

Tomography: UCoMP versus AIA versus KCOR

Summary of the techniques:

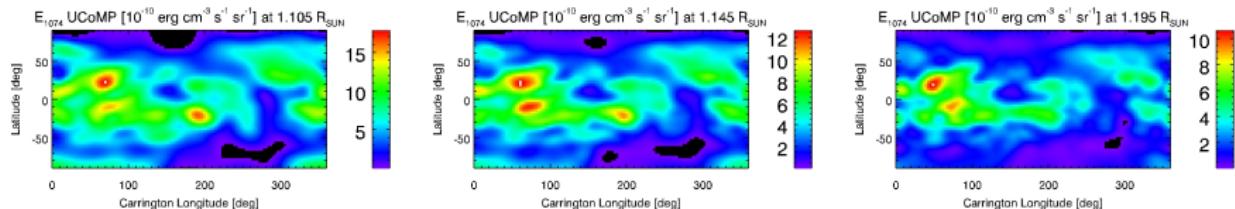
- **Solar rotational tomography (SRT)** makes use of 1/2 solar rotation (14-day) long sequences of coronal images to determine the **3D distribution of various physical quantities** of the corona, depending on the observed wavelength range.
- Using **WL pB** images (e.g. KCOR, C2, Metis), SRT allows determination of the **3D N_e** .
- Using **EUV** images with a given filter (e.g. AIA 171 Å), SRT allows determination of the **3D band-emissivity**. Based on the reconstructed band-emissivity for various filters independently (e.g. AIA 171, 193, and 211 Å), a local-DEM analysis can be carried out at each location of the corona to determine the **3D N_e** and **T_e** . The combined procedure is known as DEM-Tomography, or **DEMT**.
- Using **UCoMP** total-line (wavelength-integrated) images, SRT allows determination of the **3D line emissivity**.

Results shown in these slides:

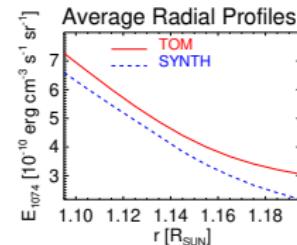
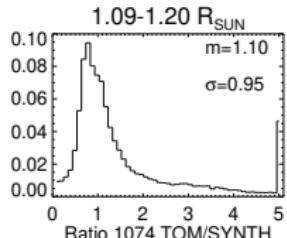
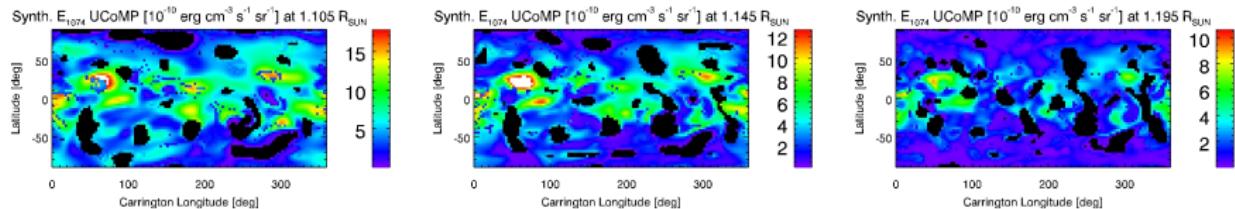
- For a specific period (September 2022), we carried out:
 - a) **UCoMP-SRT** with 1074 and 1079 nm images to determine their respective **3D emissivity maps**. The 1074:1079 emissivity-ratio can then be used to determine 3D N_e .
 - b) **AIA-DEMT** (using filters 171, 193 and 211 Å) to determine the **3D N_e** and **T_e** , in turn used with CHIANTI to compute **3D synthetic emissivity maps** for the lines at 1074 and 1079 nm.
 - c) **KCOR-SRT** to determine the 3D distribution of N_e .
- These instruments allow reconstructions over a common range of heights $1.1 - 1.2 R_\odot$. We compare:
 - 1) The tomographic UCoMP-SRT line emissivities against the synthetic prediction based on AIA-DEMT.
 - 2) The 3D N_e derived from UCoMP-SRT, derived from AIA-DEMT, and derived from KCOR-SRT.

3D Coronal Emissivity at 1074 nm

Lat/Lon maps of UCoMP 3D **Tomographic** 1074-Emissivity

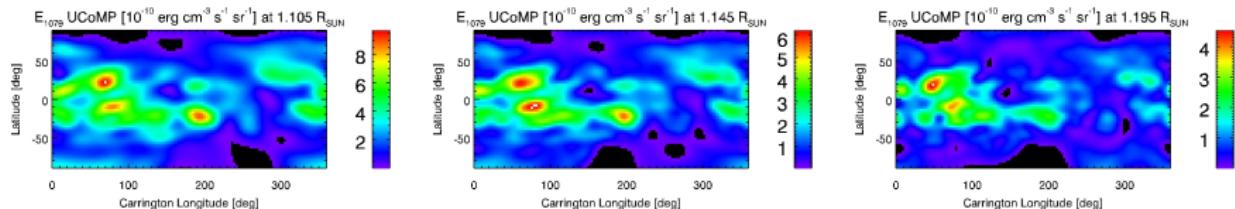


Lat/Lon maps of AIA(171-193-211)-DEMT 3D **Synthetic** 1074-Emissivity

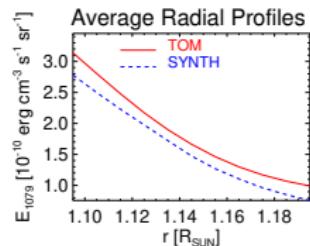
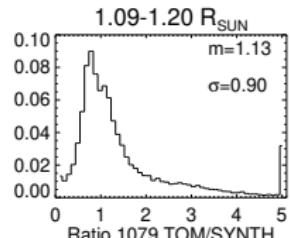
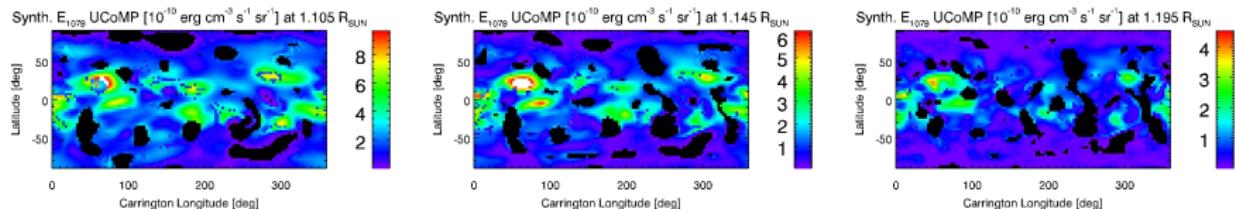


3D Coronal Emissivity at 1079 nm

Lat/Lon maps of UCoMP 3D **Tomographic** 1079-Emissivity

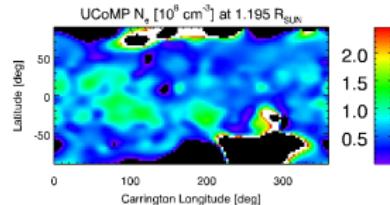
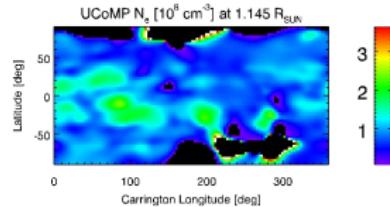
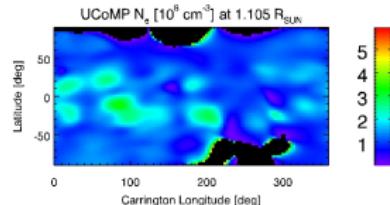


Lat/Lon maps of AIA(171-193-211)-DEMT 3D **Synthetic** 1079-Emissivity

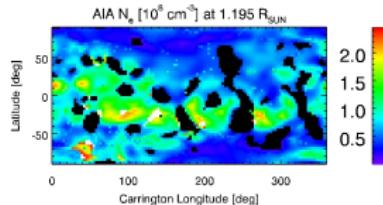
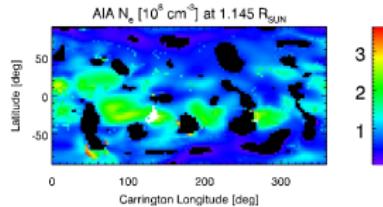
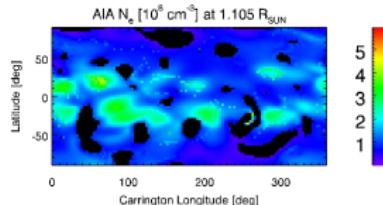


3D N_e with Three Diagnostics

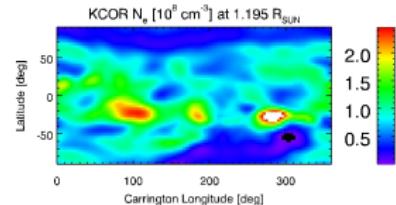
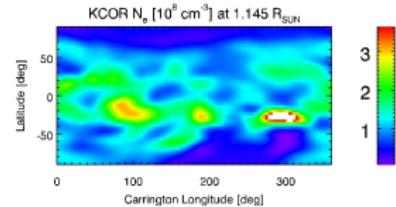
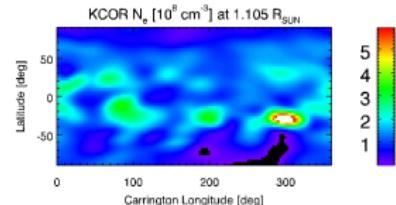
UCoMP-SRT



AIA-DEMT

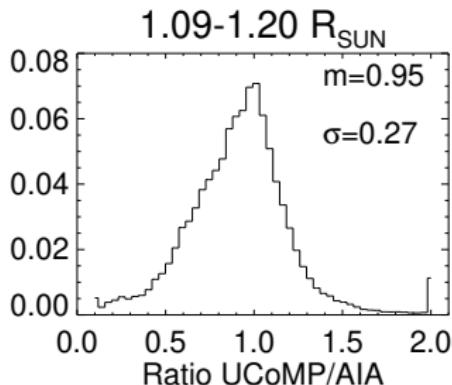


KCOR-SRT

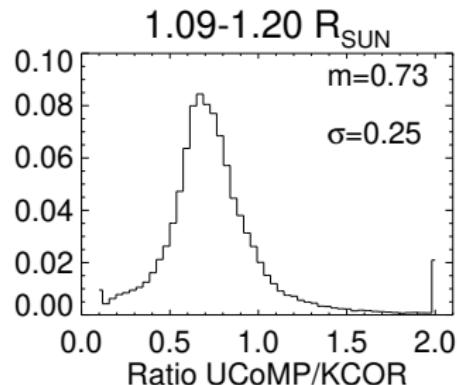


Comparison of Reconstructed N_e

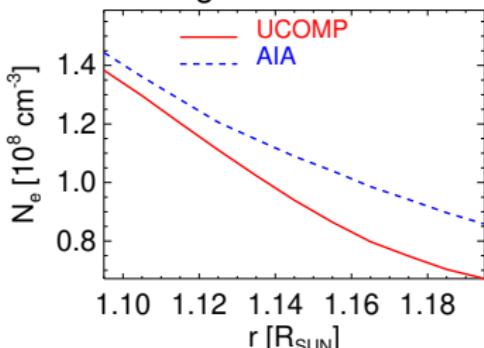
UCoMP versus AIA



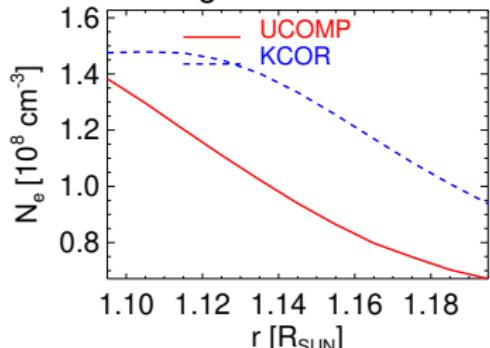
UCoMP versus KCOR



Average Radial Profiles



Average Radial Profiles



A Few Comments

- The UCoMP 1074:1079 emissivity ratio provides a direct diagnostic of N_e that can be compared to those of DEMT or KCOR-SRT. In addition, the comparison of the UCoMP 3D tomographic emissivities against the DEMT+CHIANTI synthetic maps provides an indirect consistency check for T_e as well.
- Emission lines to which UCoMP and AIA are produced by Fe ions. While the UCoMP-SRT N_e is independent of [Fe], AIA-DEMT $N_e \propto 1/\sqrt{[Fe]}$. Comparison of their reconstructed N_e can in principle provide constraints on the 3D distribution of [Fe], as well as the coronal filling factor affecting emission lines.
- The larger difference of KCOR-SRT N_e compared to AIA-DEMT N_e (and therefore also compared to UCoMP-SRT N_e) has been consistently found for other periods ([Lloveras et al. 2019](#)). Discrepancy can be due to calibration issues, coronal [Fe], and/or coronal filling factor.
- In these plots we simply carried out a voxel-by-voxel comparison within the whole reconstructed volume and not along specific field lines, which we can do next.