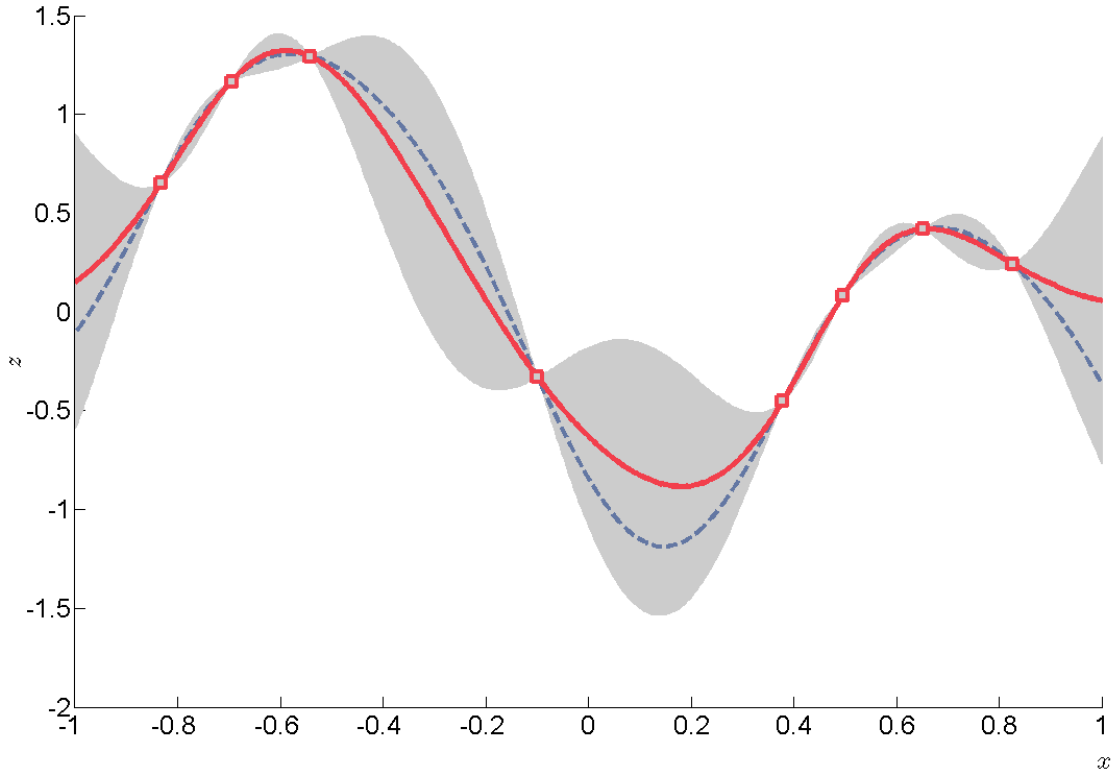
Kriging in Astronomy

Sándor Pintér
Eötvös Loránd University, Dept. of Astronomy
in collaboration with
Zs. Bagoly, L.G. Balázs, I. Horvath, I.I. Rácz, L.V. Tóth

What is Kriging?

- The basic idea



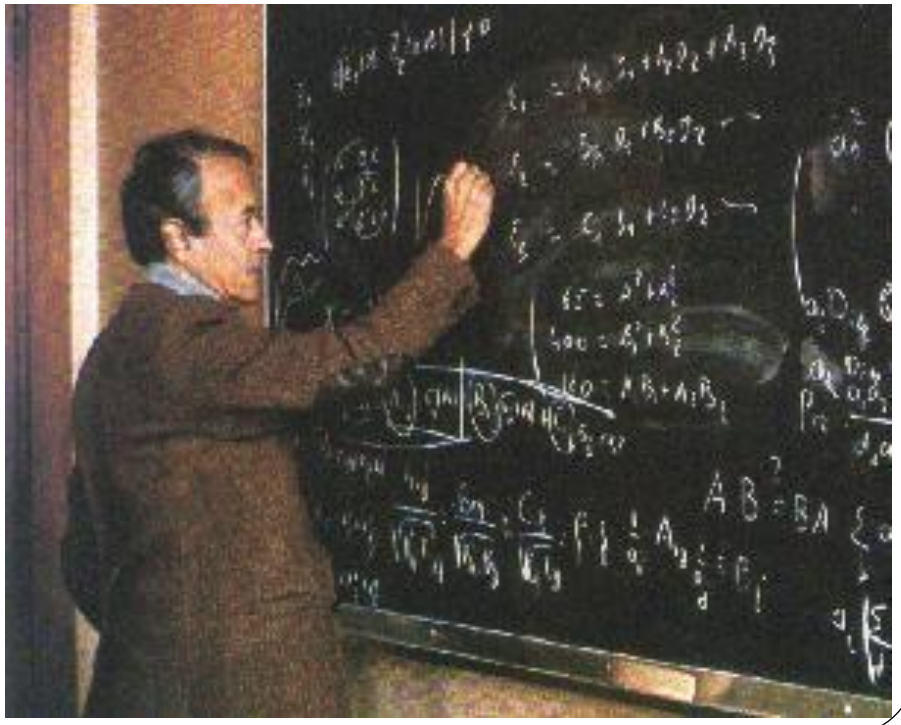
What is Kriging?

- The basic idea

- The inventor:
  Daniel Gerhardus Krige

What is Kriging?

- The basic idea
- The inventor:
  Daniel Gerhardus Krige
- The developer:
  Georges Matheron

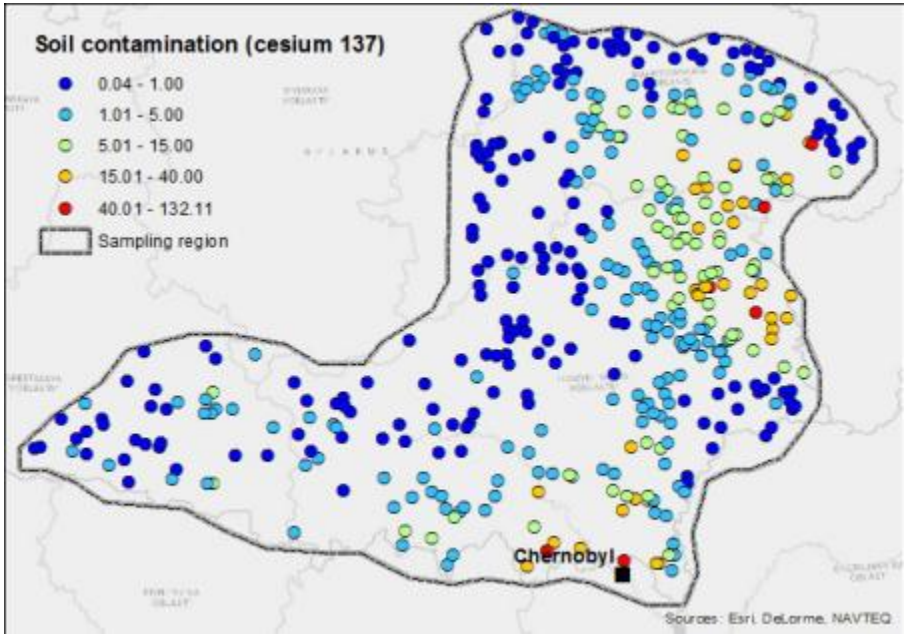


Kriging in diverse disciplines

- Geostatistics
  - Hydrology
  - Hydrogeology
  - Meteorology
  - Geography
  - Forestry
  - Agriculture
  - Mapping

Kriging in diverse disciplines

- Geostatistics
  - Hydrology
  - Hydrogeology
  - Meteorology
  - Geography
  - Forestry
  - Agriculture
  - Mapping



Kriging in astronomy

- Kriging interpolating cosmic velocity field (2015PhRvD..92h3527Y)
- Eight-year climatology of dust optical depth on Mars (2015Icar..251...65M)
- Interpolating point spread function anisotropy (2013a&a...549a...1g)

Herschel data

- SPIRE bolometer arrays
  - 326 bolometers
  - 3 observed wavelength (250, 350, and 500 microns)
- SPIRE processing pipelines

Herschel data reprocessing

- Timeline (level1) merging
- Level2 mapmaking with destriping
- Zero point calibration

Source extraction

- Direct search with HIPE
  - Sussextractor
  - Timelinefitter
- From catalog
  - SPIRE Point Source Catalog

Source extraction

- Point sources
- Slightly extended sources
- Extended sources

Source subtraction

- HIPE
  - from level1 timeline
- Kriging
  - from level2 calibrated maps

Source subtraction

- HIPE
  - from level1 timeline
  - sometimes uses over 40 GB of memory

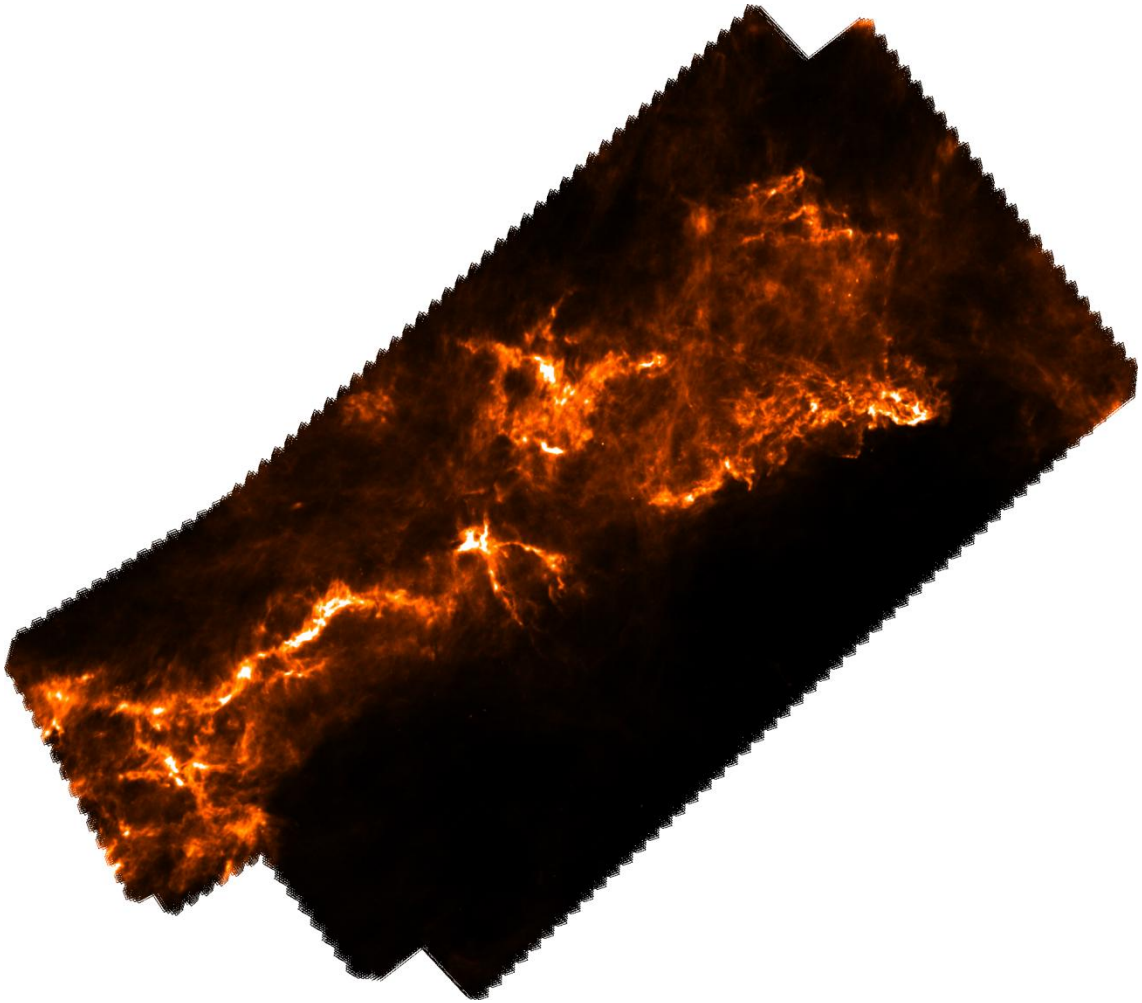
- Kriging
  - from level2 calibrated maps
  - less than 2 GB of memory

Source subtraction

- HIPE
  - from level1 timeline
  - sometimes uses over 40 GB of memory
  - >4 days running time
- Kriging
  - from level2 calibrated maps
  - less than 2 GB of memory
  - <1 day running time

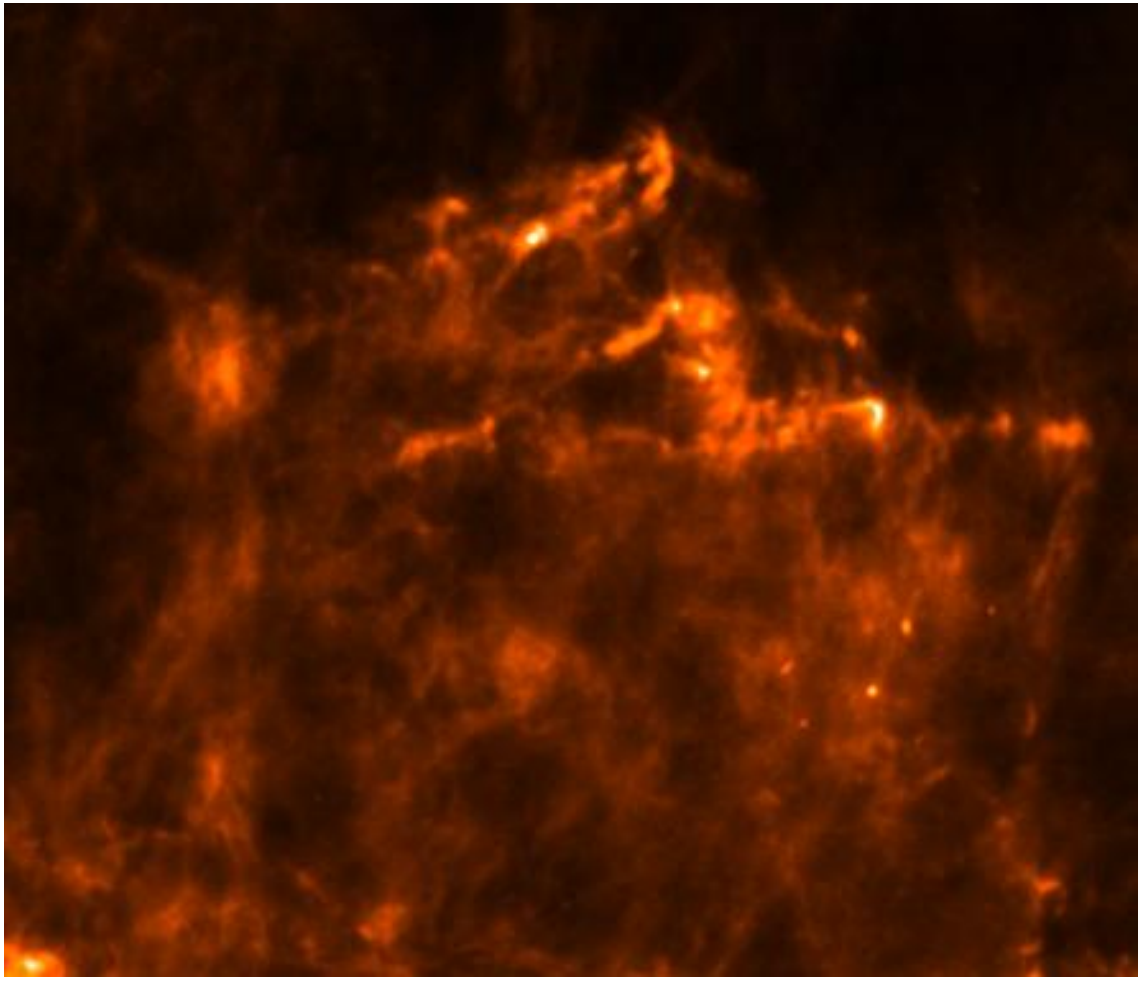
An example

- Input map with point sources: G163.82-8.32 (v31 7420)



An example

- Input map with point sources: G163.82-8.32 (v31 7420)

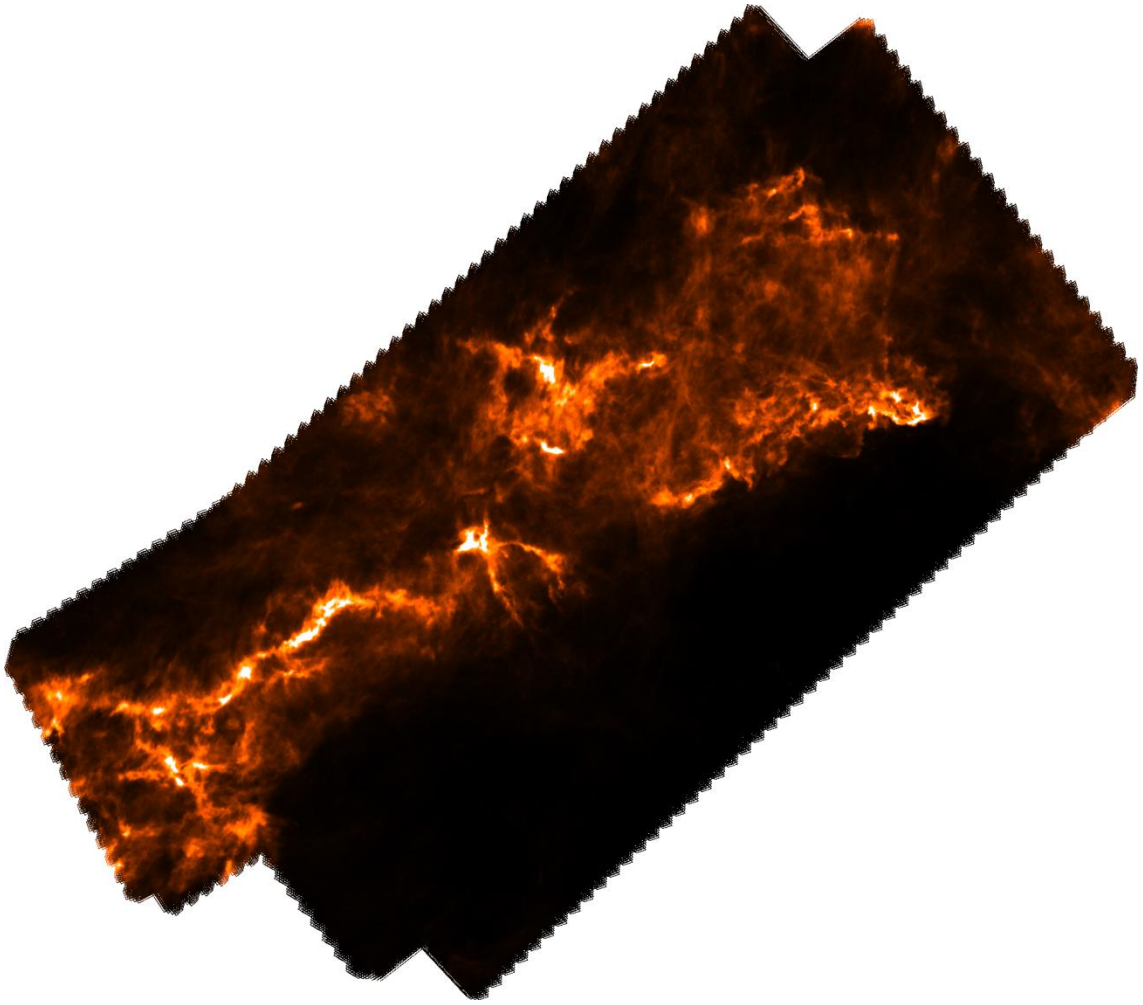


An example

- Map created from 4 observations
- Sources found:
  - PSW 3300
  - PMW 3200
  - PLW 1600
- Sources masked
- The areas were Kriged

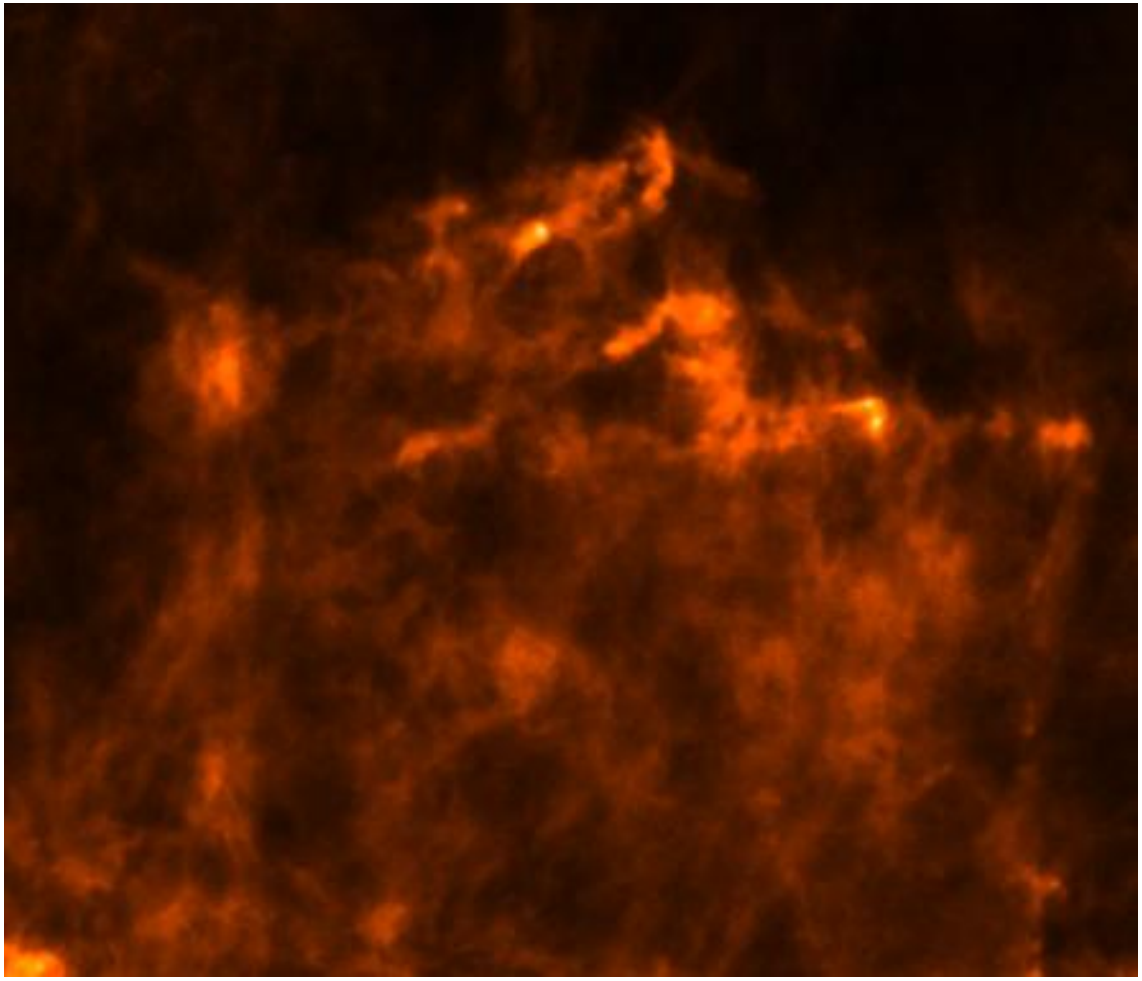
An example

- Output map without point sources

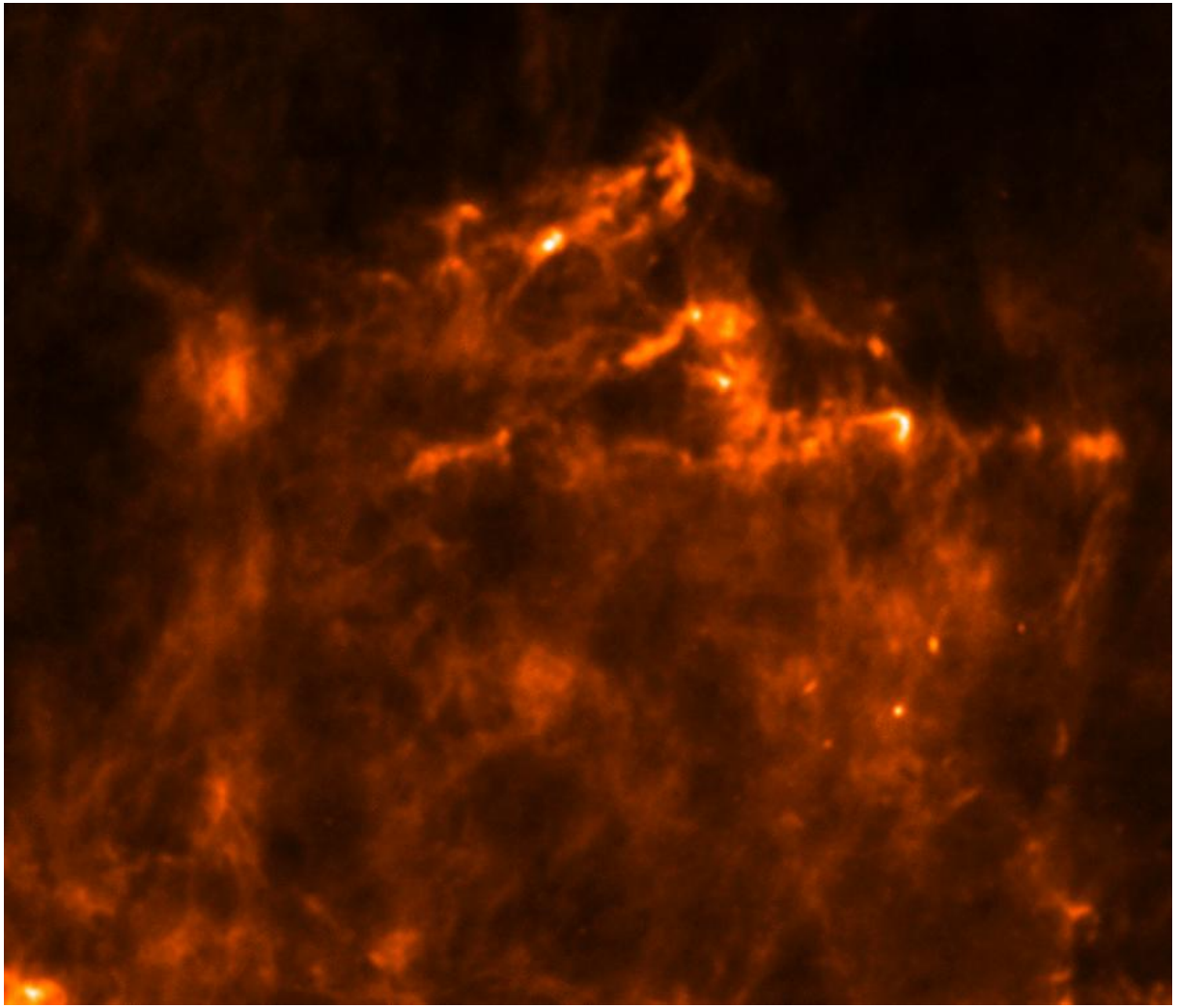


An example

- Output map without point sources



An example



Discussion

- To measure the interstellar medium we need to remove the flux from point sources
- I have found a way to remove the point sources much quicker with much less resources than the prewritten task in HIPE