

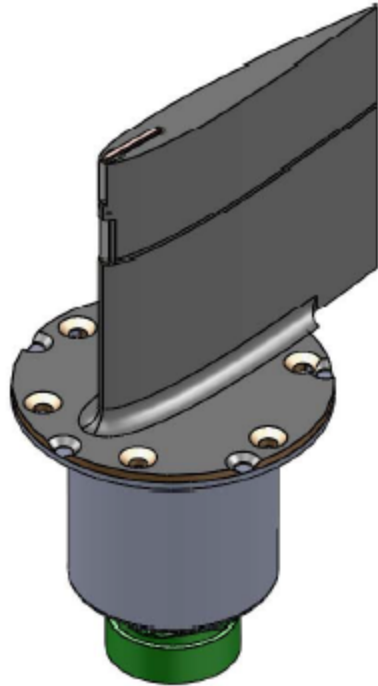
# Status of F20 Belly-Mounted Hot-Wire Data, Cayenne 2015

Prepared by Walter Strapp, Lyle Lilie  
11-Nov-15

# Summary of Data and Functionality

Flight#	Probe Installed	S.N.	Status (functionality)
C9	LWC 0.5 mm	2020	probably OK entire flight
C10	LWC 0.5 mm	2020	probably OK, except during M300 reboot 19:21-19:27 (initial climb)
C11	LWC 0.5 mm	2020	probably OK after 21:19:40 (mid-initial-climb)
C12	LWC 0.5 mm	2020	probably OK entire flight
C13	LWC 0.5 mm	2020	probably OK entire flight
C14	Ice Crystal Detector	4005	probably OK entire flight
C15	Ice Crystal Detector	4005	probably OK entire flight
C16	Robust	3015	probably OK entire flight
C17	Robust	3015	probably OK entire flight
C18	Robust	3015	probably OK entire flight
C19	Robust	3015	Circuit breaker troubles, no data from 16:08-16:56 (-10 C in heavy precipitation)
C20	Robust	3015	Circuit breaker troubles, no data from 11:18 to end of flight (final measurements in heavy precipitation)
C21	LWC 0.5 mm	2020	probably OK entire flight
C22	LWC 0.5 mm	2020	probably OK entire flight
C23	LWC 0.5 mm	2020	probably OK entire flight
C24	LWC 0.5 mm	2020	probably OK entire flight
C25	LWC 0.5 mm	2020	no data entire flight
C26	LWC 0.5 mm	2020	no data entire flight

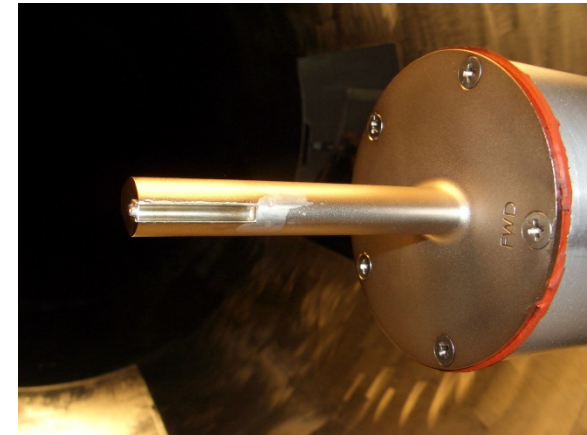
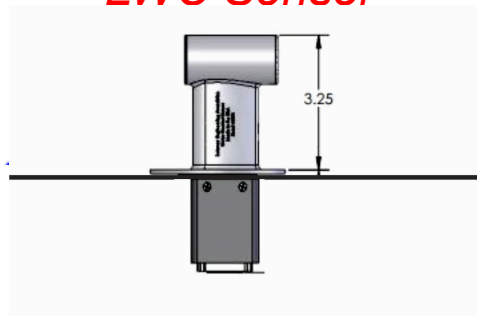
# Images of sensors:



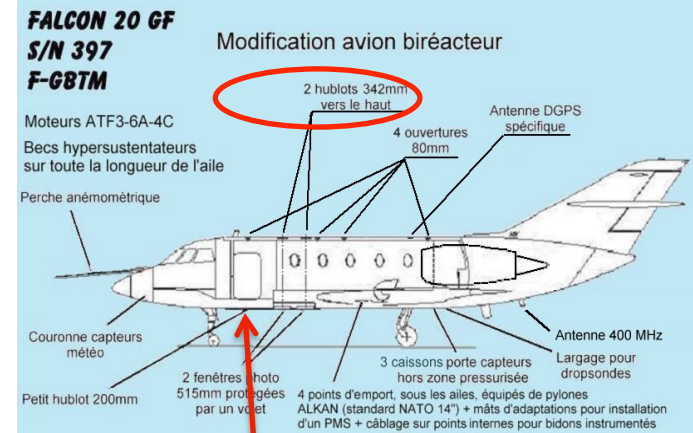
**Ice Crystal Detector Sensor**



**LWC Sensor**



**Robust Sensor**



**Location of belly hot-wire**

# Reminders:

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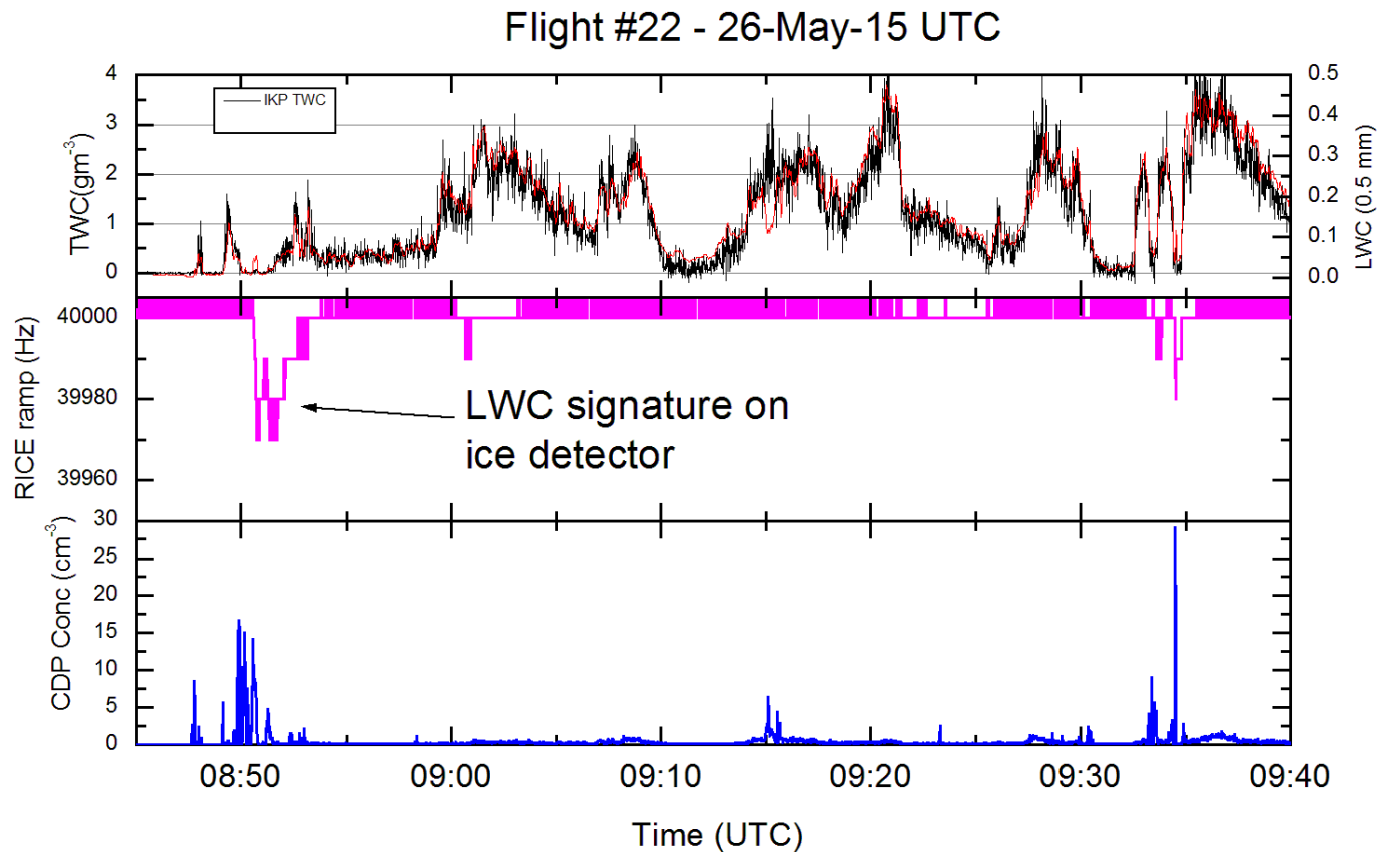
- Probes are installed close to the skin of the aircraft, and in what is suspected to be a region of enhanced IWC due to upstream debris from ice crystal collisions on the nose and forward fuselage of the aircraft
- Probes are installed behind the nose-gear of the aircraft, and show step changes and shadowing when gear is down
- LWC probe (0.5 mm) is subject to relatively large errors due to false response to IWC (locally enhanced), ~10% of true IWC
- All data may have some degree of smoothing due to M300 settings in hardware – e.g. looks like ~4-second smoothing for the robust probe (TBD)
  - Higher frequency raw data may be recoverable

# Preliminary Observations:

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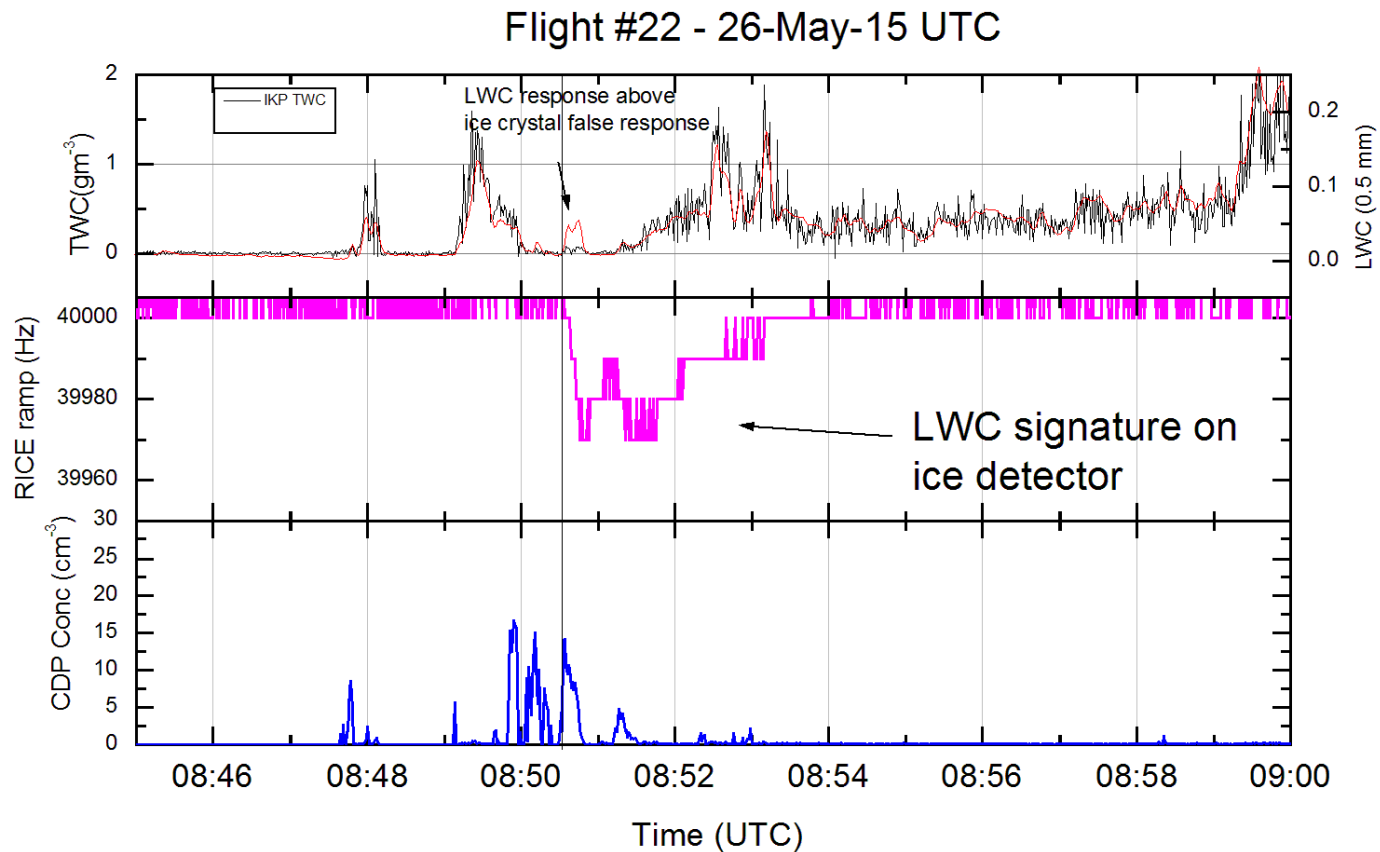
- Again, very little evidence of significant LWC on 0.5 mm sensor (i.e. response  $> 10\%$  of IWC) in HIWC conditions, even at  $-10\text{ C}$
- IWC enhancement close to skin at belly location (due to ice crystal debris from upwind surfaces) is of the order of a factor of 1.5-2.
  - Helps explain high false response on LWC sensor relative to free stream IWC values ( $\sim 10\%$ , versus  $\sim 3\text{-}5\%$  in wind tunnels)

# Preliminary Observations:



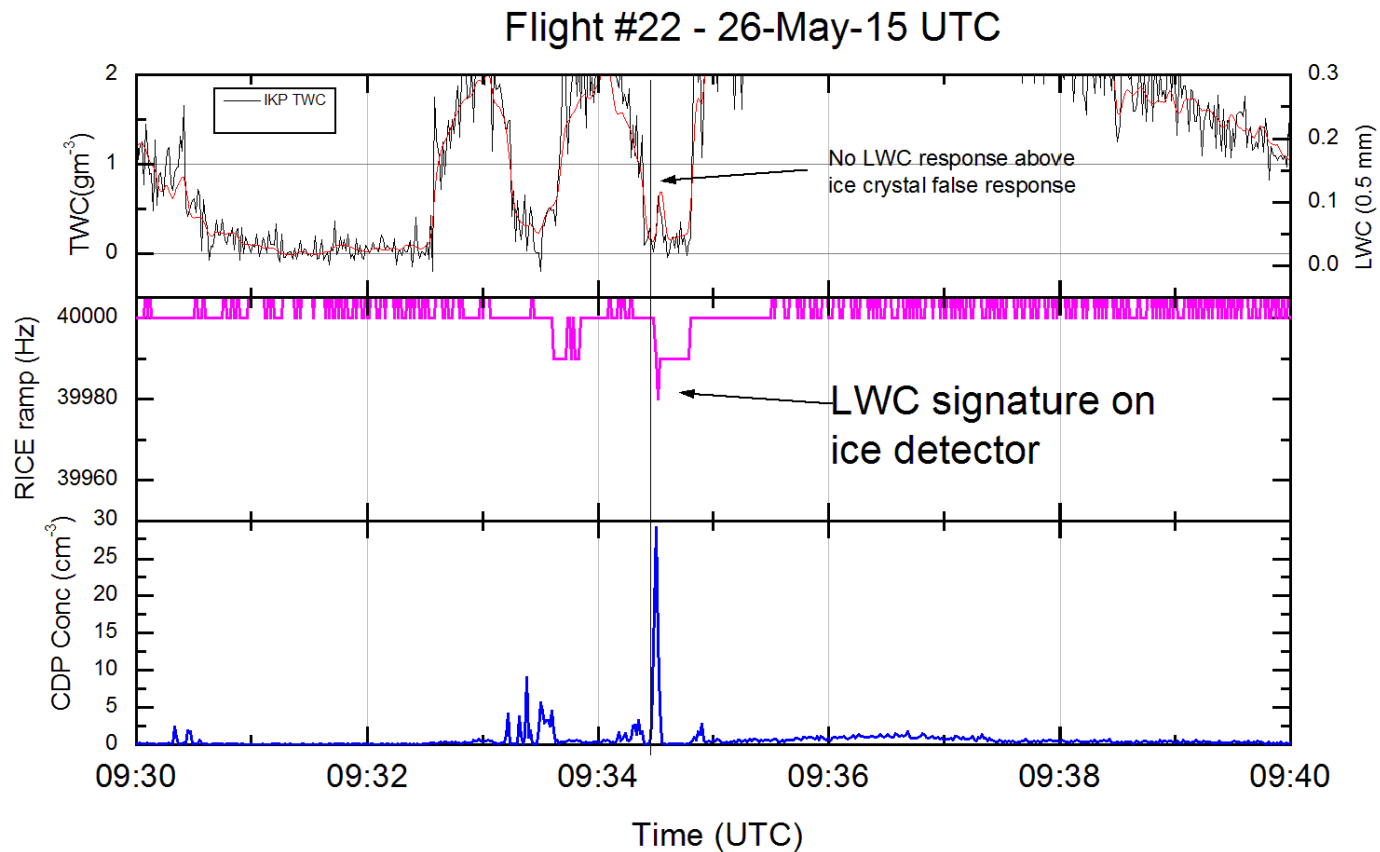
Note LWC trace top panel on a scale ~ 10 times more sensitive than IKP TWC

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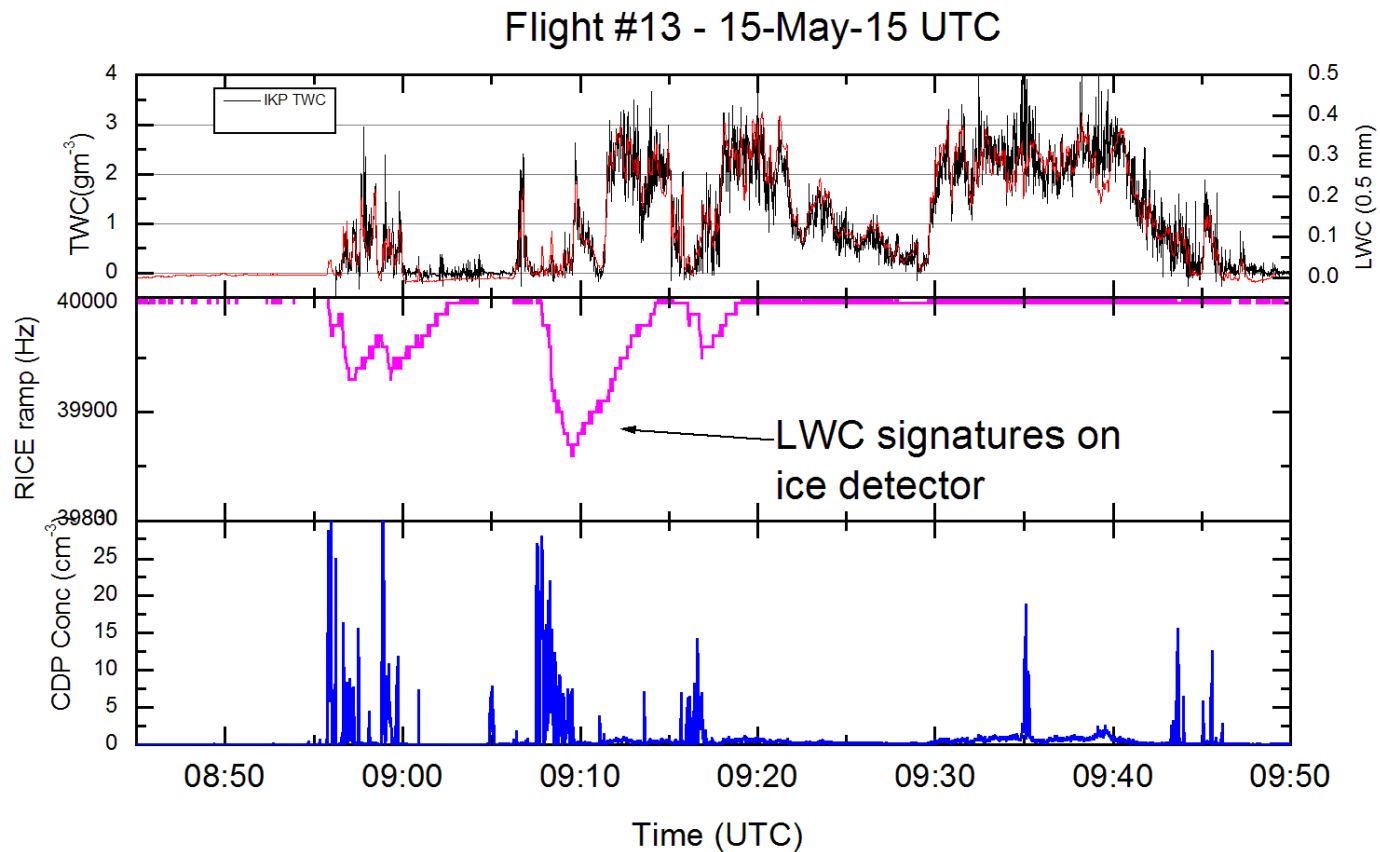
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Note LWC trace top panel on a scale ~ 10 times more sensitive than IKP TWC

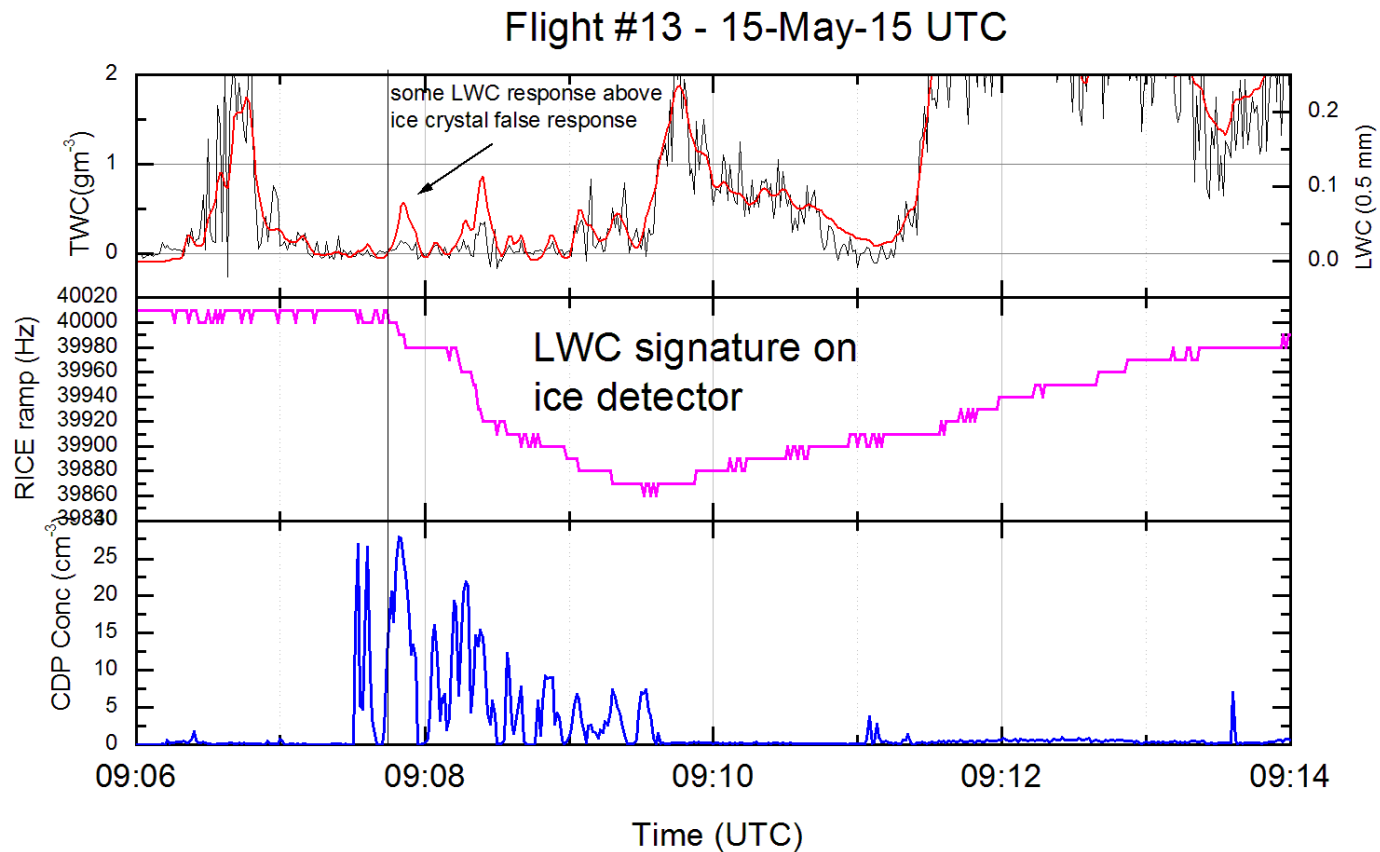


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# Data Processing Status:

## ICD, Robust, 0.5 mm LWC

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- Not very far advanced: only rough calculations available (not intending to distribute rough version)
- Lilie and Strapp to provide Robust  $\text{gm}^{-3}$  and ICD TWC  $\text{gm}^{-3}$  in approximately January 2016.
- 0.5 mm LWC, TBD – not sure if it is worthwhile to provide this data set, given potential for misinterpretation (given the large false response)
  - Data are more useful to establish the lack of a significant LWC rather than an absolute estimate of IWC.
  - Cannot detect trace amounts of LWC in HIWC conditions
  - Goodrich Ice Detector may be more useful
  - May decide to provide data without false response removal with explanation in data file that any LWC estimates are contaminated by ice crystal response, especially in HIWC conditions

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End of Presentation

Merci, Thank You

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