.



23.8 GHz

⇒ There is a trend up to safehold event then stabilization with large difference between the two yaw states on ND1-ND2. ND1 calibration appears to be drifting upward (relative to ND2 and ND3) up to safehold event then it is biased with respect to ND2 and ND3.

⇒ Increase of the difference related to yaw states after the safehold event in Nov. 2003.

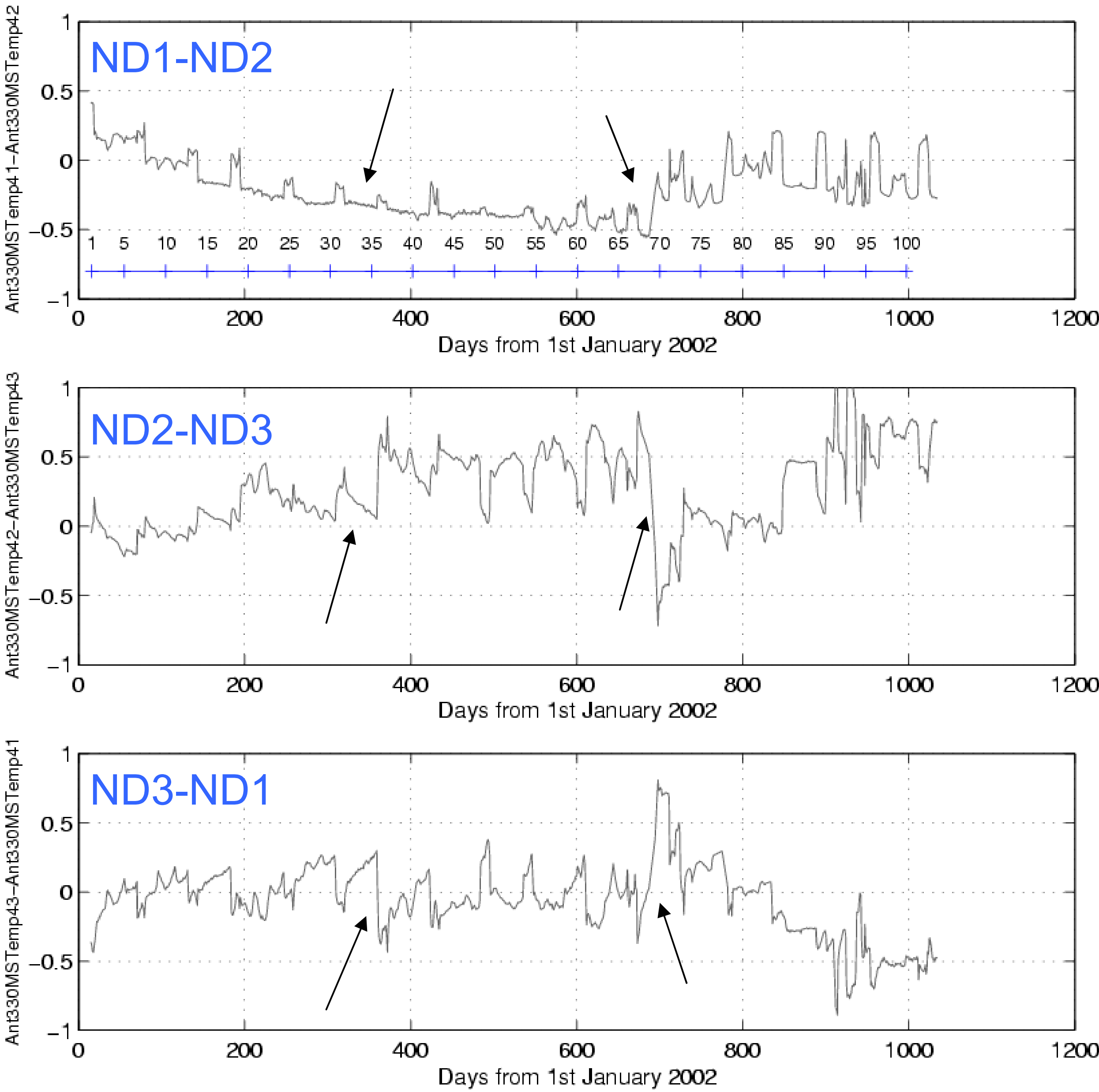
34.0 GHz

⇒ Significant changes across both the 28-33 and 68-69 intervals.

⇒ (1) in term of relative drift, the 34.0 GHz channel ND2 calibration appears to be drifting upward (relative to the ND2 and ND3).

⇒ (2) then there are biases between the 3 noise diode calibrations.

⇒ (3) the ND3 calibration appears to be drifting downward (relative to ND1 and ND3) lately.



Concluding remarks

- Removal of any yaw state dependencies on all parameters for all three channels with the new calibration ?

- Removal of relative offsets and drifts in the individual noise diode Taij calibration (3 Hz) for all three channels ?

- Is the thermal gradient across the instrument taking into account ($\Delta T \sim 0.7K$ measured by the feedhorn thermistors between launch and now and $\Delta T \sim 1.0K$ near the noise source, reference load and waveguide #1) ?

- Another change in behavior after cycle 95 ?