Summary of the 25 April, 2019, videcon

Attendees were:

Jørgen, Kiran, Sarbani, Rachel, Roger, Sushant, Sergei, Savita, Takashi, Angela, Jesper, Sylvain

There was an extensive discussion on the analysis of artificial data produced by Sasha. This included a discussion on the contents of the artificial data files, whether the splittings are just error free or also with errors. The splitting files are available on

https://www.dropbox.com/home/Rotation%20Inversions/Kosovichev/20190329

and the splitting coefficients are on

https://www.dropbox.com/home/Rotation%20Inversions/Kosovichev/20190414

There are README files in both directories and in fact a description was included in the 29 March 2019 meeting summary.

Sarbani and Rachel noted some confusion with the file names for the artificial data. It is important to note that Sylvain did not provide any artificial splittings; instead Sasha used his set of multiplets in the rotation model to calculate splittings. There were concerns with the error propagation in Sasha's artificial data that needs to be revisited.

In general, it was desired by the participants that Sasha should provide a clear description of the data and the difference between various files. It was felt that there was a need for a clearer definition of how the data were created, including the conversion to *a* coefficients and the propagation of the errors. It was also suggested that Sasha and Sylvain should provide a sufficiently detailed write-up of the procedures to make clear what was done and also point out some potential issues with the error propagation.

Sergei reported his work on the artificial data and discussed the mismatch in kernels produced by Sasha and by him, likely as a result of using different surface boundary conditions in the calculation of the oscillation eigenfunctions. These issues were discussed in some detail by Sergei and Jørgen.

Sergei also had some concerns about the unresolved issues in Sylvain's analysis of error propagation. To address Sergei comments, Sylvain suggested Sergei to prepare a detailed note highlighting the major issues.

Detailed results of Sergei's work in this connection, including some discussion of the issues of the errors, are available in

https://www.dropbox.com/home/Rotation%20Inversions/Sergei/190501.test1

Sarbani and Antia inverted artificial splittings with and without errors. They experienced problems while dealing with the data with errors. Results of Sarbani and Antia's analysis are in

https://www.dropbox.com/home/Rotation%20Inversions/HMA_SB/20190507

Rachel has produced a coherent initial report on her analysis of the artificial data in

https://www.dropbox.com/home/Rotation%20Inversions/RachelHowe/20190524

Sylvain has produced a comprehensive report on the results of the analysis of both solar observations and the artificial data obtained by Antonio and him, in

https://www.dropbox.com/home/Rotation%20Inversions/SylvainKorzennik/190524

Please also note that Sylvain very kindly combined a large set of other results, including the latest results, in the file `combined-by-sgk-on-190524.pdf` in

https://www.dropbox.com/home/Rotation%20Inversions

Jørgen suggested to contact Sasha for collecting inversion results and also for the format he would prefer to use. A subsequent proposal for a data format is provided as an appendix to this report. So far, there has been no response from Sasha on the specific point of being responsible for collecting and comparing the inversion results; this is something to discuss again.

Sylvain reported that he created a few artificial spectra, fitted these spectra using his method, measured the mode and the error bar. He successfully recovered whatever he had put in; hence there was no bias. He also mentioned that the distribution of the error bars was not Gaussian: it is much more complicated.

Sylvain and Jesper will work together to sort out the concerns with the error propagation in Sylvain's method.

Jesper mentioned that the HMI pipeline is routinely producing splitting coefficients for 1 year, however one has to pay attention while downloading the data from JSOC.

There was a discussion on how to put results in a paper – Jørgen will prepare an outline in a couple of weeks.

It was strongly felt that the progress made so far in this project should be presented at the meeting in honour of Michael in September, even if we cannot have the paper written by that time. For this, we should start producing results using a common data set. A decision on such an initial set of observations was made early in the project. There was a communication between Sylvain, Jesper and Jørgen in January this year on this topic for resolved observation, resulting in the following summary and suggestions made by Sylvain:

1. *For initial testing of the inversion algorithms we propose to use Sylvain's 32x72day dataset. What to use for the final results is TBD.*
2. *Sylvain has converted this dataset to a-coeff (CG coefs, using his or Jesper's normalization) with the number of coefficients as a function of l,n) that his current algorithm uses, up to 36.*
3. *Jesper will try to get 360-day datasets using HMI and his fitting methodology made with the same starting time as Sylvain's.*
4. *Sylvain and Jesper will make a comparison of "their" errors and the splittings and see what they learn.*
5. *For the purpose of H&H/artificial data the errors from 1. and/or 2. can be used. If desired the errors for one of the integrated light datasets can be substituted for l=1 to see if this significantly improves the resolution and errors.*

The data set to use is in

https://www.dropbox.com/home/Solar%20Splittings/SylvainKorzennik/190123

This contains a .tgz file with a number of different datasets. We probably still need to be more specific on the precise sets to be used for initial analyses.

Notes on a data format for comparison of inversion results

We have earlier discussed a format consisting of having, for each target location (r_k, theta_k):

(r_k, theta_k)_target, (r_k, theta_k)_inv, Omega_k, sigma(Omega_k), delta r_k, delta_theta_k

where (r_k, theta_k)_target is the target location, (r_k, theta_k)_inv is the location of the averaging kernel (this should perhaps be expanded to include several measures of locations such as target location, centre of gravity, maximum), Omega_k is the solution with error sigma(Omega_k) and delta r_k and delta_theta_k are suitable measures of resolution. The advantage of this is that it is not constrained to a specific grid of target locations, at the expense of a slight redundancy for, e.g., rectangular target grids. I would welcome comments on this, including on how to define these quantities more precisely in a form that is valid for any inversion method.