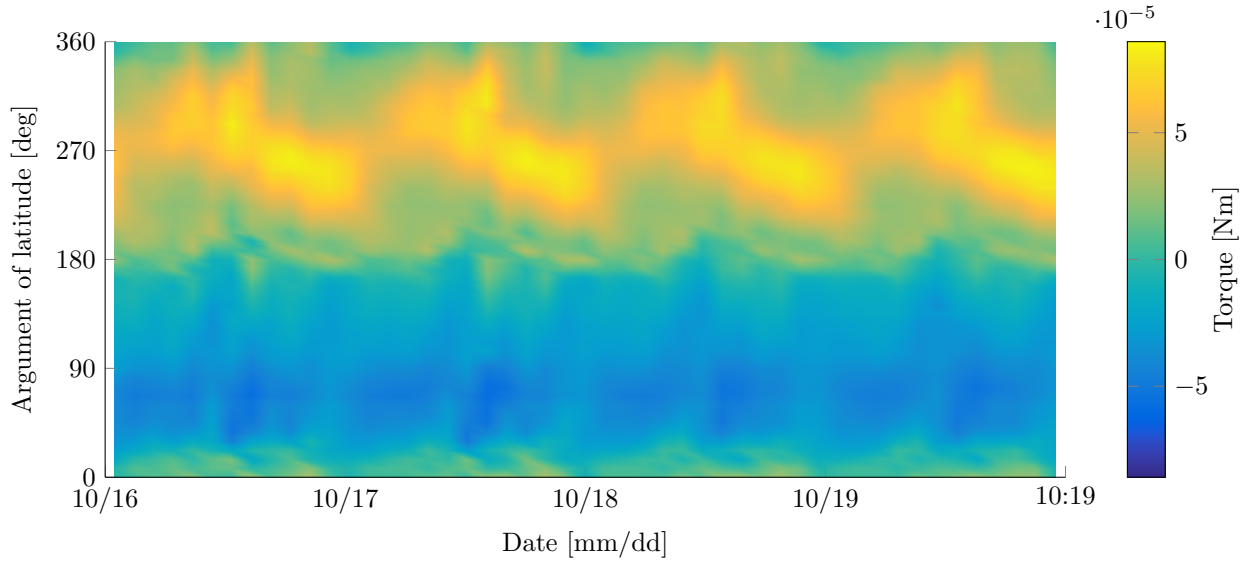
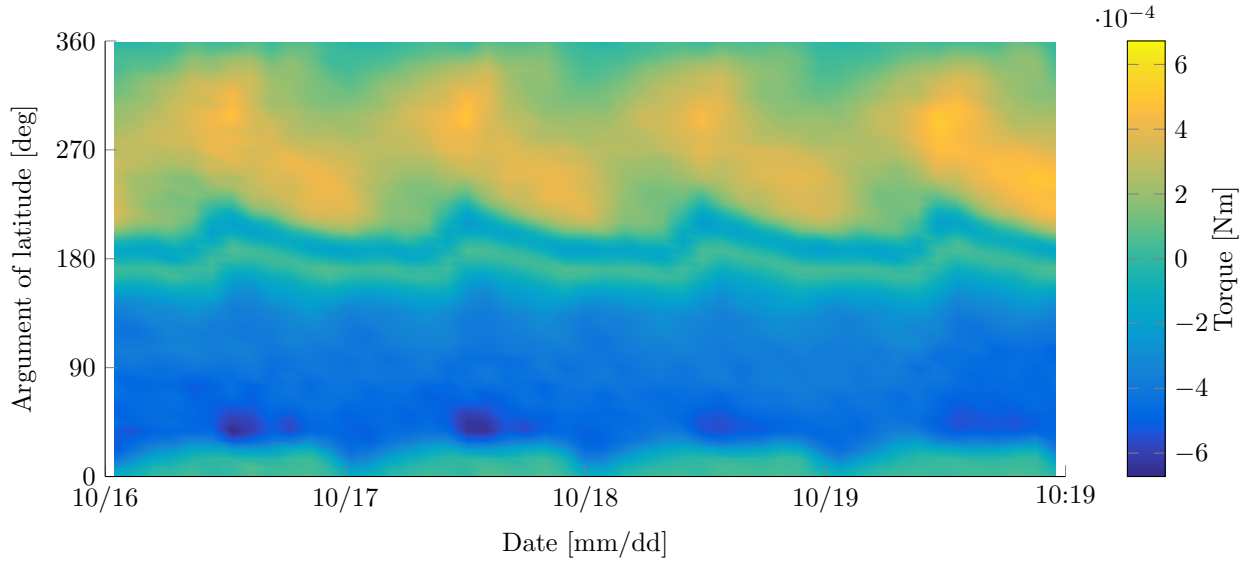
# Time series versus argument of latitude

**GOCE Aerodynamic Torque Modeling**

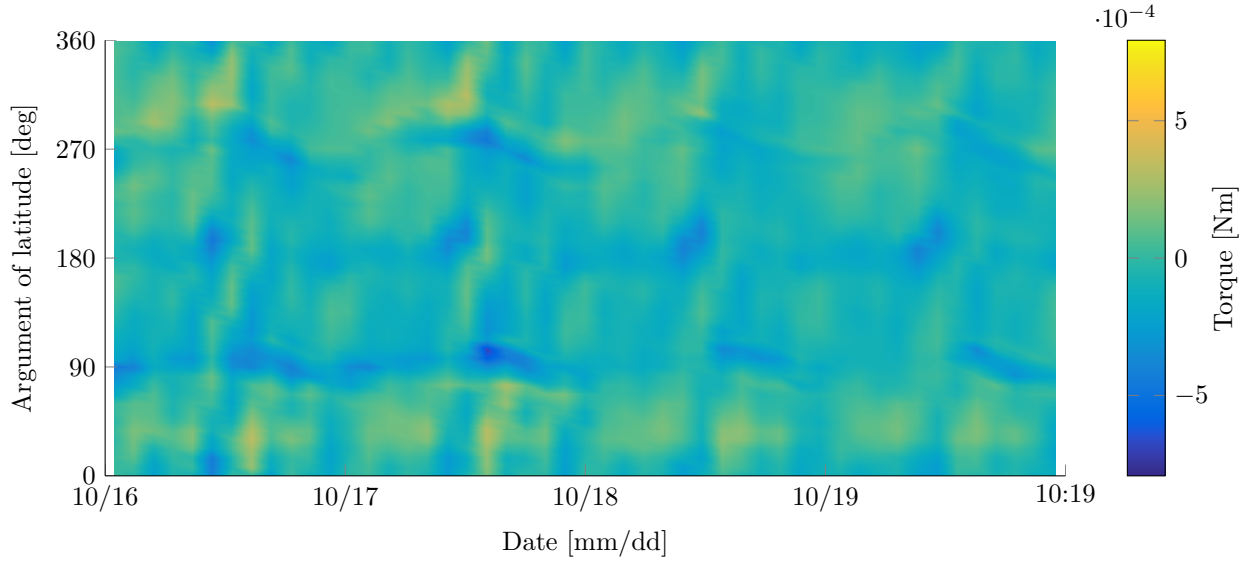
T. Visser, E.N. Doornbos, C.C. de Visser, P.N.A.M. Visser
*Faculty of Aerospace Engineering, Delft University of Technology, Delft, The Netherlands*
B. Fritsche
*Hyperschall Technologie Göttingen GmbH, Katlenburg-Lindau, Germany*




(a) $\bar{\boldsymbol{T}}$roll

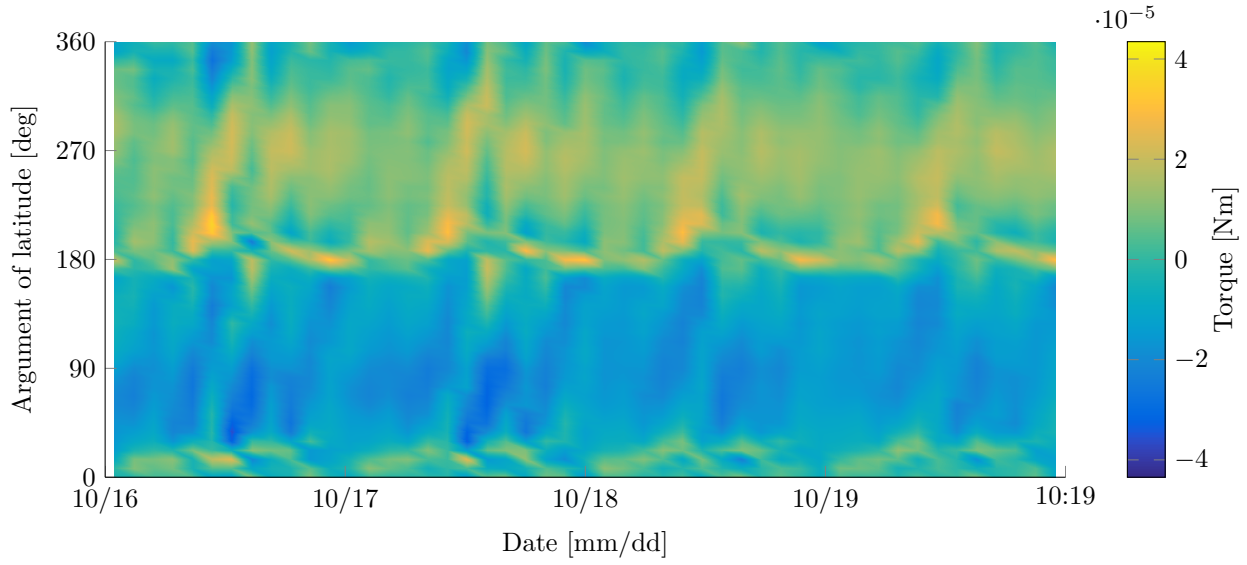



(b) $\bar{\boldsymbol{T}}$pitch

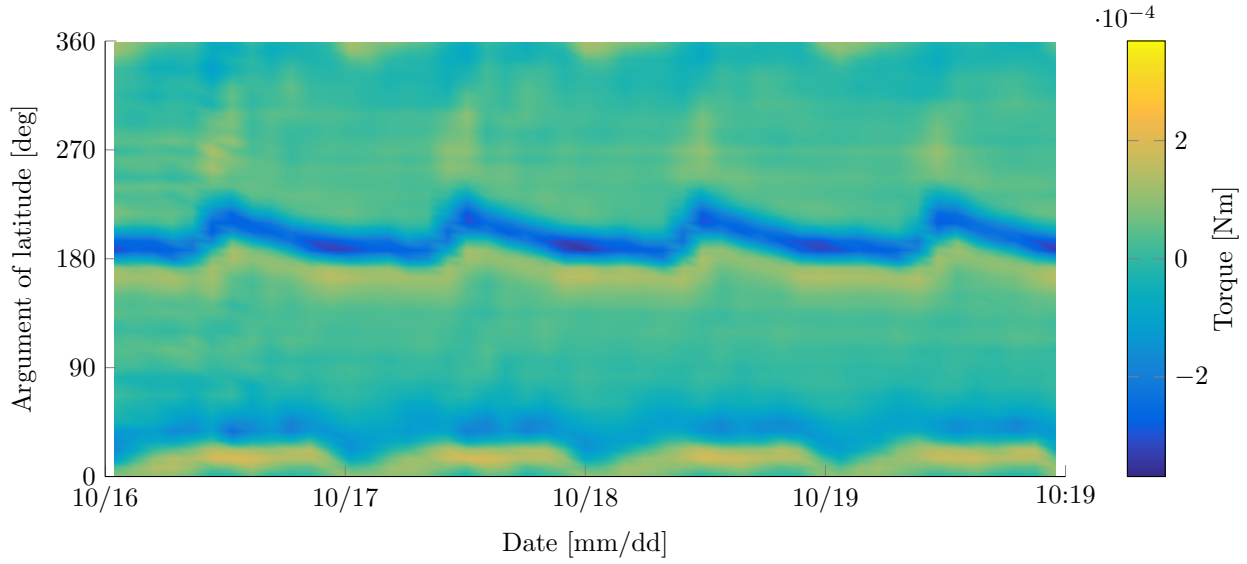



(c) $\bar{\boldsymbol{T}}$yaw

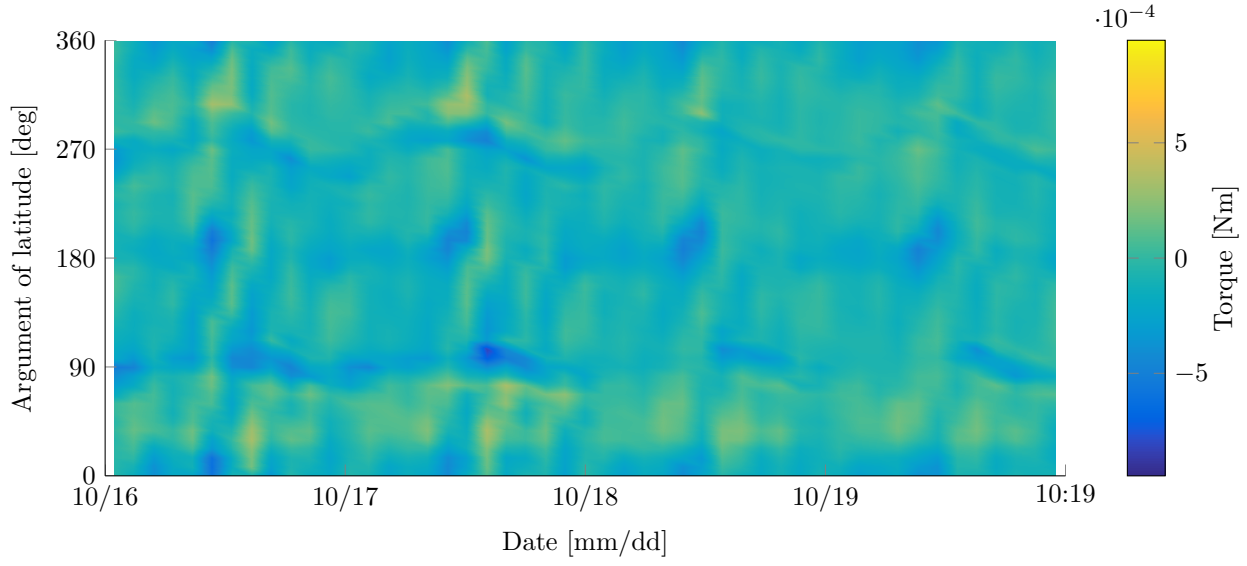
Figure 1: Total modeled torque $\bar{\boldsymbol{T}}$ as a function of time and argument of latitude in 2013.




(a) $\boldsymbol{T}$roll

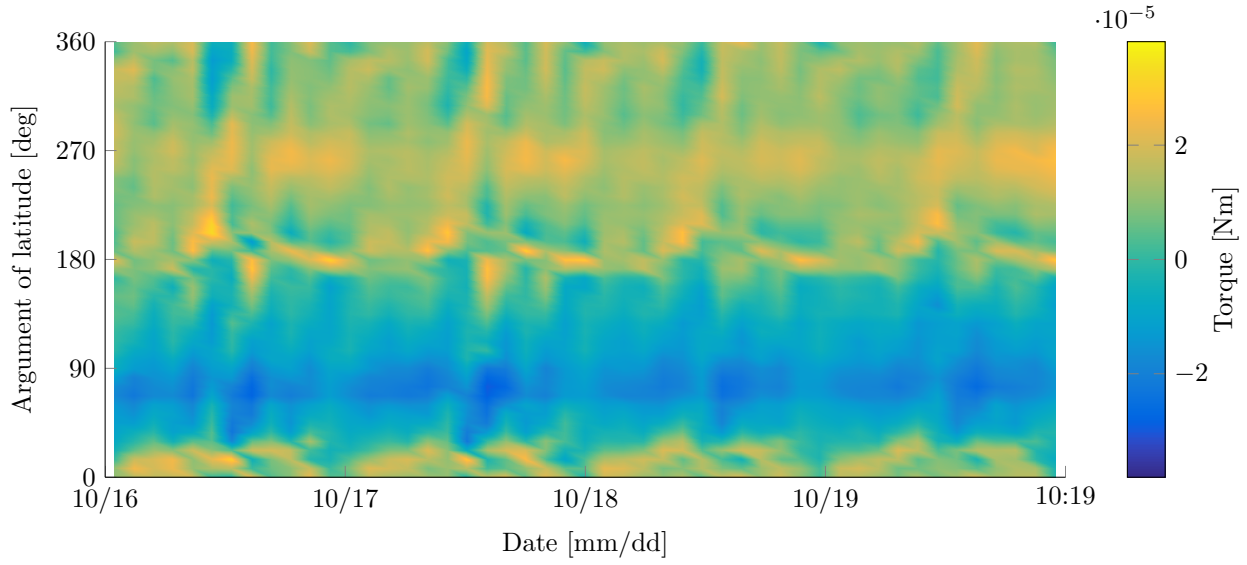



(b) $\boldsymbol{T}$pitch

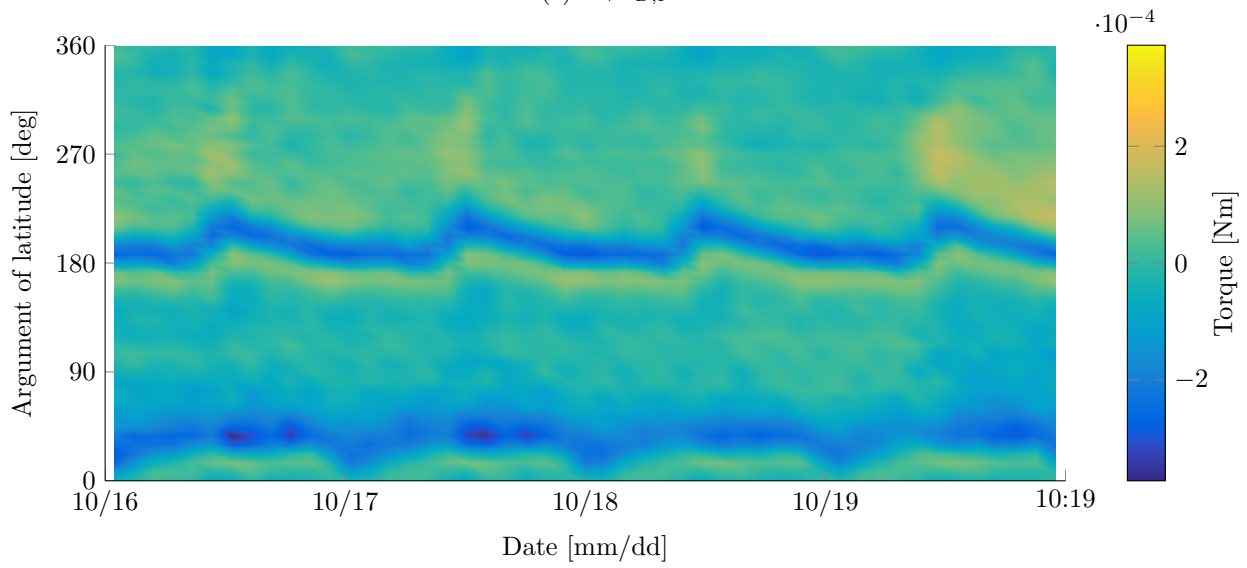



(c) $\boldsymbol{T}$yaw

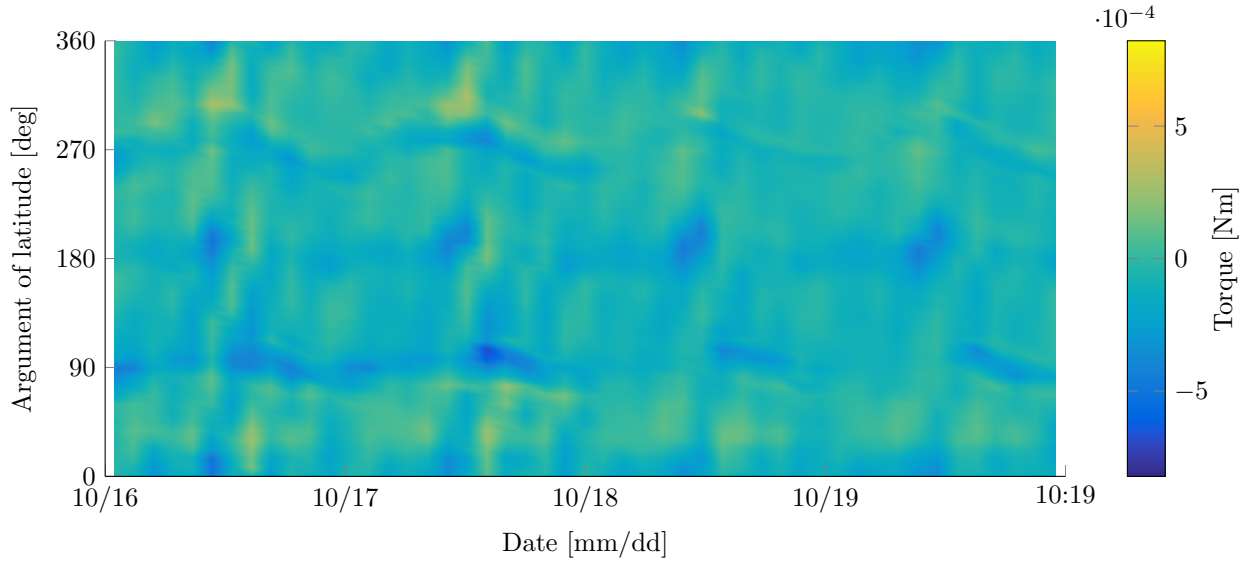
Figure 2: Measured torque $\boldsymbol{T}$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}+\hat{\boldsymbol{T}}_{D,P}$roll

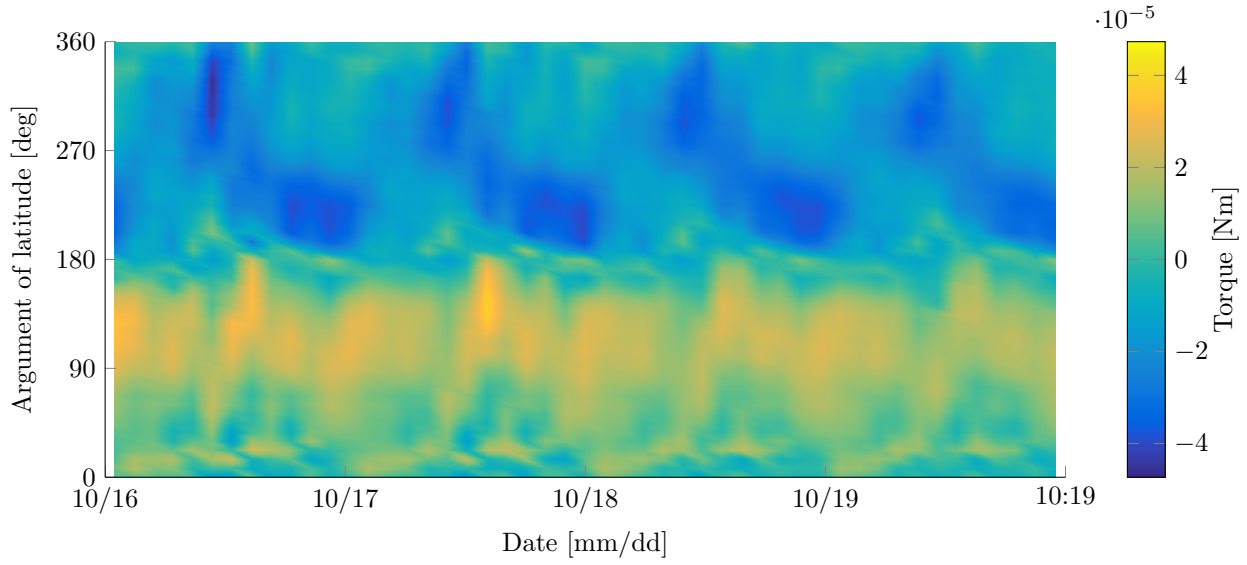



(b) $\bar{\boldsymbol{T}}+\hat{\boldsymbol{T}}_{D,P}$pitch

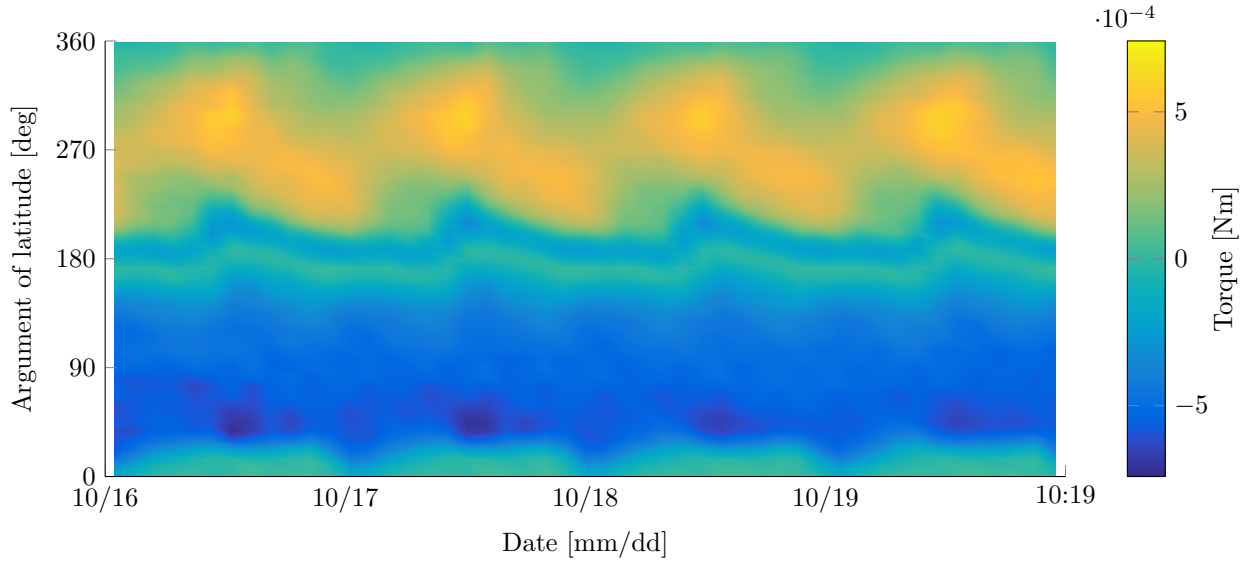



(c) $\bar{\boldsymbol{T}}+\hat{\boldsymbol{T}}_{D,P}$yaw

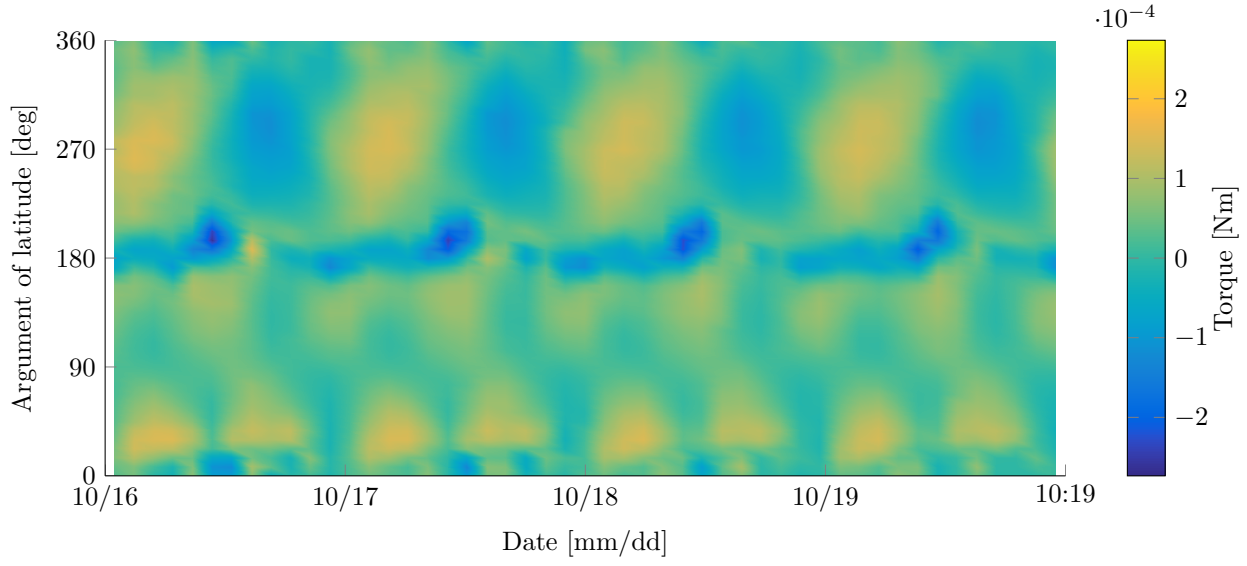
Figure 3: Total modeled torque $\bar{\boldsymbol{T}}$, and fitted payload dipole torque $\hat{\boldsymbol{T}}_{D,P}$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_C$roll

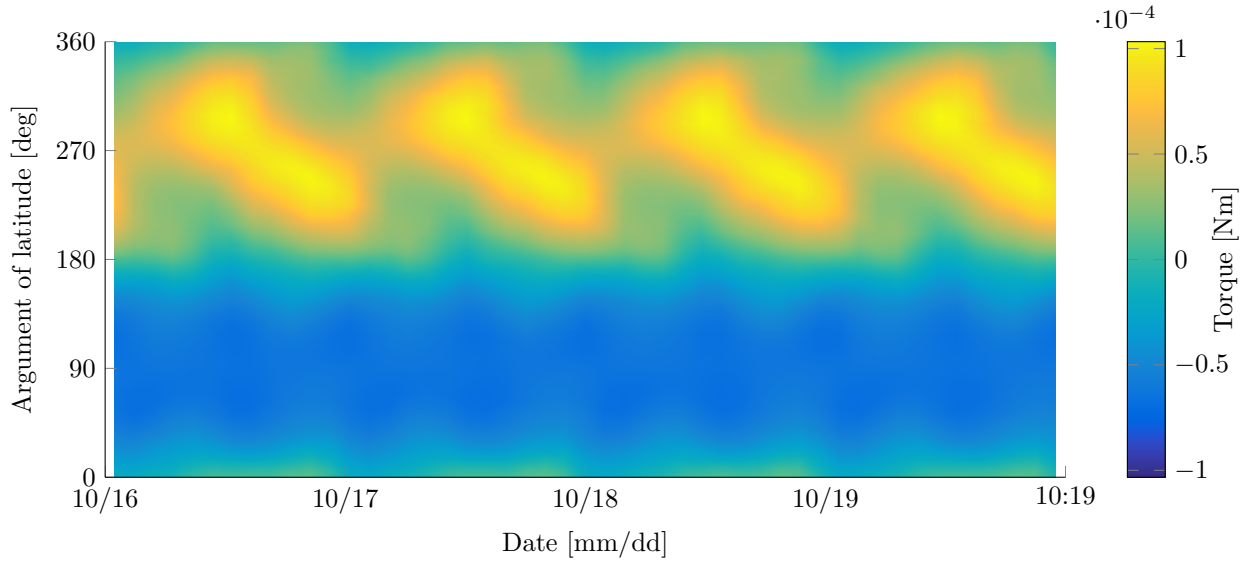



(b) $\bar{\boldsymbol{T}}_C$pitch

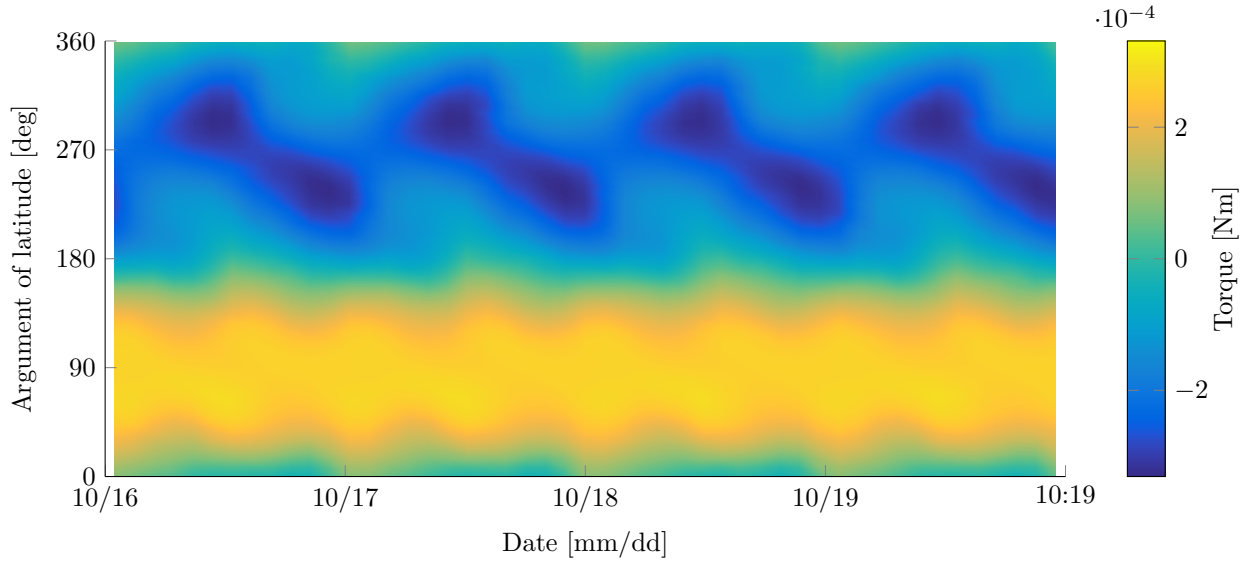



(c) $\bar{\boldsymbol{T}}_C$yaw

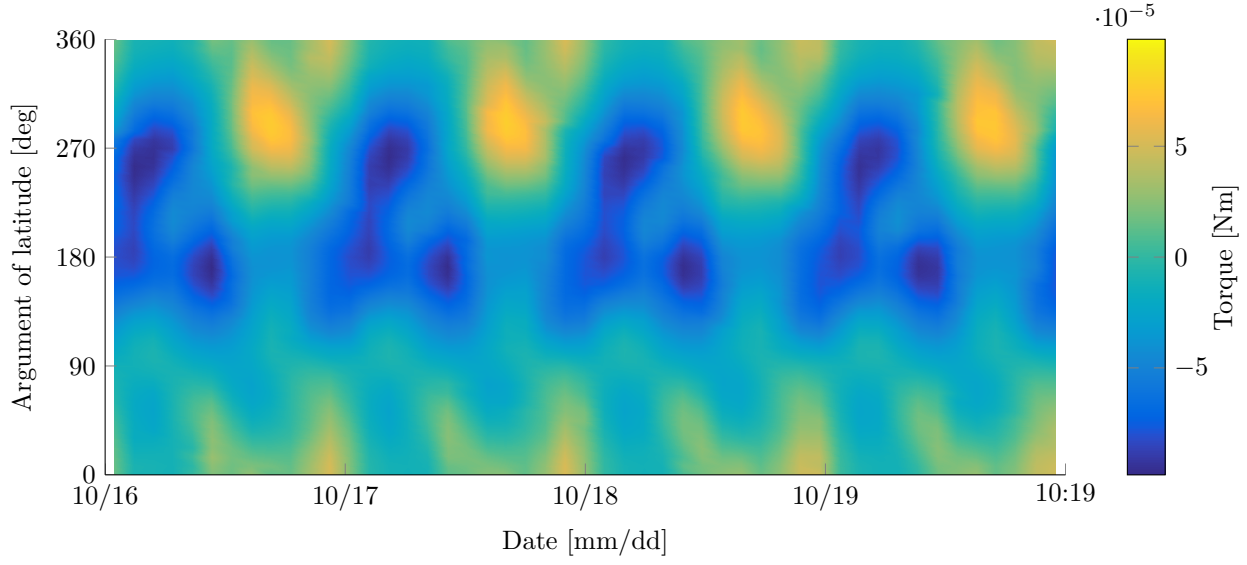
Figure 4: Magentic control torque $\bar{\boldsymbol{T}}_C$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_{D,B}$roll

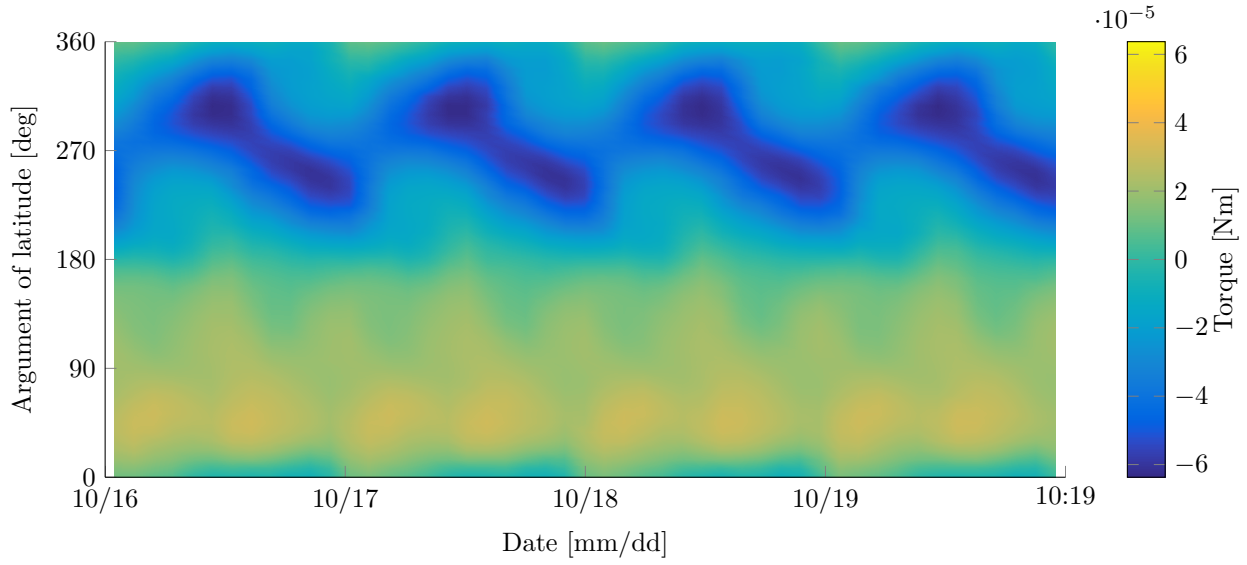



(b) $\bar{\boldsymbol{T}}_{D,B}$pitch

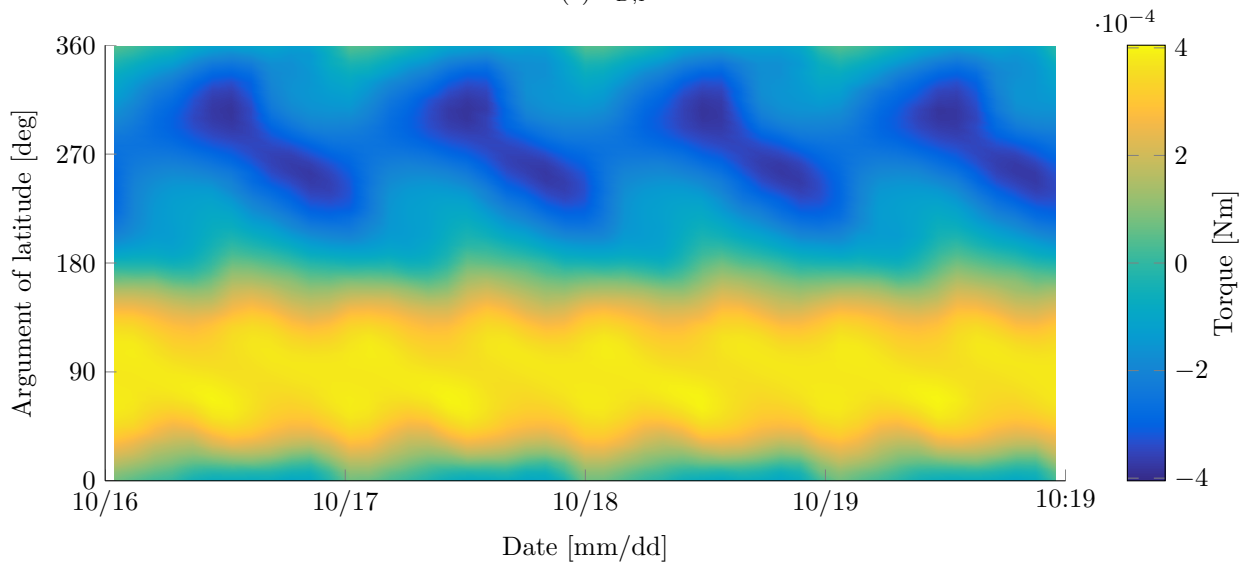



(c) $\bar{\boldsymbol{T}}_{D,B}$yaw

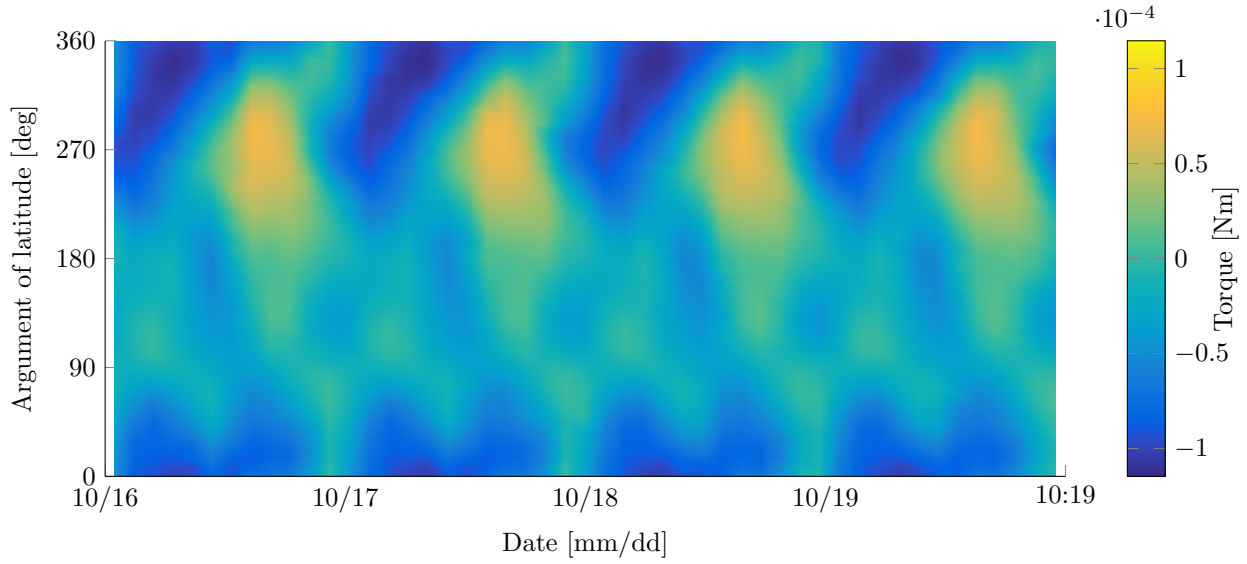
Figure 5: Residual bus dipole torque $\bar{\boldsymbol{T}}_{D,B}$ as a function of time and argument of latitude in 2013.




(a) $\hat{\boldsymbol{T}}_{D,P}$roll

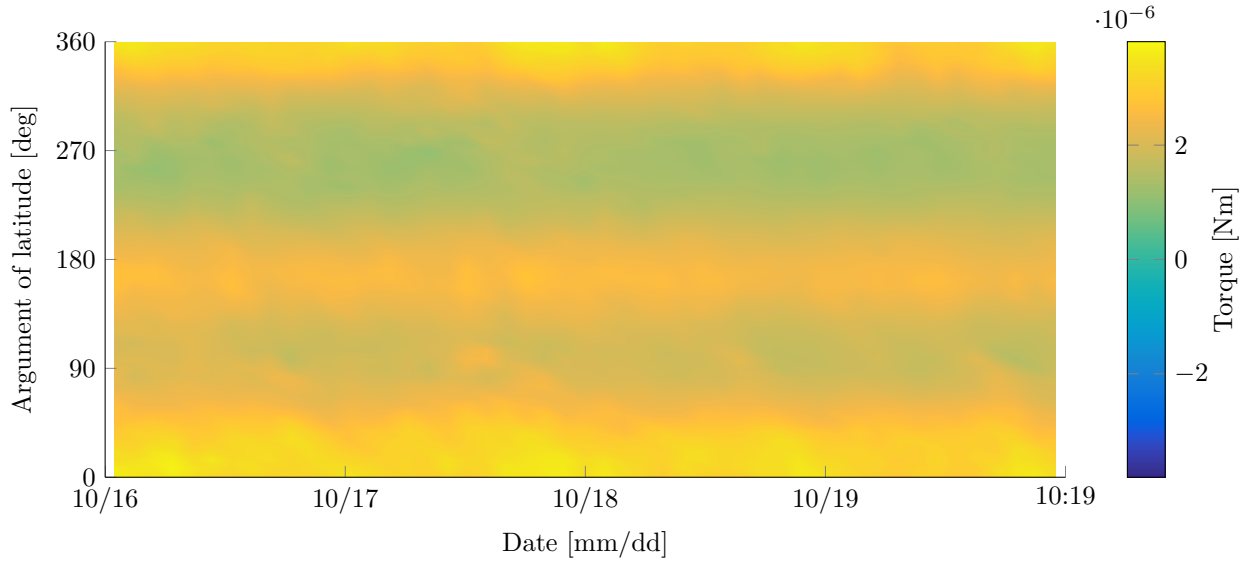



(b) $\hat{\boldsymbol{T}}_{D,P}$pitch

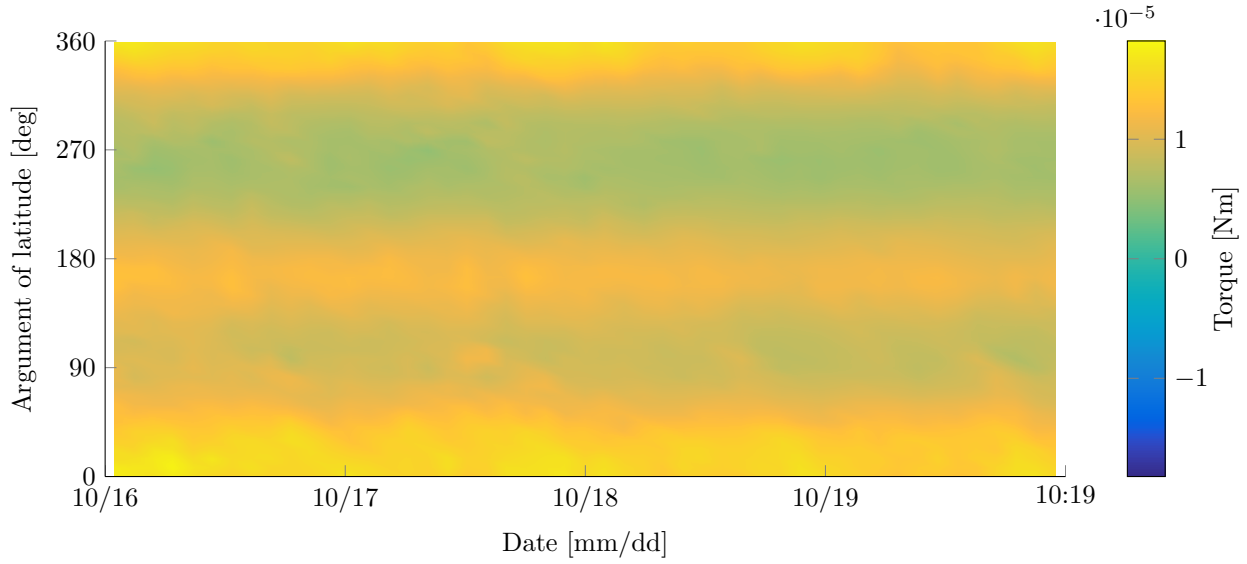



(c) $\hat{\boldsymbol{T}}_{D,P}$yaw

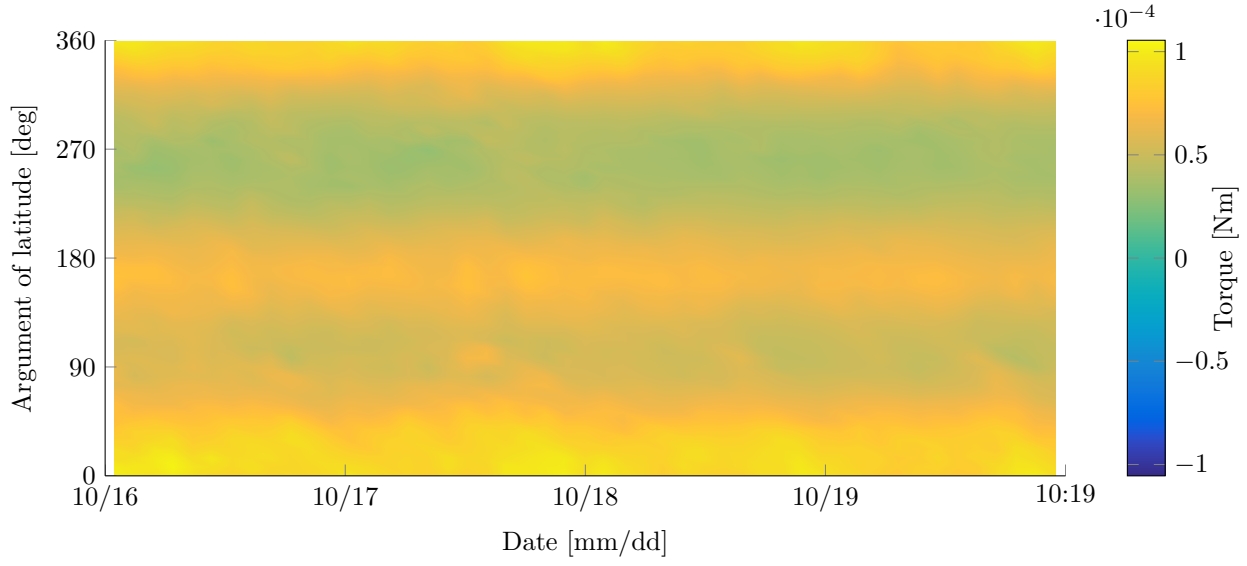
Figure 6: Fitted payload dipole torque $\hat{\boldsymbol{T}}_{D,P}$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_T$roll

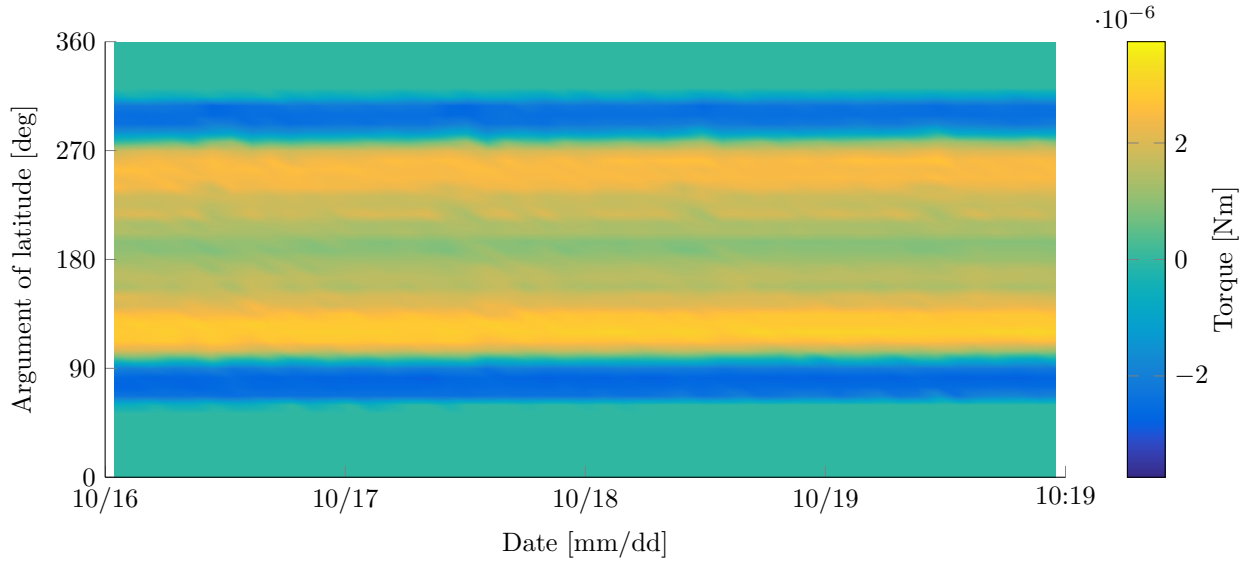



(b) $\bar{\boldsymbol{T}}_T$pitch

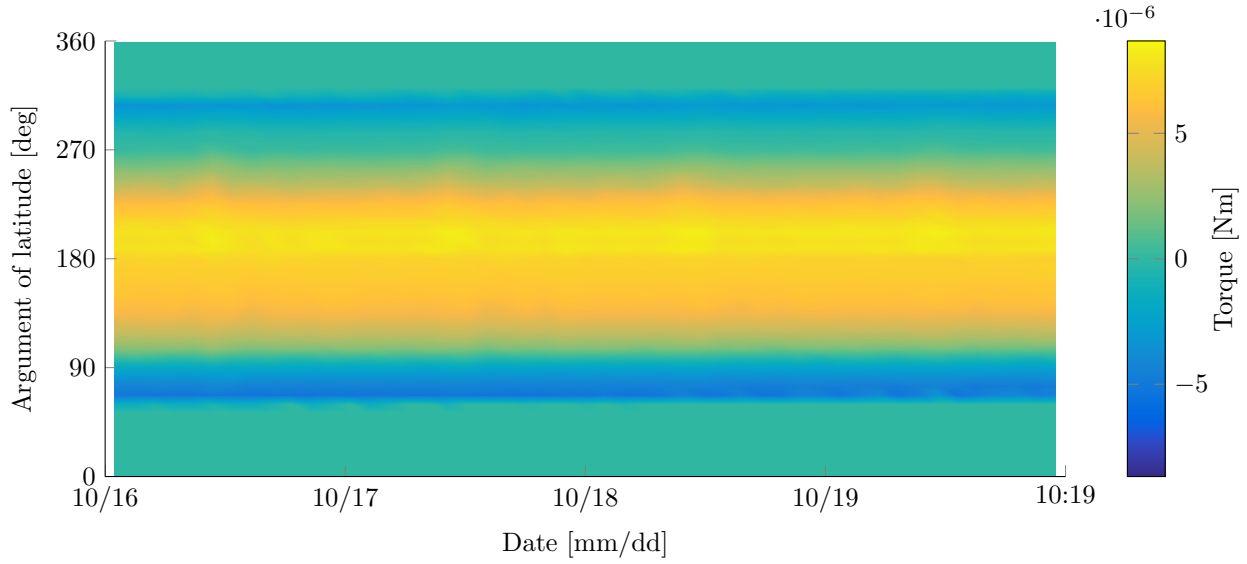



(c) $\bar{\boldsymbol{T}}_T$yaw

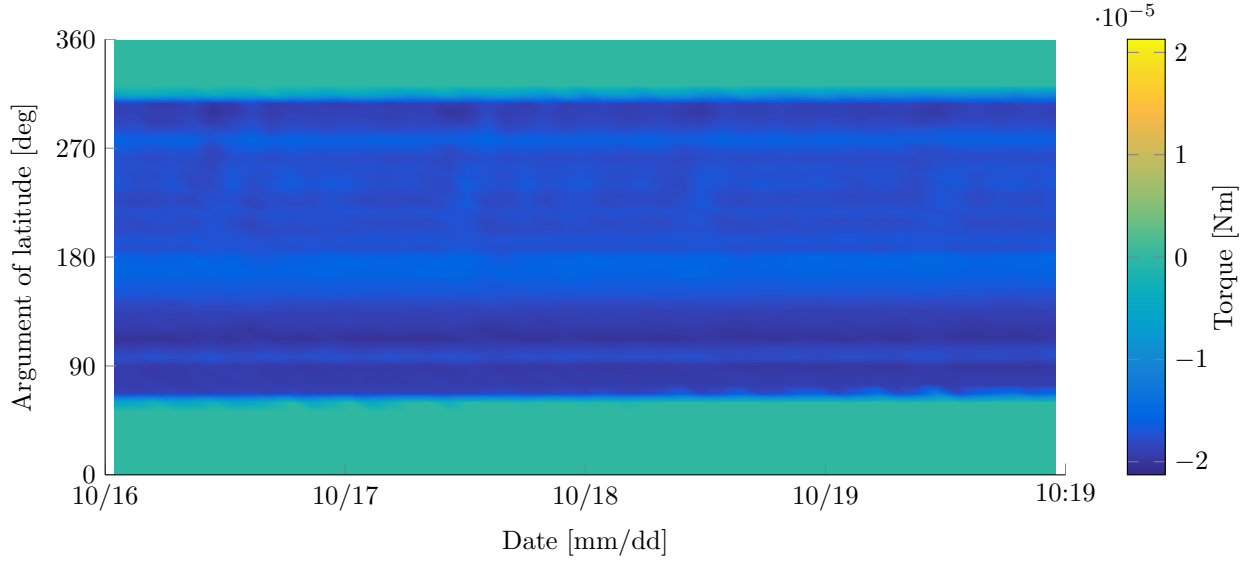
Figure 7: Thruster misalignment torque $\bar{\boldsymbol{T}}_T$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_S$roll

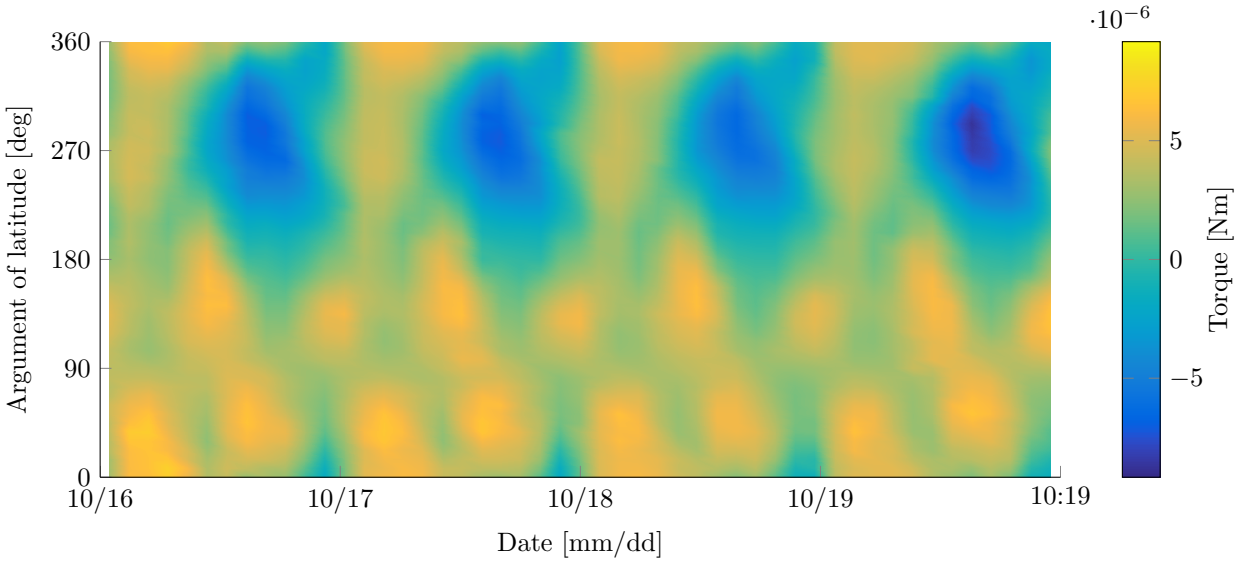



(b) $\bar{\boldsymbol{T}}_S$pitch

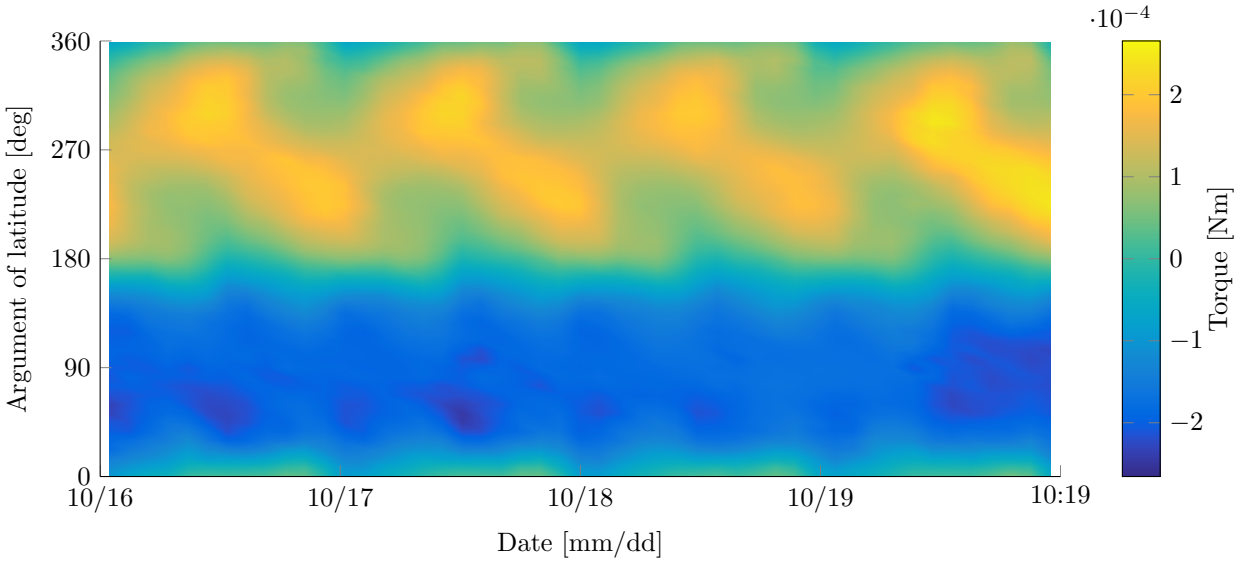



(c) $\bar{\boldsymbol{T}}_S$yaw

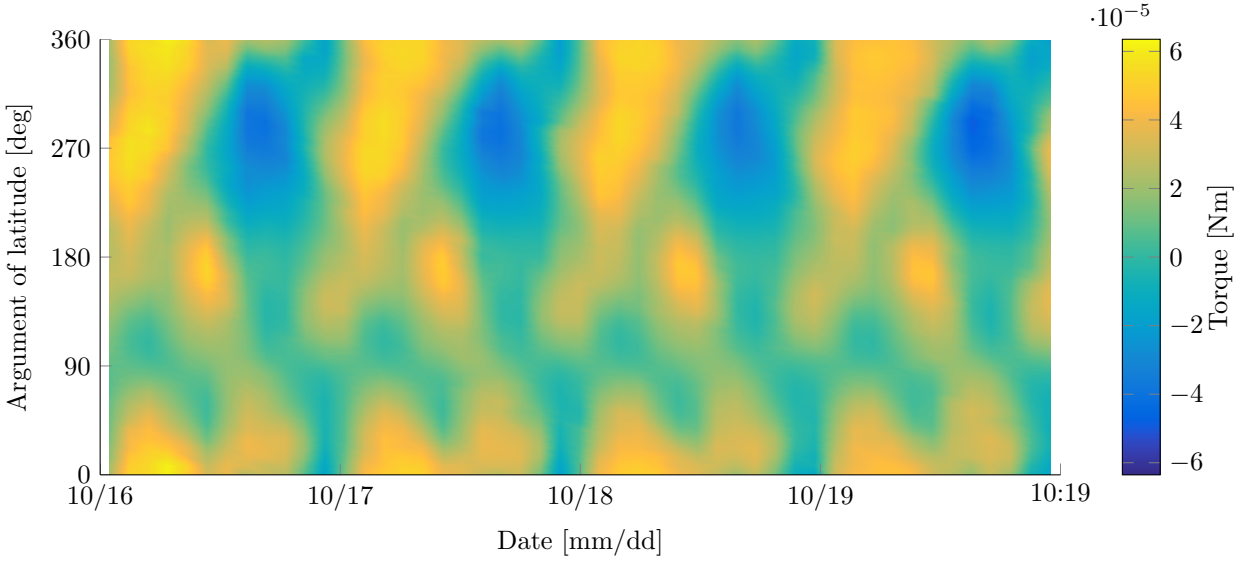
Figure 8: Solar radiation pressure torque $\bar{\boldsymbol{T}}_S$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_{D,T}$roll

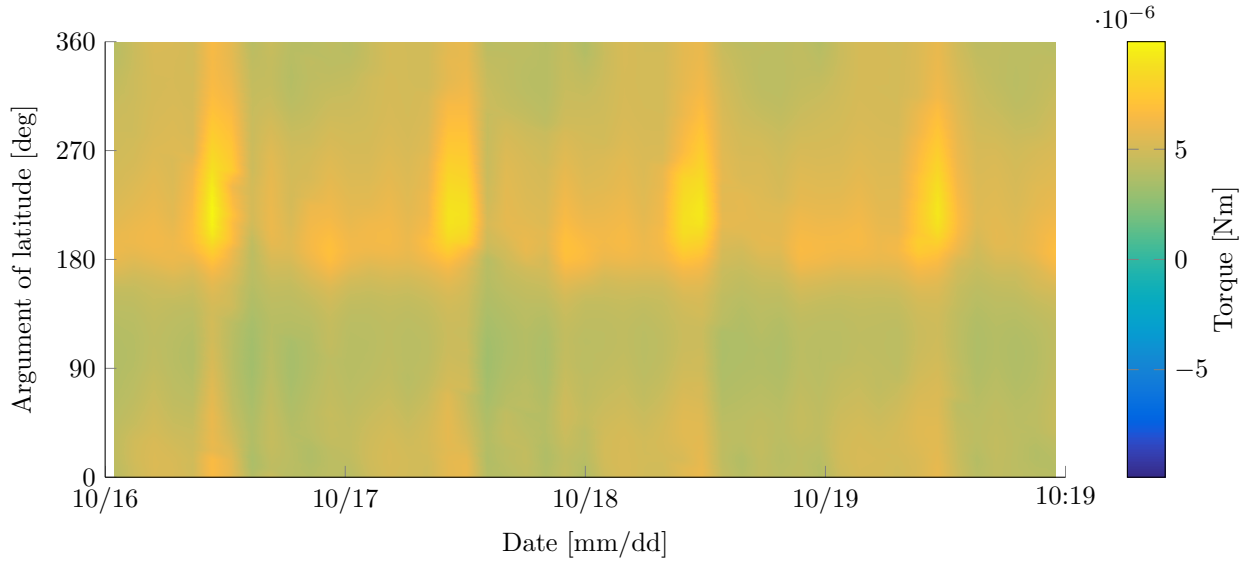



(b) $\bar{\boldsymbol{T}}_{D,T}$pitch

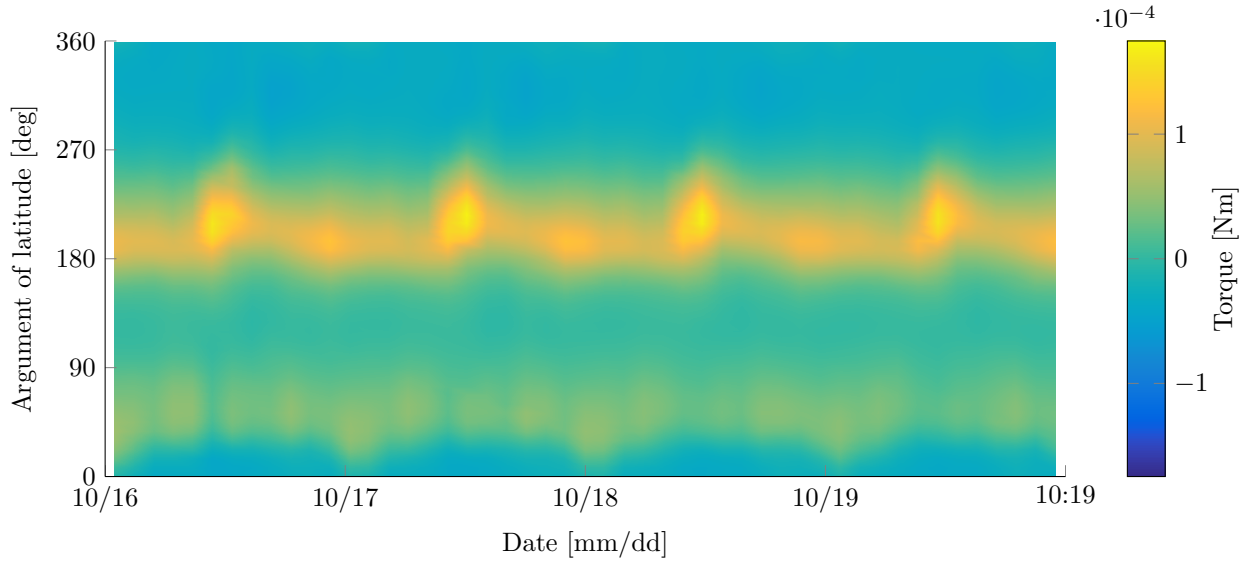



(c) $\bar{\boldsymbol{T}}_{D,T}$yaw

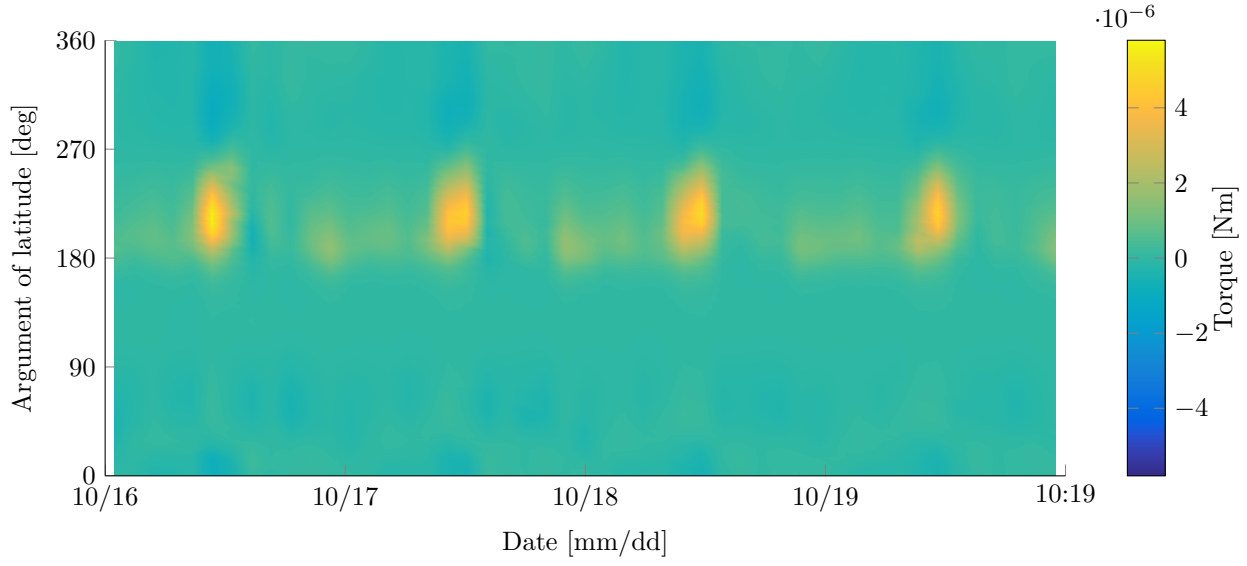
Figure 9: Thruster dipole torque $\bar{\boldsymbol{T}}_{D,T}$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_G$roll

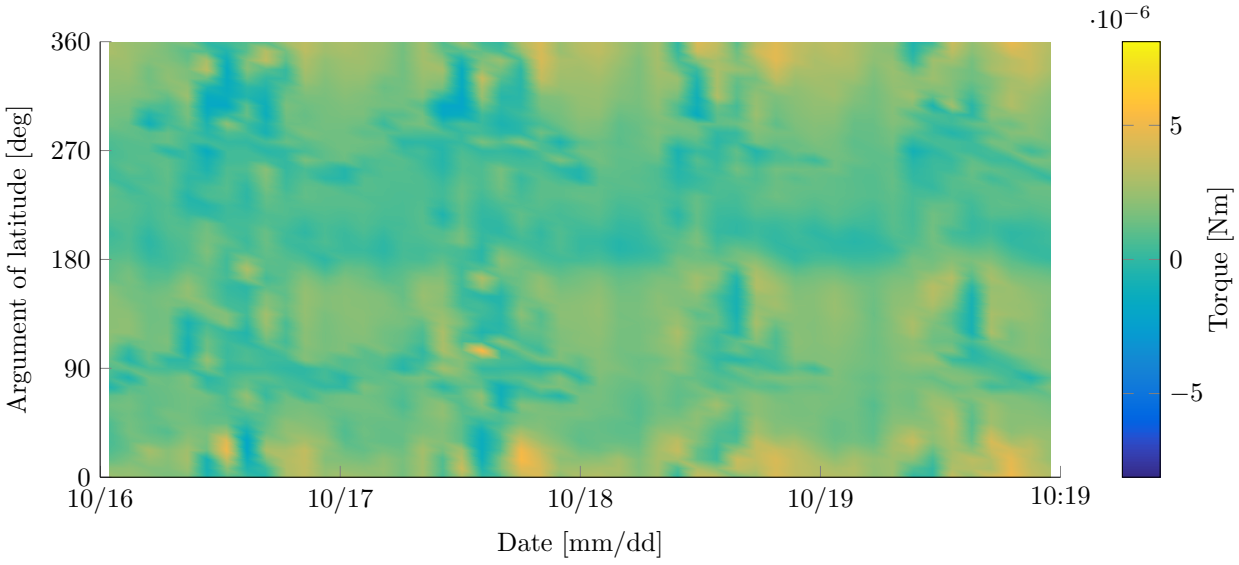



(b) $\bar{\boldsymbol{T}}_G$pitch

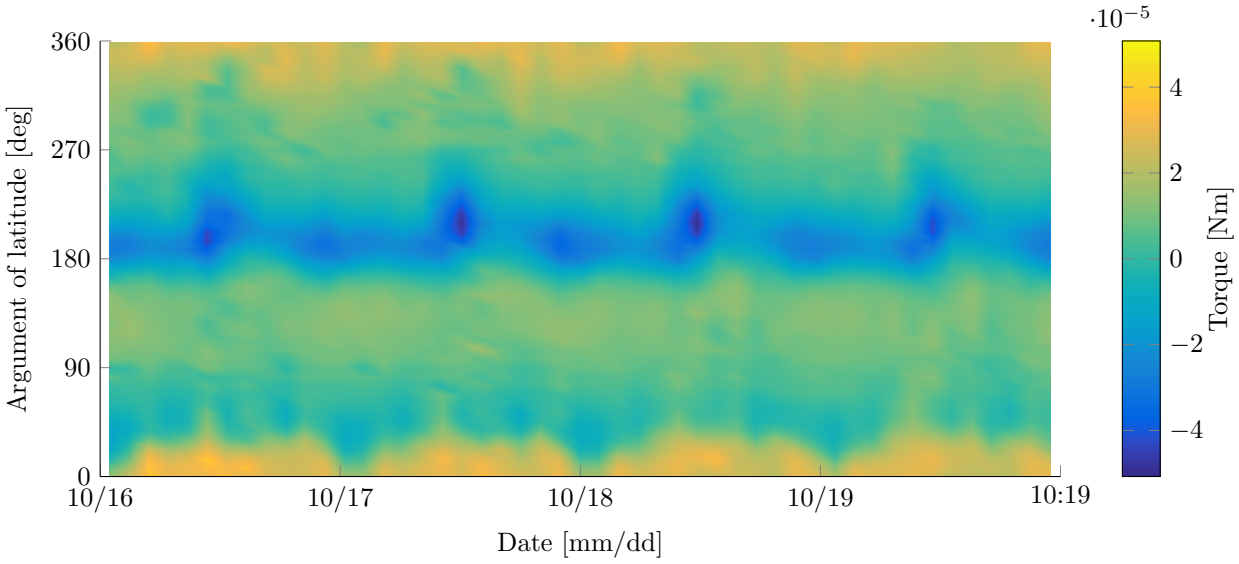



(c) $\bar{\boldsymbol{T}}_G$yaw

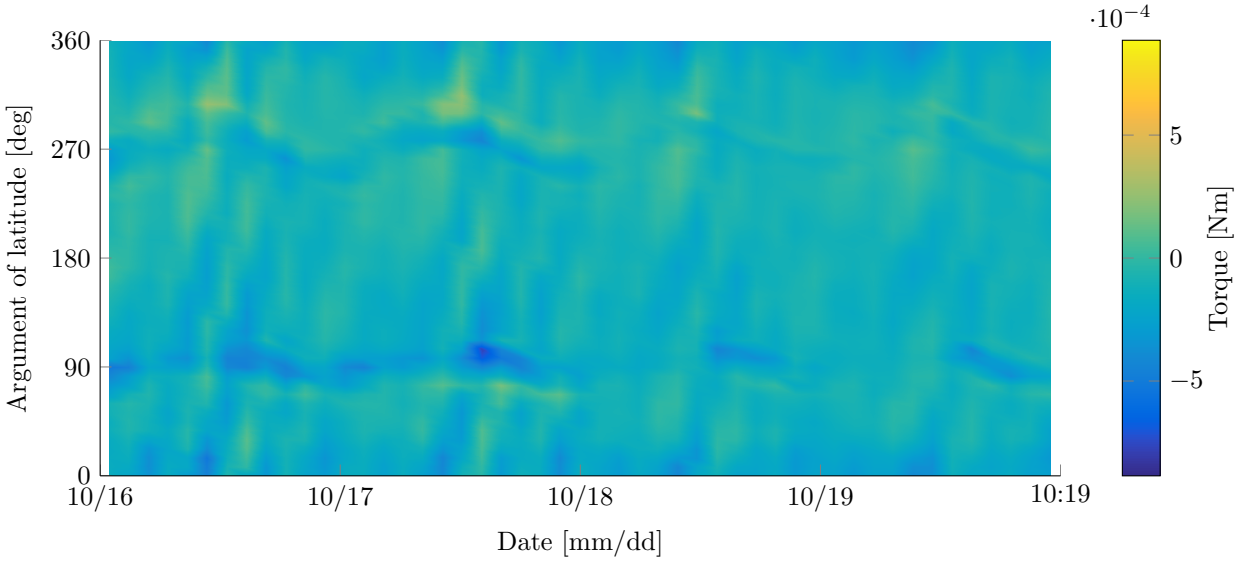
Figure 10: Gravity gradient torque $\bar{\boldsymbol{T}}_G$ as a function of time and argument of latitude in 2013.




(a) $\bar{\boldsymbol{T}}_A$roll

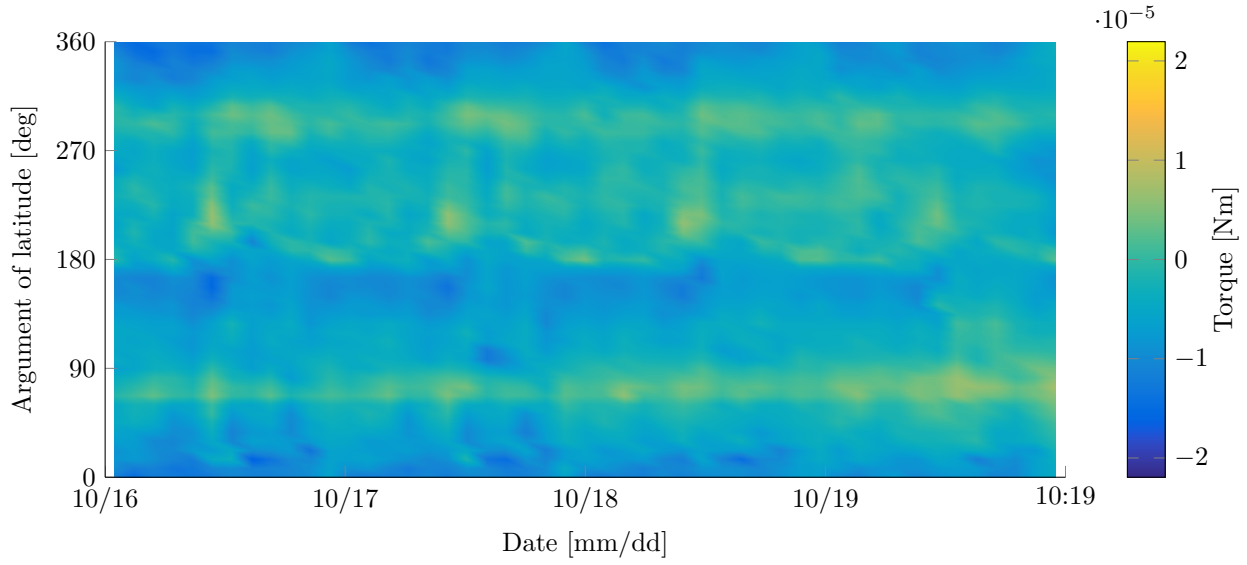



(b) $\bar{\boldsymbol{T}}_A$pitch

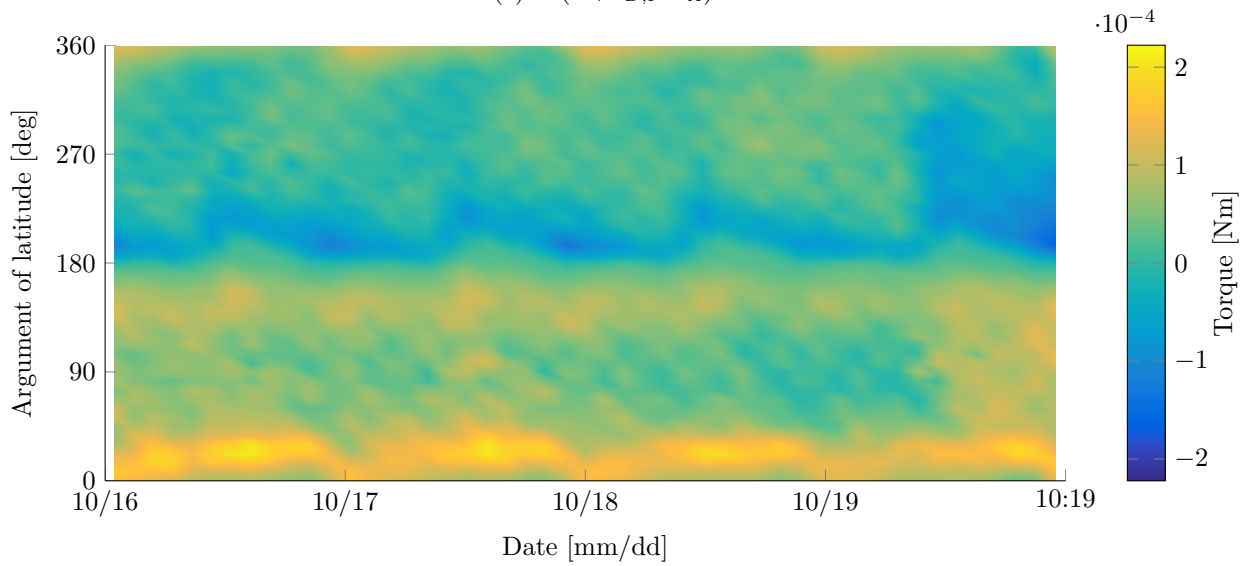



(c) $\bar{\boldsymbol{T}}_A$yaw

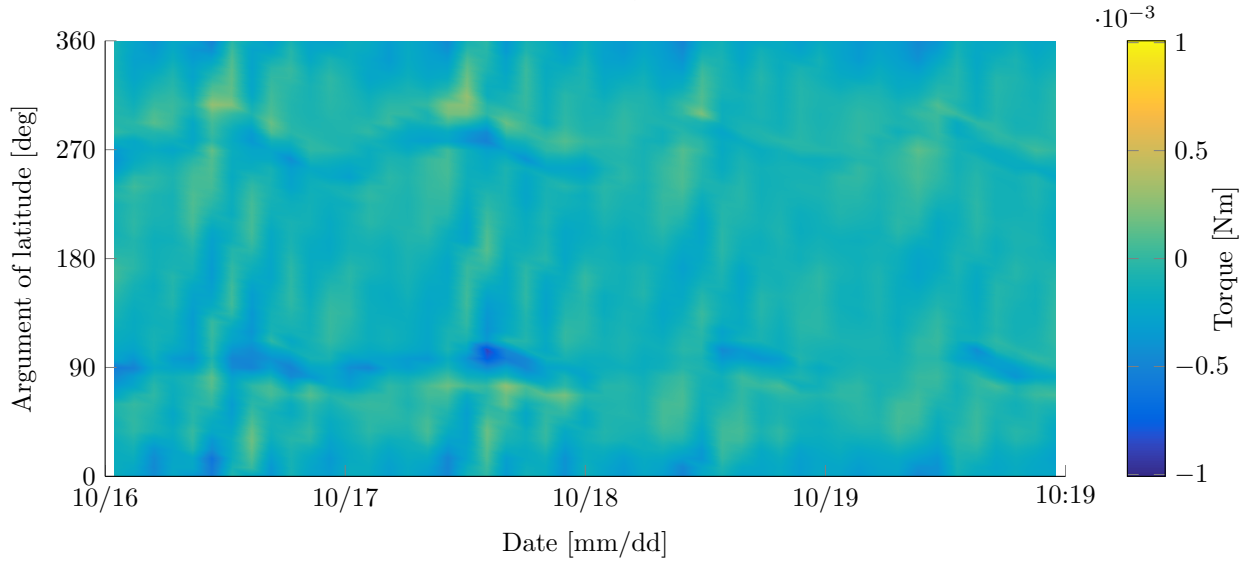
Figure 11: Aerodynamic torque $\bar{\boldsymbol{T}}_A$ as a function of time and argument of latitude in 2013.




(a) $\boldsymbol{T}$-($\bar{\boldsymbol{T}}$+$\hat{\boldsymbol{T}}_{D,P}$-$\bar{\boldsymbol{T}}_A$) roll




(b) $\boldsymbol{T}$-($\bar{\boldsymbol{T}}$+$\hat{\boldsymbol{T}}_{D,P}$-$\bar{\boldsymbol{T}}_A$) pitch




(c) $\boldsymbol{T}$-($\bar{\boldsymbol{T}}$+$\hat{\boldsymbol{T}}_{D,P}$-$\bar{\boldsymbol{T}}_A$) yaw

Figure 12: Measured torque $\boldsymbol{T}$, total modeled torque $\bar{\boldsymbol{T}}$, fitted payload dipole torque $\hat{\boldsymbol{T}}_{D,P}$, and aerodynamic torque $\bar{\boldsymbol{T}}_A$ as a function of time and argument of latitude in 2013.