

Study of Mucus Hurricanes

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1 SPECIFIC AIMS

Airway surface liquid is comprised of mucus and an underlying, watery periciliary liquid (PCL). Theoretical analysis predicts that the PCL is stationary but the conventional and confocal microscopy of fluorescent microspheres and photoactivated fluorescent dyes showed that the entire PCL is transported at approximately the same rate as mucus. Also removing the mucus layer reduces PCL transport by 80%, giving us a value close to the value predicted from theoretical analyses. Hence, the rapid movement of PCL is dependent upon the transport of mucus. This mucus-dependent PCL transport along airway epithelial surfaces is an important component of salt and water physiology in the lung in health disease.

Particle Image Velocimetry uses fluorescent tracers to quantify fluid flow. We expect to get a bunch of image data in which the tracers (microbeads) track the movement of mucus. After taking the Maximal Intensity Projection (MIP) of the particles We expect to observe an image in which particles are moving in an ellipsoidal path.

2 AIM 1: Identify the center of the mucus hurricane

Studying the movement of mucus is important. An important aspect of it is to find the center of the hurricane. This will be our primary aim. We plan to use a method similar to hough transform for lines to find the parameters, like centroids, major and minor axes for the elliptical patterns formed by the traced particles of the mucus.

3 AIM 2: Effects of tilt angle

Experiments done by Jerome Carpenter show that tilt angle is an important parameter that has an influence on mucus transport measurements. We expect to get the mucus hurricane data for multiple tilt angles. We will use this data to identify the effects of tilt angle on the movement of the center of the hurricane whether it goes upwards or downwards.