National Aeronautics and Space Administration

Proposal for TA Bias Correction Using Deflection Ratios

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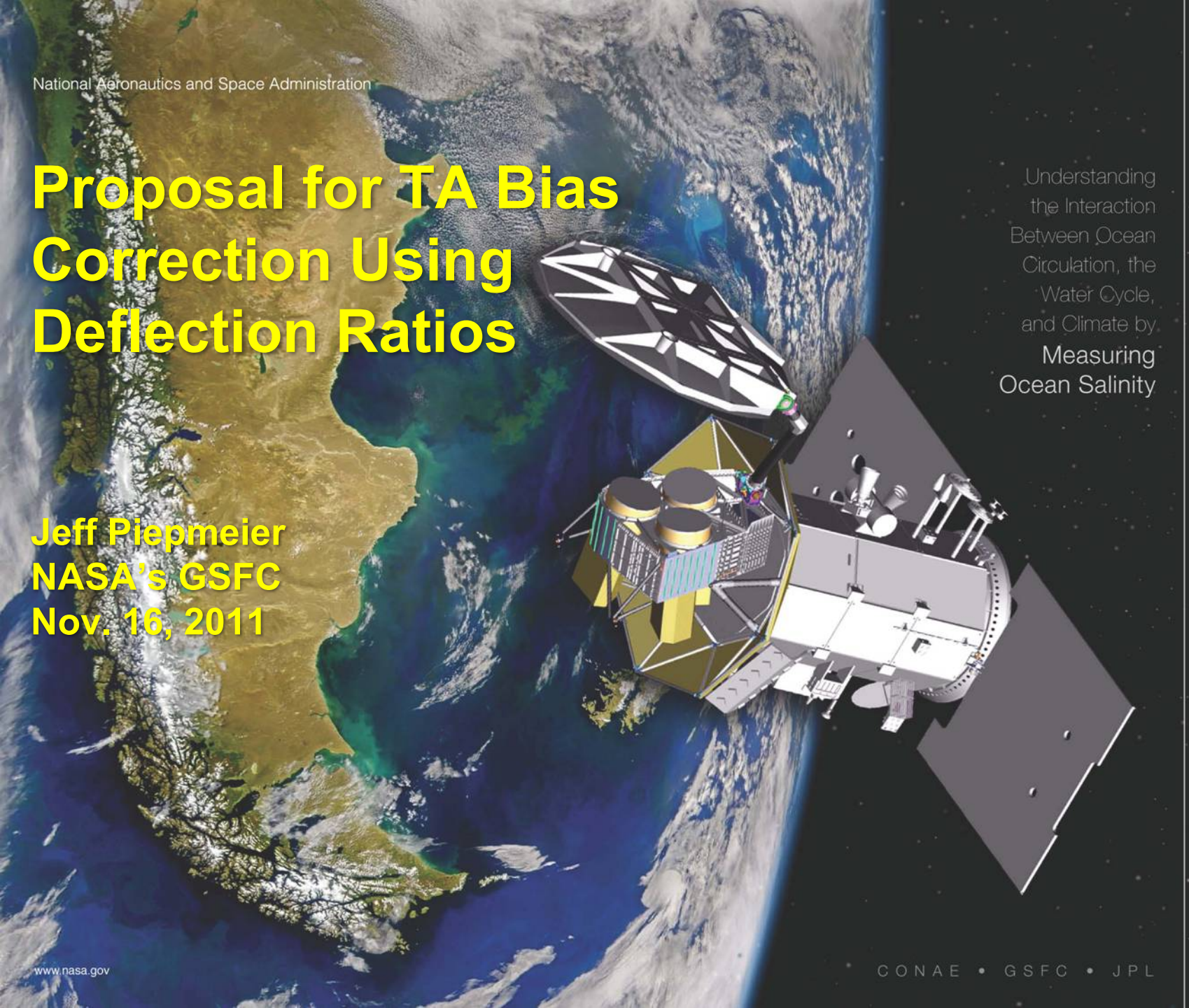

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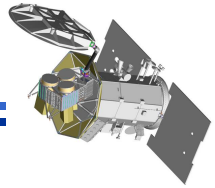
Outline

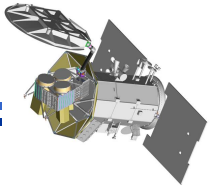


- Problem: freely forcing radiometer calibration bias to <dTA>=0 could mask geophysical modeling errors

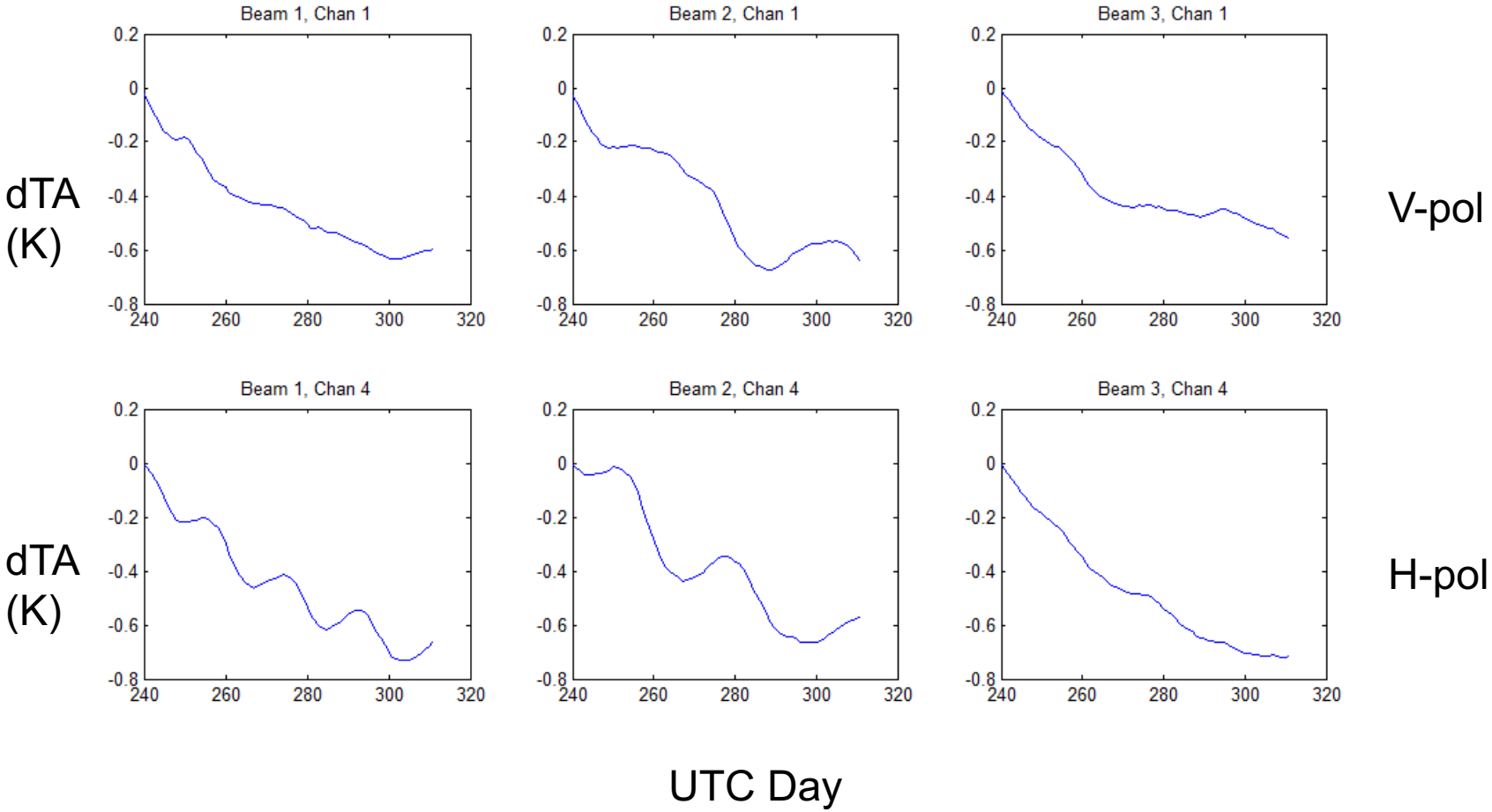
- Objective: constrain bias correction to instrument behavior

- Approach and algorithm
- Extrapolation in time and ops concept
- Comparison to V1.2
- Convergence of model parameters

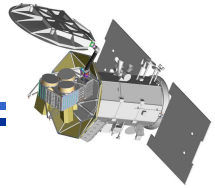
75 Days of TA Bias Drift



Blue = dTA(V1.1) 7-day smoothed



Approach

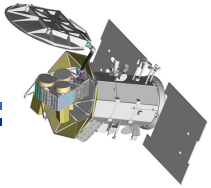


- Near term: Use deflection ratios (DR's) of
  - Internal noise diode (ND) counts
  - External correlated noise diode (CND) counts
- Fit linear combination of deflection ratios to <dTA> (L2V1.1)
- Extrapolate fit in time until <dTA'> (L2V1.3) exceeds threshold
- Refit data and continue with previous step

- Caveats:
  - Indirect handling of instrument physics
  - Offset bias correction only

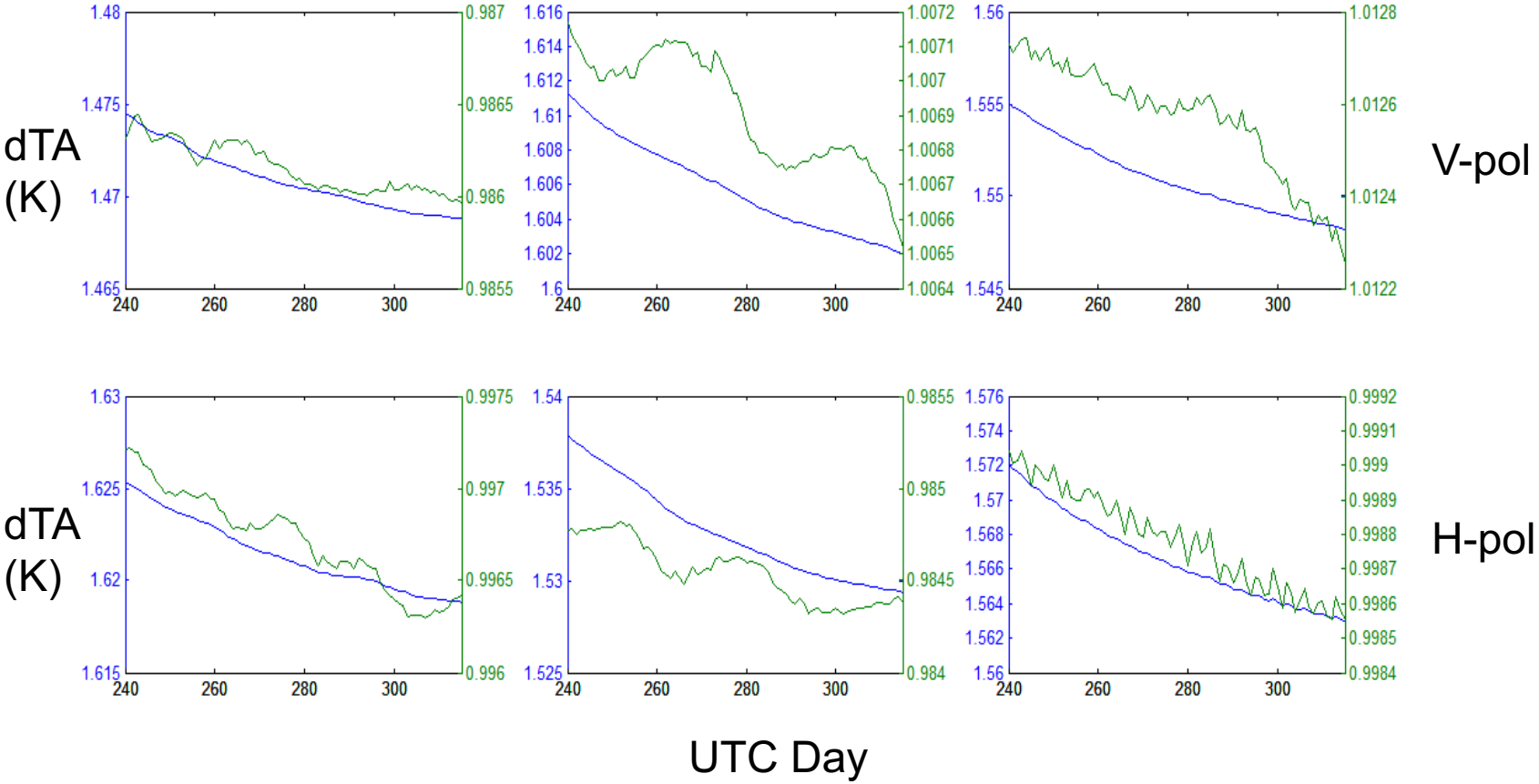
- Long term plan:
  - Separate <dTA> into gain and offset bias terms
  - Parameterize RF model coefficents instead of fitting DR's
  - Utilize same extrapolation/threshold/refit algorithm

75 Days of Deflection Ratios

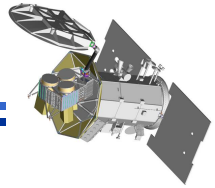


Blue = ND(DL)/CND

Green = ND(ANT)/ND(DL)



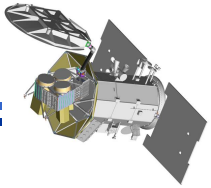
Current Fitting Algorithm



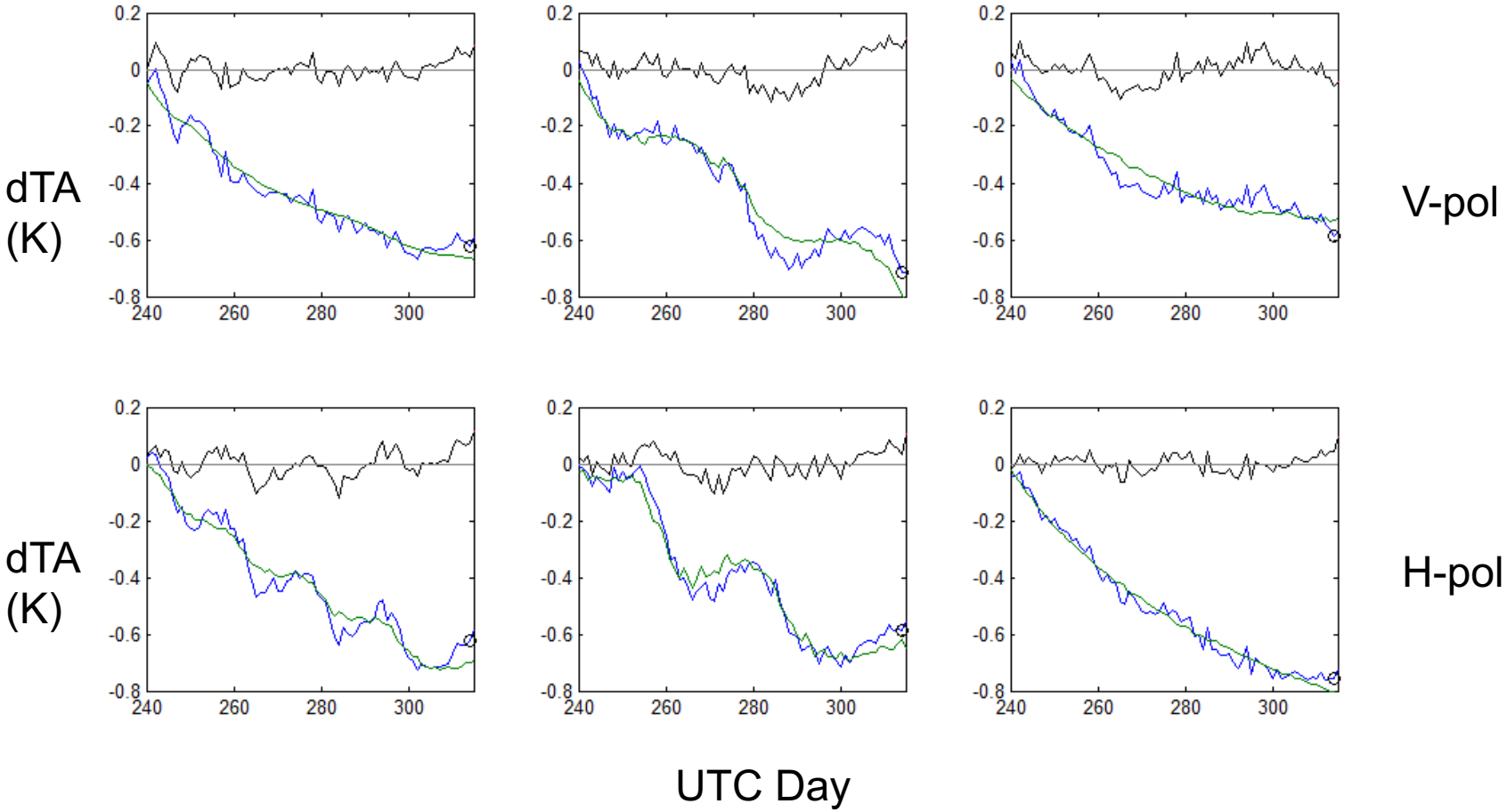
- Compute daily means of orbital medians
  - ND(ANT)/ND(DL)
  - CND/ND(DL)
- Compute daily mean of dTA = (TA-TAexp) for 99.9% ocean
- LMMSE fit to dTA (using pseudoinverse)
  - c0 – offset term
  - c1 – weighting of ND(DL)/CND
  - c2 – weighting of 10 x [ND(DL)/ND(ANT) – 1]

- Notes
  - Orbital medians used to filter RFI
  - ND(DL)/CND and ND(DL)/ND(ANT) have positive correlation to dTA
  - Offset in ND(DL)/CND causes c0 and c1 to be anticorrelated
  - Offset and scaling ND(DL)/ND(ANT) to make c2 similar range to c0, c1

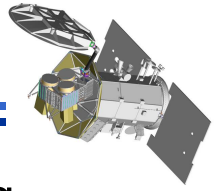
75 Days of LMMSE Fitting



Blue = dTA
Green = dTA estimated by projection of DR signatures onto dTA
Black = residual difference



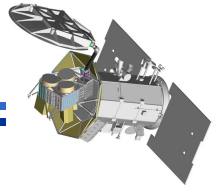
Ability to Extrapolate



- If dTA caused by hardware problem (and can be modeled using DR's), then should be able to extrapolate dTA correction in time

- Implementation concept for V1.3
  - Initialize [c0,c1,c2] with all available data at beginning of V1.3
  - Monitor dTA(V1.3) and wait until exceeds threshold
  - When exceeds, recompute [c0,c1,c2] with all available data
- Questions
  - What is threshold?
  - Compute and compare 7-day dTA?

20 Days of LMMSE Fitting



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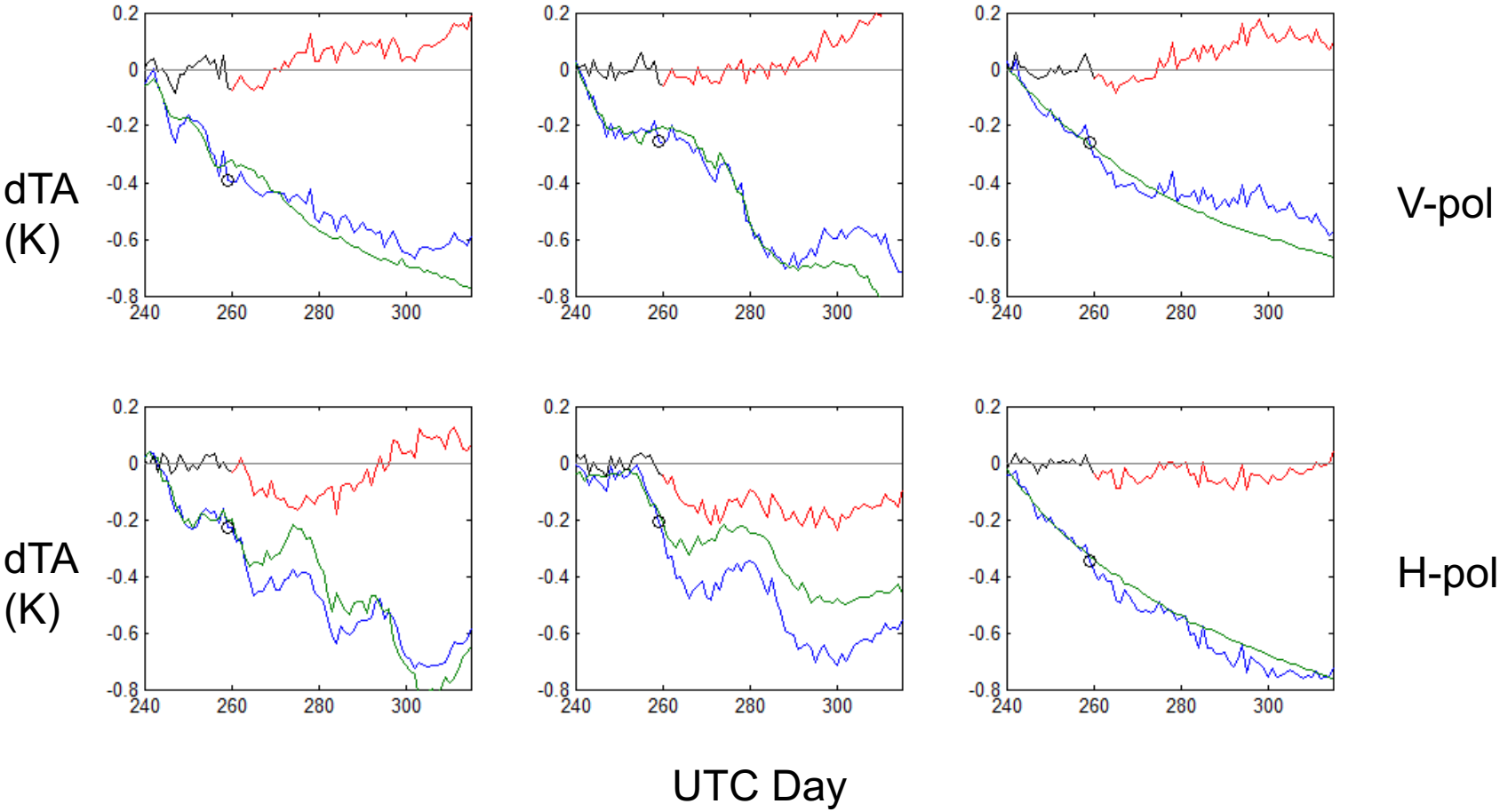
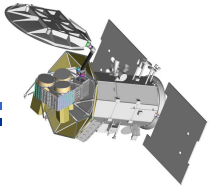
Black = error in fitted dTA
Red = error in predicted dTA



40 Days of LMMSE Fitting



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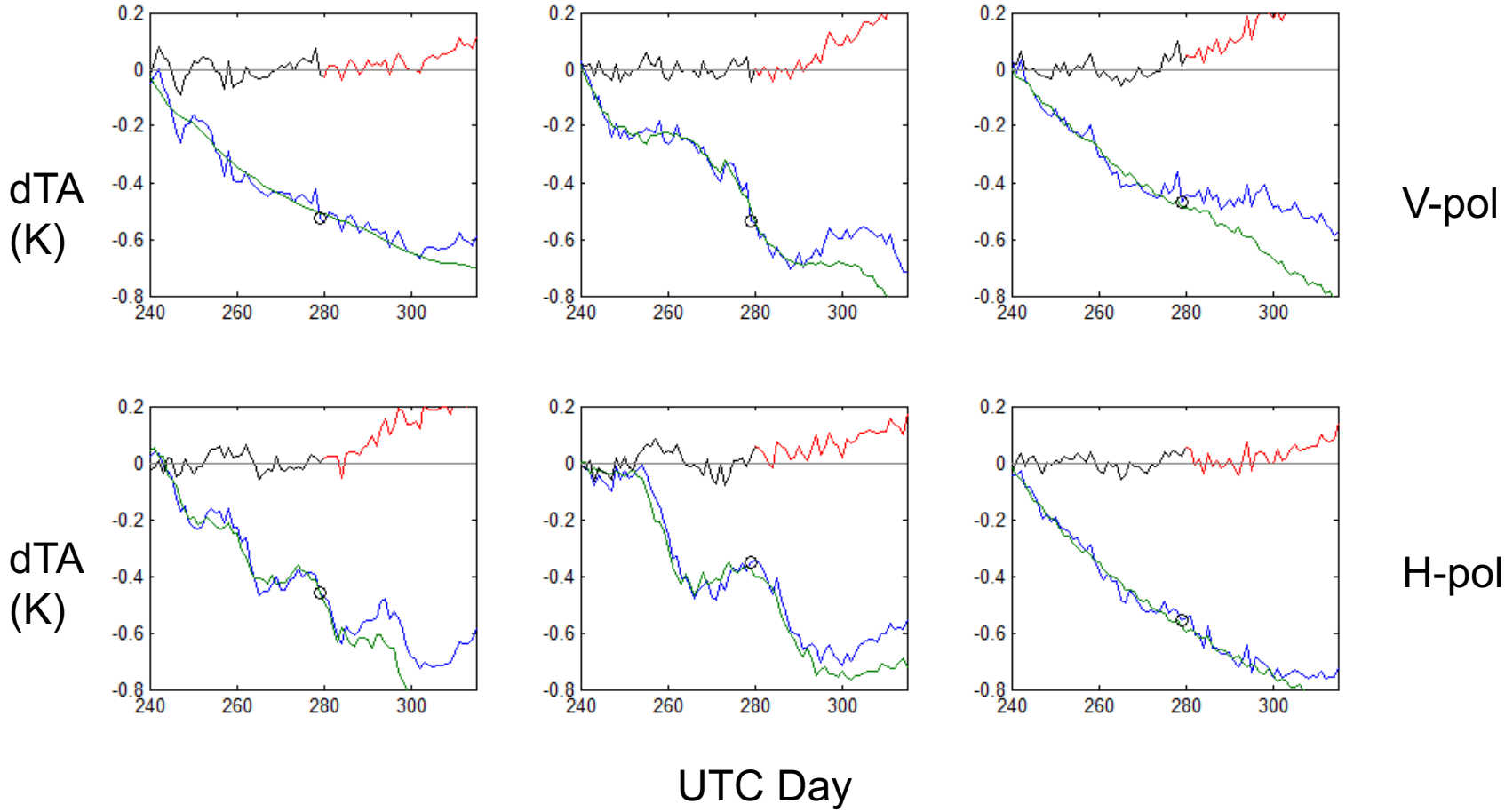
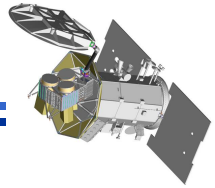


60 Days of LMMSE Fitting



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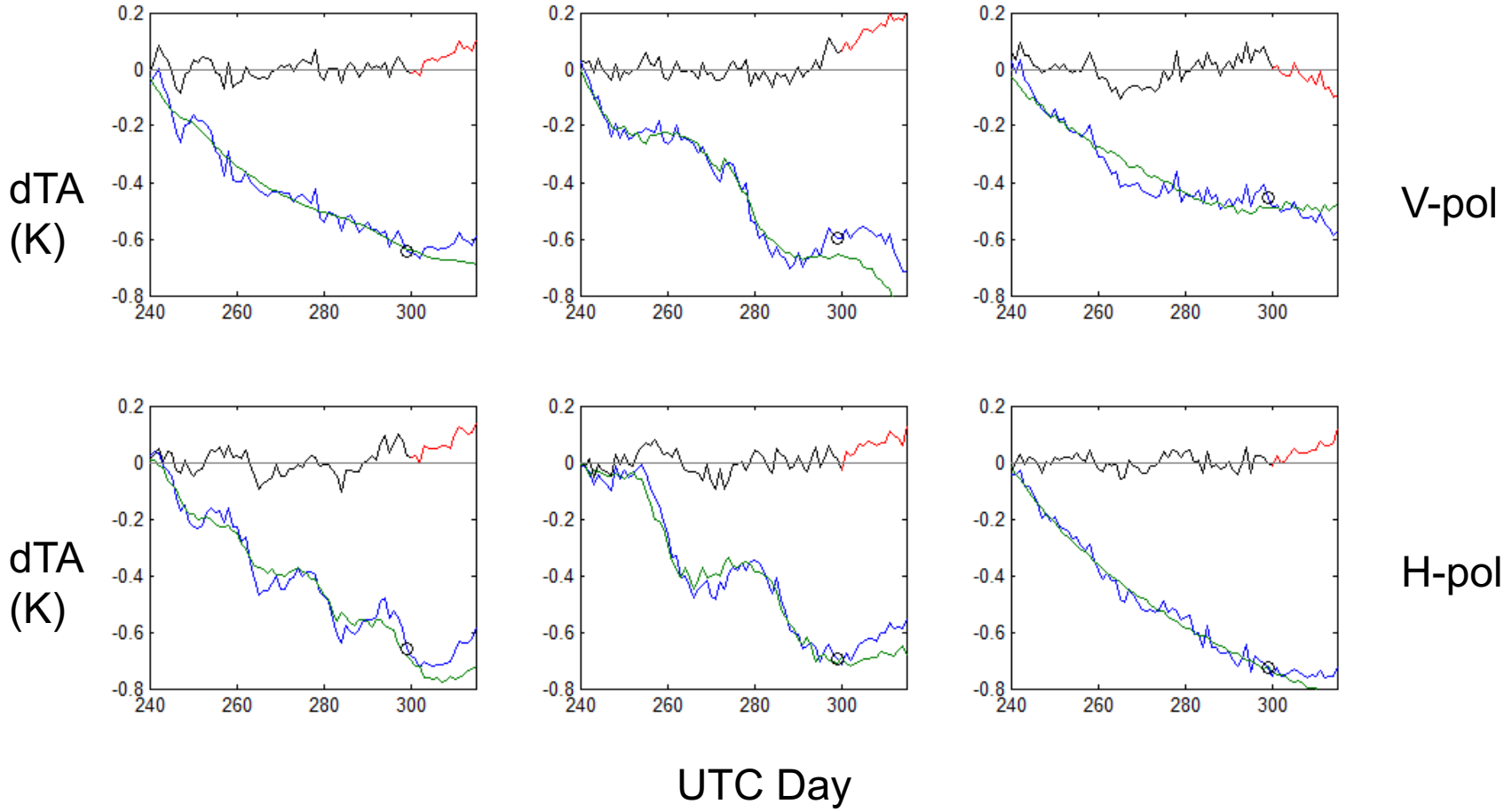
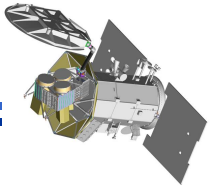


75 Days of LMMSE Fitting



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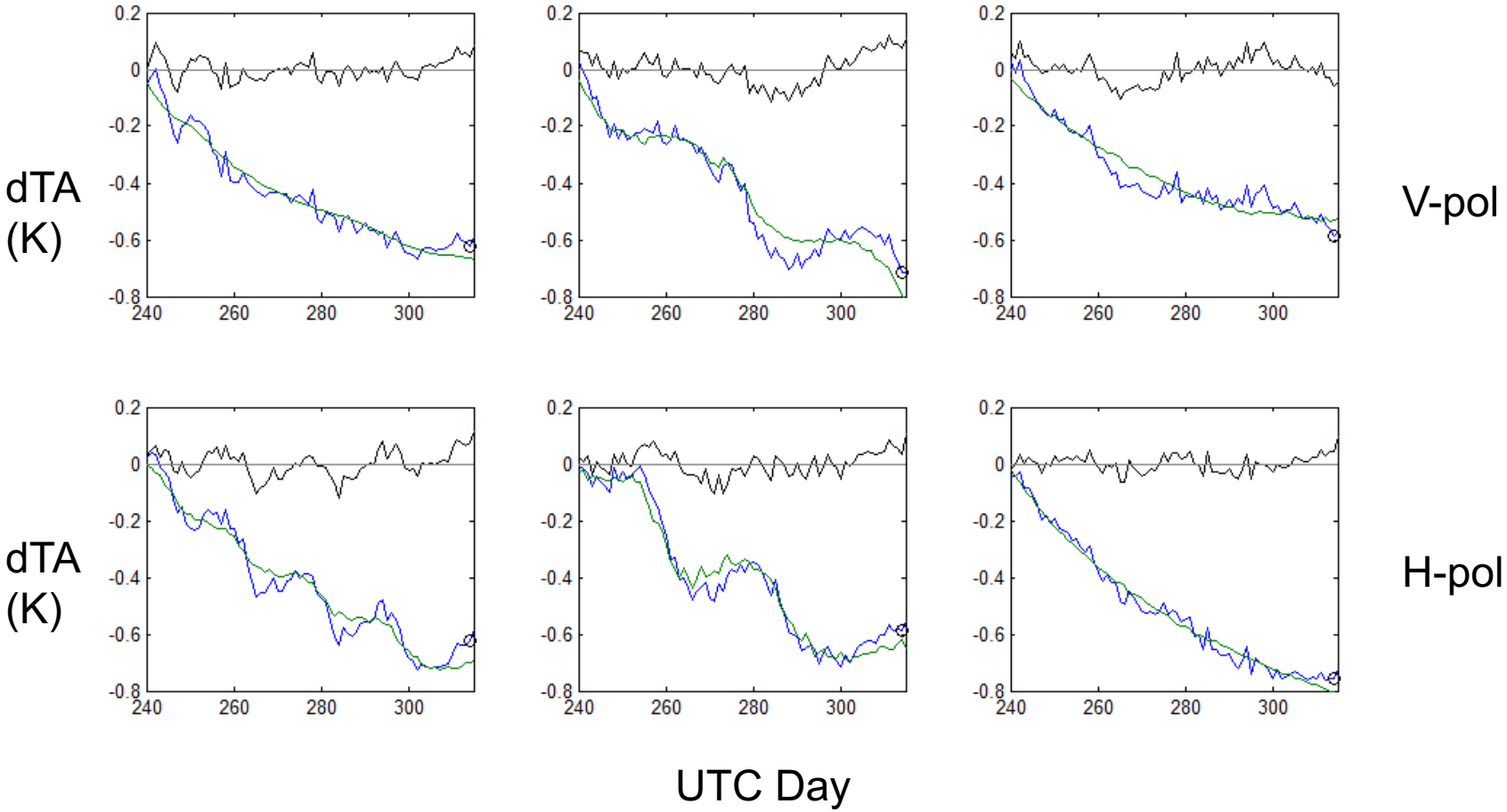
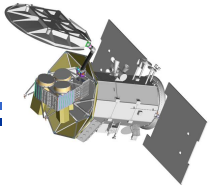
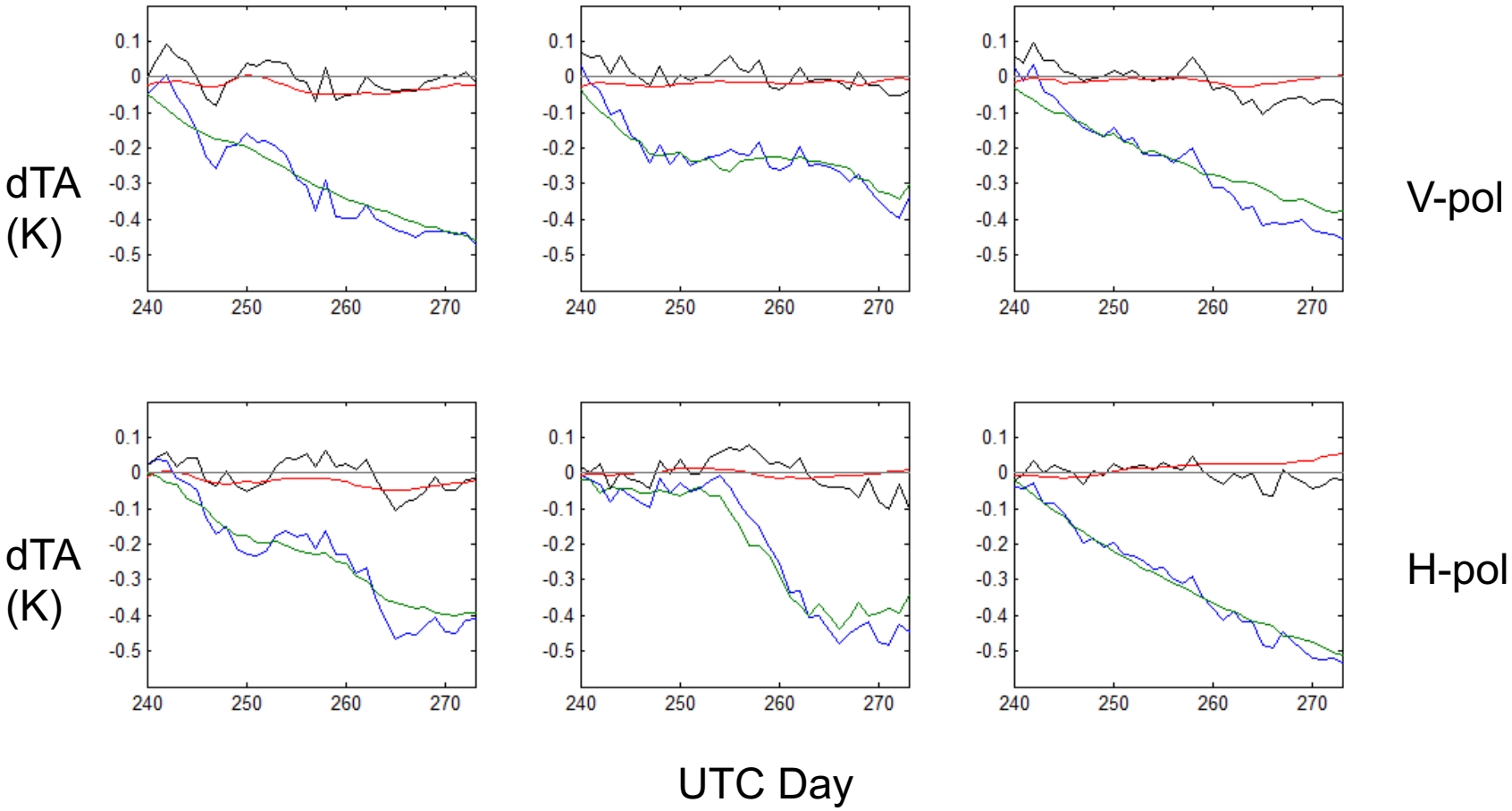


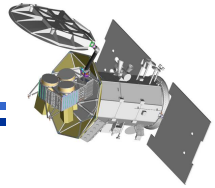
Comparison to V1.2



Blue = dTA V1.1
Green = dTA estimated by projection of DR signatures onto dTA V1.1
Black = error in fitted dTA V1.1 using all data
Red = dTA V1.2 (7-day smoothed)

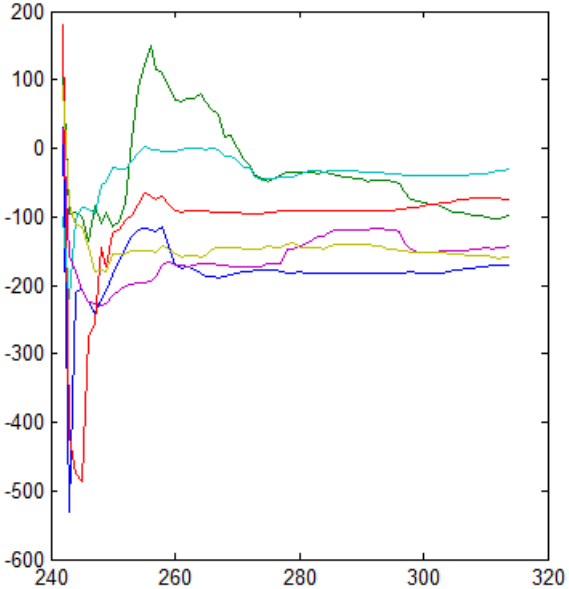


Convergence – 1

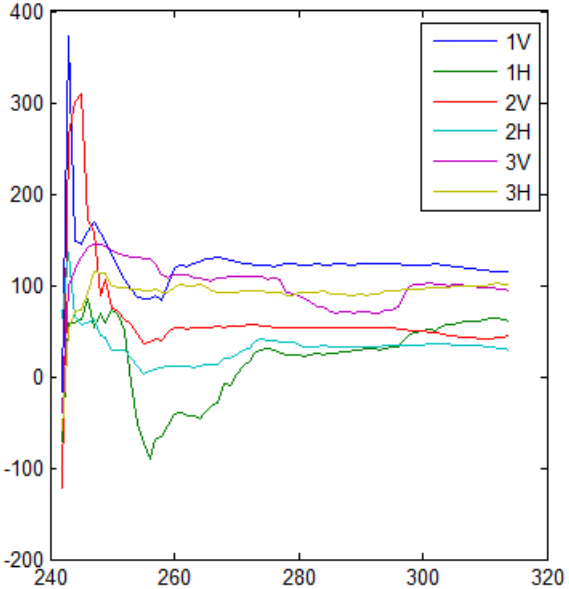


- Model coefficients converged within ~ 40 days
- (Rad 3V is exception with c2 flipping signs)
- Offset (c0) and CND/ND (c1) are anticorrelated

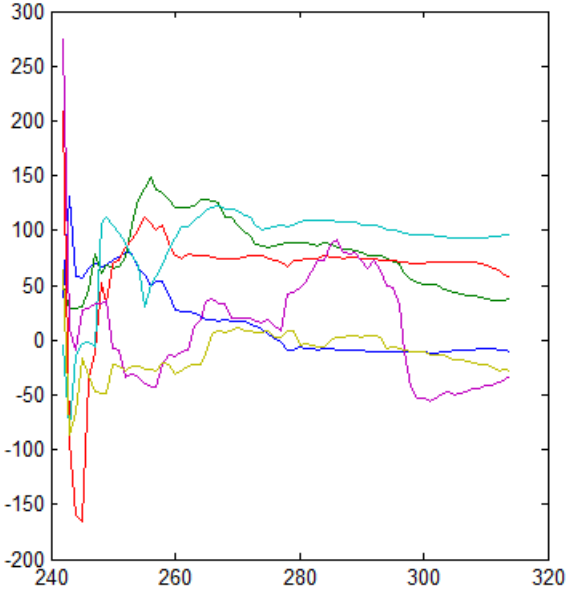
c0



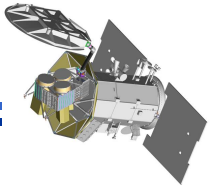
c1



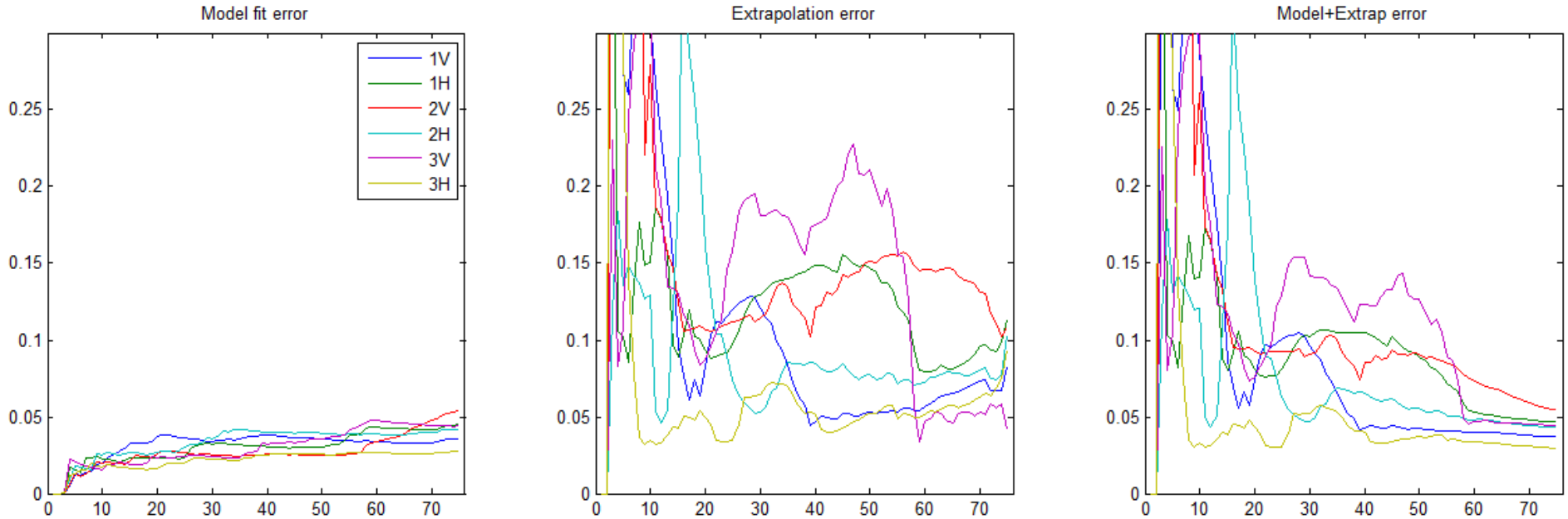
c2



Convergence – 2



- Model fit RMSE slowly increasing with time
- Extrapolation RMSE < 0.15 K for >20 days of fitted data
- (Rad 3V is exception with c2 flipping signs)



Days of fitted data

Convergence – 3